A Step Towards Better Traffic:
Walking to School in Karmiel, Israel

An Interactive Qualifying Project Report
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by:

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Abstract

Karmiel, Israel experiences severe traffic congestion during commute hours. The goal of this project, sponsored by Braude College of Engineering, was to persuade high school students to walk rather than be driven to school, thereby reducing morning traffic. Using surveys, observational discoveries, and interviews, we determined socialization is the most effective motivator for students to walk. Our solution, the Walk2School application, combines opportunities for peer interaction and incentivization to encourage walking to school, potentially alleviating traffic issues in the area.

Acknowledgments

Our team would like to start by thanking our sponsor, Braude College of Engineering, for giving us the opportunity to work on this project. We would specifically like to thank our direct contacts, Dr. Nirit Gavish and Dr. Anat Dahan, for providing the assistance and guidance necessary to succeed in this project. Many other people on the Israeli end deserve mention. We would like to thank Braude student and high-school contact Bar Levy, for he was an invaluable remote connection and without his hard-work, we would not have been able to advance so far in so little time. Logistical coordinator Dr. Nadav Badrian was also a great help. He did his utmost to ensure our group felt at home on campus and zealously attended to any requests or problems we had. Our efforts would have been futile if not for the students and faculty of Ort Kramim. We were received warmly by Principal Kort Omi and Data Science teachers Limor and Imbal. They were very receptive to our project and approved of its proposed direction. The students were a joy to interact with and took to showing us around their school with great energy.

Finally, we want to mention the people at WPI who provided clarity in the face of great uncertainty. Our IQP advisors, Professors Svetlana Nikitina and Ivan Mardilovich, were integral to what proved to be a seamless transition from Russia to Israel and helped steer our project once the metaphorical smoke cleared. Finally, our irreverent ID2050 professor, Alejandro Manga, is worthy of the highest praise. His guidance and teaching helped us get this substantial undertaking off the ground. The passion he had for research and his students was palpable in the classroom and we carried it to Israel in our hearts.

Authorship

This project was created through a collaborative effort of all members of the Walk to School D2023 IQP team: Benjaminh D. Brodeur, Andrei L. Ignatiev, Serena A. Mower, Dylan G. Nguyen, and Nathan D. Pollock. Dylan G. Nguyen and Nathan D. Pollock mainly focused on the programming portion of the project, while Benjaminh D. Brodeur, Andrei L. Ignatiev, and Serena A. Mower completed the writing of the paper, with final edits being completed by Serena A. Mower.

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Executive Summary

Traffic congestion is a growing issue throughout all of Israel, and Karmiel is no exception. The city suffers from limited access, with only three main exits, and a combination of around twenty schools from K-12 as well as Braude College of Engineering. To address this traffic problem, our project aims to promote walking to school among high school students at Ort Kramim rather than receiving rides from their parents.

Literature Review

The Covid-19 pandemic led to a surge in personal vehicle usage, and since the return to a relatively normal lifestyle, many individuals still have not switched back to using public transportation methods (Keller-Lynn, 2021). However, with Israel's population estimated to grow by 2.5 million people in the next twenty years (World Population Review, 2023, United Nations, 2022), the traffic congestion issue is expected to worsen if action is not taken to improve the situation.

Israel has been trying to discover ways to reduce their traffic congestion since before Covid-19 started. They have looked to other countries for solutions and are planning to implement a congestion charge much like the ones in Stockholm, Singapore, and London. This congestion charge would tax drivers for entering larger cities like Tel Aviv during high commuting times.

Additionally, the hope in Karmiel is that an increase in the number of students who walk to school would also help to lower traffic congestion during the morning rush hours. However, certain barriers exist that may prevent students that do not already walk from walking. For example, the topography of Karmiel is hilly, and at times the weather can be extremely hot and

dry. Furthermore, sometimes students simply do not want to walk to school even if it is entirely probable, whether that be because of a student's lack of motivation or the sheer extra time it takes to walk instead of getting a ride.

There are a wide variety of solutions possible for encouraging students to walk to school. For example, solutions include requiring parents to purchase drop off permits, educating students on the health and environmental benefits of walking, along with incentivizing walking to school. Since students have various reasons for why they do not already walk to school, different approaches will help to motivate different groups of students.

Methodology

During this project, most of our focus involved interacting with students under the age of eighteen. We received special IRB approval for working with minors, and ensured we had parental consent for every student that was a part of our study. Additionally, our interactions with students at Ort Kramim were overseen by teachers or faculty from the school.

Our data collection efforts were centered around two foci: student opinions on walking and traffic congestion. To collect student data, we interviewed four students and sent out a survey that received around two hundred responses. In terms of traffic congestion, an application created by a Software Engineering class at Ort Kramim will be used that allows students to log the way they went to school and, if applicable, how much traffic (in minutes) they experienced.

Additionally, we developed an application called Walk2School to reward students when they walk to school. Each meter gives a student one point with additional multipliers possible when students walk to school consecutive days in a row. Students can use these points to redeem rewards set up by the school, such as coupons to local businesses or the school cafeteria.

There were also some limitations we encountered. One major issue was created from a language barrier issue. There is the possibility for sources of error within our survey responses due to the translation between English and Hebrew. For example, one of our questions asked students how often they "walked" to school, where the Hebrew translation asked how often they "went" to school. We had additional limitations caused by timing constraints and conflicts due to the minimal time we had while in Karmiel.

Results

Upon arrival, our first observational discovery was the hilly topography of the city of Karmiel. While not a large issue for smaller distances, the hills could potentially prevent students from walking distances that would not be an issue with smaller elevation changes. However, the area around Ort Kramim has many walkable features. There are crosswalks and sidewalks on almost every street, and while some of them could use some maintenance, they are lined with many trees and other foliage that keep the walking paths shaded and cool.

The biggest discovery we found from our research was that most students said they would be more likely to walk to school if their friends were walking. The next largest reason listed was incentives, which was where this project was mainly focused. However, we believe that efforts to increase the social aspect through the Walk2School application could be a huge help in encouraging students to walk to school.

Due to time constraints and issues with approval from the Google Play Store, we were not able to have students test our application on Walk-to-School Day. Additionally, we had to adjust the way we collected traffic congestion data due to complications with the data collection app being built by the Ort Kramim high school. Our new method involved counting cars in areas

where heavier traffic congestion occurs. However, Walk-to-School Day didn't have as much of an effect as we would have liked, mostly due to a lack of organization and participation from students. However, despite the lack of turn out, we were able to determine that traffic congestion can be created when thirty students cross the rotaries one at a time rather than all thirty at once. This leaves the possibility for future application features, such as the possibility for bonus points when a large group of students cross the street together rather than individually.

Conclusions

From our research, we have determined the ideal situation for walking is in a mild temperature with few elevation changes and light weather conditions. Many individuals are driven away from walking in harsh heat or heavy rain, while others can be deterred by just a large hill. Additionally, many individuals find walking with other people to be a more enjoyable experience than walking to school, so the opportunity for socializing is another factor that plays into how good the walking experience will be.

In terms of encouraging students to walk, our research shows that the best way to get students to walk is to get them to walk together. Our survey shows that 59.0% of Ort Kramim students would walk to school if they are walking with their friends. Incentivization with rewards such as coupons or vouchers for food was the next highest motivator, with 15.8% of students saying some form of reward would get them to walk to school. The remaining factors for encouraging students (knowledge of health and environmental benefits, encouragement from others, safety concerns, better pedestrian infrastructure) were mentioned by around 5-7% of the students.

There is always room for improvement and new features in any project, and this one is no exception. After receiving the results from our survey, we discovered that the Walk2School application could be improved to better encourage students to walk if we incorporated more features to help connect students who would like to walk together. Additionally, implementing ways to include students who cannot walk because of distance or disability in the app would help ensure every student is able to utilize the app in some way. Community action is another factor that plays into the future success of this project. Utilizing local municipality to fund the rewards for the Walk2School application is one of the most important ways to keep this project successful.

1. Introduction

Traffic congestion is a growing challenge in cities worldwide. It causes significant delays for drivers and commuters while also contributing to air pollution, stress, and pedestrian safety. Israel is no exception to this problem. When the state was established in 1948, it had a population of roughly 850,000, and over the past seventy-five years this historical land has grown to reach nine million people. This rapid population growth could not have been predicted, and the current infrastructure was not built to effectively support the number of vehicles present on the road (Cohen & Scheer, 2015). One area where this problem is evident is the presence of traffic congestion near schools. This poses a significant threat to student safety and can also affect the timeliness of parents on their way to work. Transportation Ministry models predict an average citizen could be spending an additional fifty-five minutes per day traveling by car (Tal, 2017).

One solution to this issue is promoting walking to school, but various factors may discourage students from doing so, such as community safety, environmental conditions, and student attitudes. Karmiel, Israel suffers from the consequences of traffic congestion. With a population of 46,000 and over twenty K-12 schools and a university, the city's inadequate planning has resulted in a shortage of school parking and ineffective commuting solutions for parents. The city's limited three main exits (as seen in Figure 1) combined with its rapidly expanding population has led to a dramatic increase in traffic congestion, causing residents to endure wait times of up to thirty minutes in traffic.
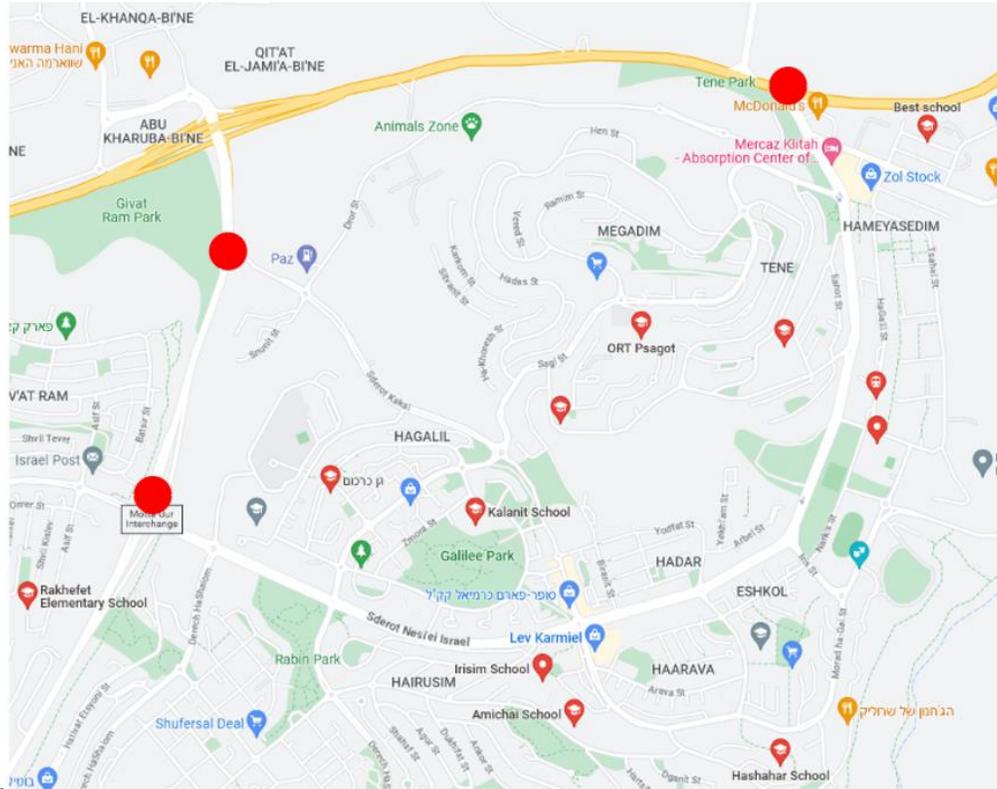
Figure 1: Map of Karmiel. Exits are marked in red.

The goal of this Interactive Qualifying Project (IQP) was to investigate the walkability of the area around Ort Kramim Comprehensive High School and determine a solution for encouraging students to utilize walking as their mode of transportation to school. To determine the barriers preventing students from walking, we surveyed around two hundred students to gain insight into their opinions on walking to school. Additionally, we interviewed school faculty and held a focus group with five students for a chance to further discuss the situation. We also completed participant observations around the school to gain a better sense of the walking conditions and road safety in the area. Finally, we developed an application that gamifies walking to incentive students to walk, which will hopefully help students start walking to school consistently.

Through this project, we were able to discover the roadblocks preventing students from walking to school, and the possible benefits that occur from a daily habit of walking to school. For example, students will experience better physical and mental health from starting their day with an activity that gets their blood moving. Physical activity during the school day has been linked to better performance in the classroom (Active Living Research, 2012), and walking to school provides an opportunity for socializing with friends to help build better connections. We held a Walk-to-School Day to increase the number of students walking to school and to determine whether there is conclusive data pointing to a reduction in traffic around Ort Kramim. In theory, a larger number of students should choose to walk over vehicular modes of transportation like cars and buses. While reduced traffic was the goal, unfortunately our data was inconclusive in determining whether our application or the Walk-to-School Day effectively lowered traffic congestion. Regardless, we still were able to determine that the most effective way to encourage students is through peer interactions, and future research should be completed to determine the best way to utilize this motivator.

2. Literature Review

Israel is no exception to the growing traffic congestion issue in the world. During the Covid-19 pandemic, many individuals moved away from public transportation in favor of safer, more private methods. As the risk lessened, people did not switch back to utilizing public transportation despite the return to daily routine and life. With schools and places of work back to full capacity, there has not been a decrease in the use of personal vehicles, creating consistent traffic congestion problems in Israel (Lenchitz, 2021).

In this section, we aim to describe the traffic congestion situation in Israel along with the negative side effects produced by it. Additionally, we will discuss the potential challenges involved with encouraging students to walk in Karmiel. These factors include community safety concerns, environmental factors, and attitudinal barriers among students.

2.1 Traffic Congestion in Israel

Traffic congestion has become a growing concern in Israel in recent years. In fact, traffic data shows that Israel has the highest traffic density among a sampling of countries with comparable living standards. Despite being one of the smallest nations in the dataset, Israel also has one of the highest annual mileage values per vehicle (OECD, 2019). This phenomenon has several possible explanations. First, Israel's compact metropolitan areas leave little space for housing vehicles, resulting in fewer cars per household and more miles logged per car. Second, Israel's primary urban centers are relatively close to each other, meaning longer drives between cities are a more viable option compared to using alternative transportation methods such as buses or trains. Finally, Israel's craggy geography and strict construction codes limit road construction, leaving few alternatives when roads become congested. Despite the abundance of

buses and trains, public transportation has been ineffective in reducing congestion, and most people continue to rely on vehicles. Although buses and trains abound, they seem to be sub-optimal options and most people continue to turn to a vehicle for transportation needs. To sway transportation choices, plans to expand railway lines and subway systems have been put in place. However, short-term solutions are also necessary to address the dire traffic problems.
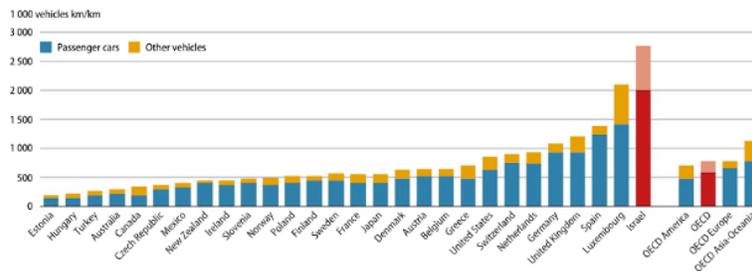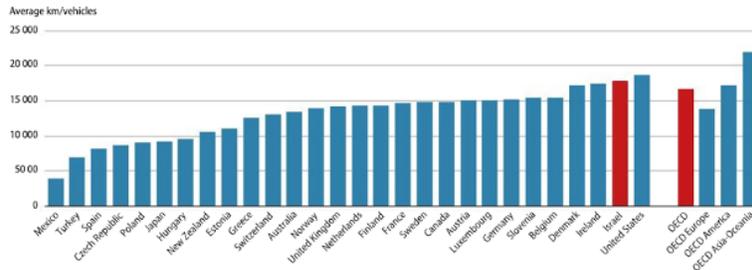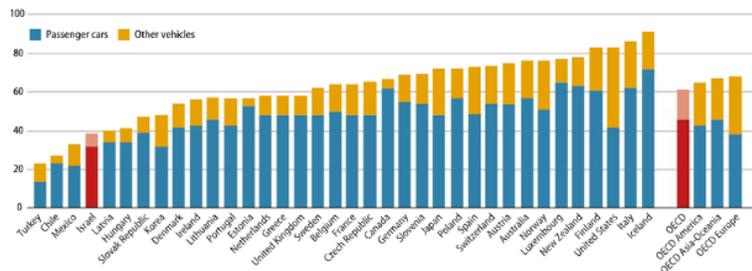
Figure 2: Bar charts noting traffic patterns in Israel and other select countries (OECD, 2019).

Since before Covid-19, the Israeli government has been attempting to find a solution to the traffic congestion issue. Initially, Israel attempted to implement a "fast lane" on the busy Route 1 highway in Tel Aviv. There was a toll required to use this lane, and the money was to be used for transportation and infrastructure development costs. However, this solution did not reduce the traffic as much as the government would have liked.

Israel then turned to other cities for ideas on how to alleviate traffic congestion. Cities such as London, Singapore, and Stockholm have implemented congestion pricing that taxes drivers for entering these cities during peak commuting times. This approach has led to initial reductions in traffic and improvements in air quality while generating a steady stream of revenue to support public transit and other infrastructure (TOI Staff, 2019). In 2019, New York City was also planning to become the first American city to introduce congestion pricing. However, no such tax has been implemented due to the Covid-19 pandemic and government red tape (Julian, 2021).

Israel is planning to follow the lead of other cities and introduce congestion pricing in March of 2024 (Julian, 2021). This charge, officially titled the "public transport fee", aims to generate funds for a five-year plan to develop public transport. Despite facing opposition from officials who argue that it will disproportionately impact the less well-off, Israel's Ministry of Finance successfully passed the congestion charge into the Economic Arrangements Bill (Lieberman, 2021). The reason for this is the worsening transport crisis in Gush Dan, making it necessary to reduce traffic in the short term. The revenue generated from the charge will also be used to fund transportation infrastructure projects to address the problem in the long run. Specifically, the change will divide the greater Tel Aviv area into three zones, with higher

charges resulting the closer you get to the central city. It is reported that the maximum charge will not exceed NIS 37.50 per day, even if you pass through all tolls (Lieberman, 2021).

While the problem of traffic congestion in Karmiel is mainly attributed to the poor infrastructure, the Covid-19 pandemic has undoubtedly exacerbated the issue. Over the last five years, Israel's number of cars per 1,000 residents has risen from three hundred to four hundred. This statistic is independent of Israel's rapid population growth; however, the population increase also makes traffic congestion higher than usual. Because of the pandemic, people are carpooling less, which is observed by Shakman, head of the Division for Data Collection, Survey, and Research at Ayalon Highways (Keller-Lynn, 2021).
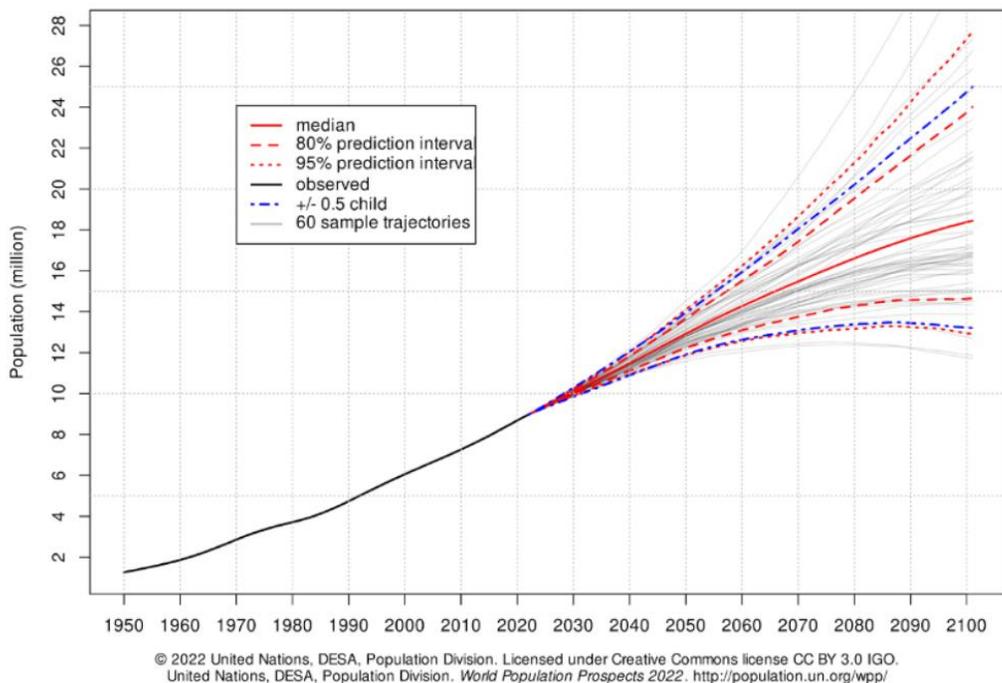
Figure 3: Projected population growth of Israel (United Nations, 2022).

The traffic problem in Israel is not going away on its own. Work must be done to lower traffic congestion, whether that is through congestion charges, a renewed feeling of health safety when riding public transport and carpooling, or other larger-scale projects such as traffic infrastructure changes. With a population growth rate of 1.64% and an expected population of 11.5 million people by 2040, the traffic congestion issue in Israel will only continue to get worse if action is not taken (World Population Review, 2023, United Nations, 2022).

2.2 Barriers to Walking to School

There are many ways traffic congestion issues can be combated, such as increased public transportation infrastructure, efforts to create hybrid or remote working environments, and, as previously mentioned, introducing congestion charges during heavy commute times. For the scope of this project, we decided to focus on reducing traffic congestion during morning commute times by finding ways to increase the number of students who walk to school rather than taking rides from their parents. Currently, the morning traffic in Karmiel is primarily caused by parents dropping off their children before heading to work. By reducing the number of students who are driven to school, the traffic congestion in the area can be significantly reduced (Reyer et al., 2014).

While encouraging students to walk to school seems easy enough in theory, there are various barriers that can occur that may reduce the walkability of an environment. For example, the safety of an area is a huge thing to consider, both with crime rates and traffic accidents involving pedestrians. Other factors to consider are the infrastructure in place for walking, such as sidewalks, shading trees, and crossing walks with signals, the weather, distance, and other environmental considerations, and the internal motivation of the individuals walking.

First off, crime rates are particularly important as they contribute to the sense of disorder in a neighborhood, which can make people uncomfortable about walking outside. Research has found that the presence of "broken windows, graffiti, unmaintained greenspaces, etc." reduces the likelihood of people leaving their homes on foot (Pearson et al., 2021). This feeling of discomfort could discourage students from walking to school as opposed to other, potentially safer, modes of transportation.

However, crime rates in Karmiel are very low, and there are no signs of a significant increase in crime in the future. The perceived safety of walking alone during the day is 100%, while the perceived safety of walking alone at night only drops to 87.5% (*Crime in Karmiel*, n.d.). With such low crime rates, there is an opportunity for students to enjoy the benefits of walking to school without compromising their safety.

The number of traffic accidents involving pedestrians can also be a contributing factor to whether students walk to school. A study conducted in Seoul, South Korea, found that Pedestrian Priority Streets (PPS) garnered a significant uptick in the perceived safety of the local population. Taking a closer look at the data for the streets improved by PPS reveals that 66.9% of pedestrian traffic accidents occur on streets not employing PPS. Not only do more traffic accidents occur in areas without PPS, but after employing the practice on previously non-PPS streets, there is a subsequent decrease in pedestrian traffic accidents (Lee & Kim, 2021). Based on the success of this study, it can be concluded that enabling PPS practices on the streets of Karmiel could increase pedestrian confidence and thus increase the number of students walking to school.
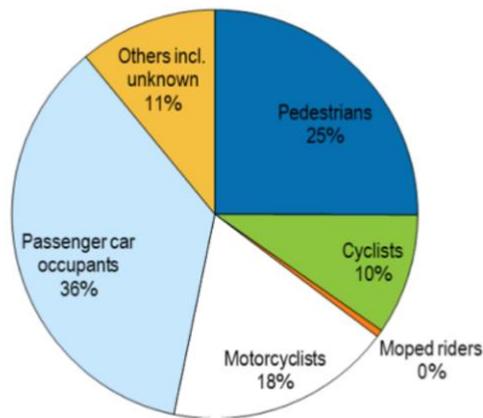
Note: the "Others including unknown" category includes drivers and passengers of buses, trucks and tractors, riders of electric bicycles and unknown fatalities.

Figure 4: Road fatalities by road user groups in Israel.

Although Karmiel does not employ PPS, Israel has a low number of traffic deaths, with only "3.9 traffic deaths per 100,000 inhabitants," compared to the European Union's "5.1 deaths per 100,000 inhabitants in 2019" (Israel - International Transport Forum, 2020). Additionally, as shown in Figure 4, only 25% of traffic deaths are pedestrians. Based on these statistics, it can be concluded that Israel's safe community creates an opportunity for students to walk to school. Environmental factors can play a large role in whether a student is willing to walk to school. Factors such as extreme heat or rain, long walking distances, and significant elevation changes can contribute to general inconvenience, potentially discouraging students from walking and incentivizing them to use other modes of transportation.
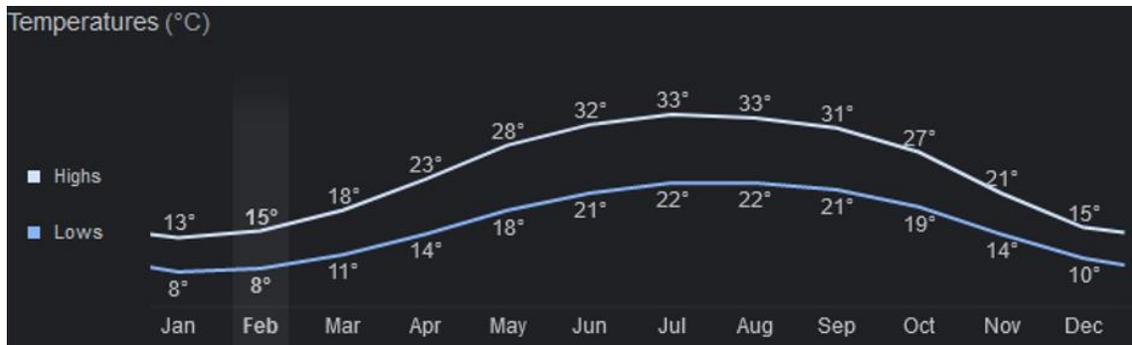
Figure 5: NOAA sourced weather averages in Karmiel, Israel.

In Karmiel, however, the weather is generally mild, making it a comfortable experience for students to walk to school. Average temperatures range from eight degrees Celsius in January to thirty-three degrees in July (see Figure 5), allowing for a comfortable walking experience for most of the year, especially for shorter distances.

As distance and other deterring factors arise, alternative means of transportation may make more sense. While walking itself may be a fun experience for over 70% of students (McDonald, 2008), studies have shown that adverse traffic acts as a barrier for 40% of children, and distance inhibits over 50% of kids (CDC, 1999).
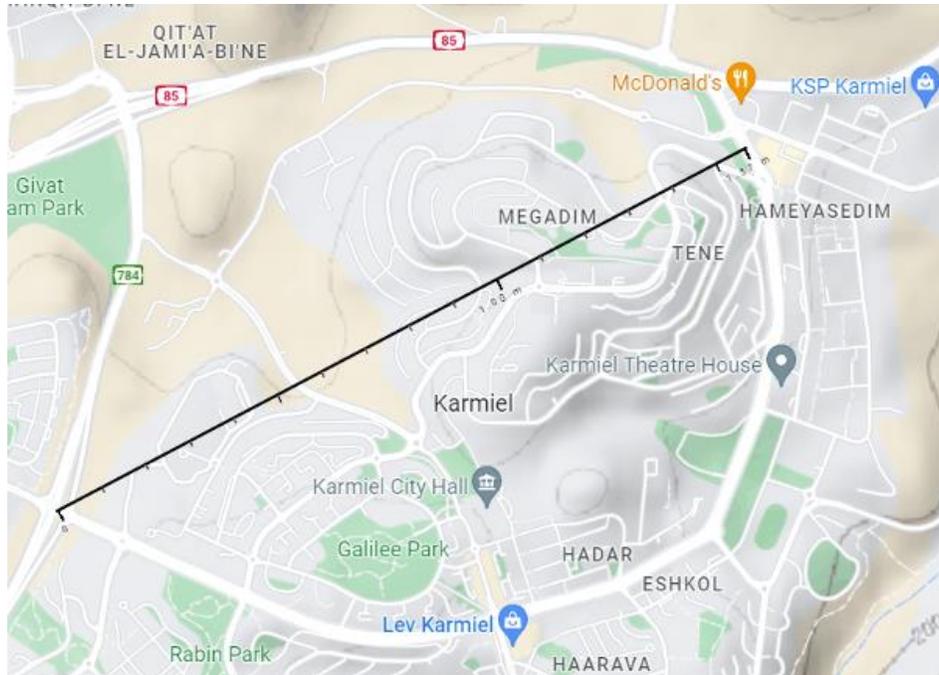
Figure 6*: Topology map of Karmiel, which is 2.53 kilometers (1.57 miles) across.*

Fortunately, the schools in Karmiel are evenly distributed throughout the city, and most students are within walking distance as Karmiel is only 2.53 kilometers across. However, the city's elevation changes can negatively impact its walkability, particularly in the eastern part of the city, which is built on hills. Many roads spiral up the hills (see Figure 6), which increases the walking distance and difficulty of the terrain. Even small changes in elevation can significantly increase the difficulty of walking. For cyclists, an 8% gradient is considered the "Last Good Grade," which is the highest gradient they can still manage without excessive strain, while 12% is considered painful for most riders (Neef, 2013).

Despite being within walking distance, the perceived lack of convenience often determines a student's preferred mode of transportation to and from school. Unfortunately, walking is often seen as less convenient compared to other methods of transportation. Naturally, there is an inclination to opt for the easiest option. If buses or personal family vehicles are

available to the student, they are less likely to walk to school. On the flip side, students without access to these luxuries may need to walk out of necessity.

Some studies estimate that about a quarter of children who are not deterred from walking by any identifiable barriers still do not walk to school (CDC, 2002). This is likely due to the perceived convenience of driving to school rather than walking.
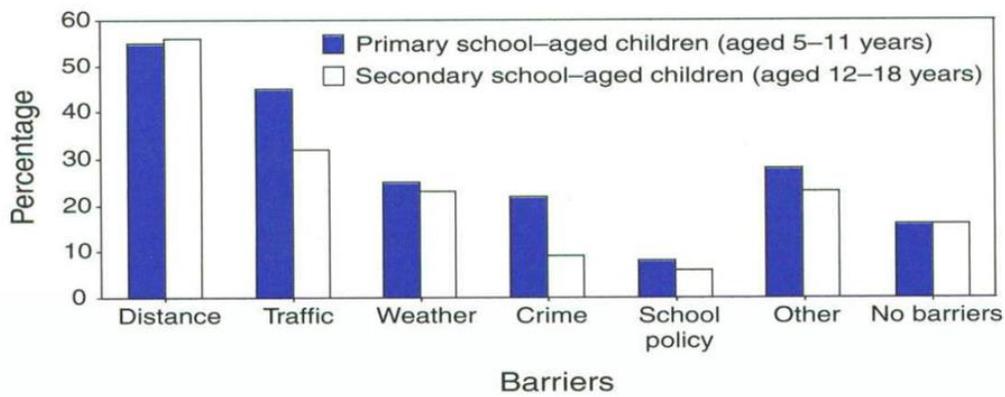
Figure 7: Barriers to walking to school distributed by age groups (CDC, 2002).

Finally, there is also the question of whether high school students are driving themselves to school. However, the size of this group will not be large enough to have any significant impact. Firstly, we will be working with younger high schoolers who cannot legally hold a driver's license. Furthermore, Israeli upperclassmen obtain licenses quite late into their high-school career. Driving regulations in Israel require new drivers to be seventeen years old and imposes a three-month moratorium where the student cannot drive unaccompanied by an adult (Taubman-Ben-Ari, 2010). Additionally, Israel's generally congested cityscapes mean owning extra cars is difficult for families. A more practical solution would involve the student taking advantage of public transport or pedestrian infrastructure. In short, teenage driving in Israel is

comparatively inconvenient, and addressing it would not have a significant impact on Karmiel's traffic problem.

2.3 Solutions to Encourage Walking to School

There are several solutions that can be implemented to encourage students to walk to school, and one approach is to focus on community building. Research has shown a positive correlation between neighborhood density and the number of students walking to school. While the exact aspects of a dense neighborhood that contribute to increased walking are up for debate, pedestrian-focused infrastructure must be in place to accommodate a greater number of residents. Additionally, higher population density is often associated with lower incomes, which can lead to more people walking due to a lack of affordability of other transportation methods. While it may be impossible to create high-density neighborhoods next to schools that do not already have them, certain features of these neighborhoods can be applied to a walk-to-school program. For example, walkability near the school can be improved, or walk-to-school days can be established to simulate what it is like to live in a crowded neighborhood (Braza, 2004).

Proactive solutions for encouraging walking to school can be implemented through school ordinances. For example, schools can ban buses for students who live within walking distance or require parents to purchase permits for dropping off their children. Such measures can reduce the convenience of alternative transportation methods and encourage students to walk. Another approach is to promote infrastructure projects that improve walkability in the long term, but this may not be feasible within the short timeframe of this project.

A more practical solution could involve placing crossing guards at dangerous intersections. This measure would not only ease traffic but also make the roadways safer for

pedestrians. Students may be more inclined to walk if areas near the school were made less intimidating by the presence of an official. However, it is worth noting that Karmiel already appears to be a very walkable community, and crossing guards may not be necessary.

Although environmental aesthetics may not be a significant factor in deterring students from walking, a well-maintained and attractive area can enhance the experience. Nobody wants to walk through an unappealing and dirty environment to reach their destination. Key factors that influence the aesthetics of an environment include the beauty of the scenery, foliage, building structures, business signs, and roadside plantings or trees (Chiang et al, 2017). Additionally, roadside trees can provide shade to pedestrians, which can be helpful on warmer days throughout the year.

Another possible solution to encourage students to walk to school is through incentivization. While many students are already motivated by the intrinsic value of walking to school, such as physical fitness and reduced commute time for their parents, others may need extrinsic motivation in the form of direct rewards to start walking. However, it is important to consider that extrinsic motivation should not be the final solution. A study on intrinsic and extrinsic motivation in children's academic performance found that "intrinsic motivation is an essential quality for students to possess in order to learn to their fullest potential" and "the use of extrinsic motivators and rewards in school undermine a student's developing intrinsic motivation and have a negative effect on learning for all students." This can also apply to a student's motivation to walk to school. Extrinsic motivation can be used to get students to walk to school initially, then gradually phase out direct rewards as students begin to realize the intrinsic value of walking to school (Baranek, 1996).

One potential solution to motivate students to walk to school is through software gamification, otherwise known as the action or process of making something into or like a game. Research has shown that gamification can increase student engagement and performance in the classroom, and this approach can be applied to a wide range of ages (de Freitas & de Freitas, 2013). By using gamification to turn walking to school into a fun and competitive game, students may be more likely to participate and overcome barriers that may be preventing them from walking.

One effective strategy for encouraging students to walk to school is to communicate the benefits that walking can have for both the individual and the community. This can be achieved through a variety of channels, such as mobile or web apps, infographics, and Q&A forums. Educating the community on the advantages of walking raises awareness and encourages more students to choose this mode of transportation.

Another compelling reason for encouraging students to walk to school is the potential health and wellness benefits. Walking to school can help students start their day with physical activity, which can improve their overall health and well-being. Regular physical activity has been linked to a range of benefits, including improved cardiovascular health, stronger bones and muscles, and better mental health. Additionally, numerous studies have shown that increased physical activity in students can lead to improved academic performance and decreased behavioral problems (Active Living Research, 2012). By promoting walking to school, students can develop healthy habits that can benefit them throughout their lives.

An additional benefit of promoting students walking to school is the positive impact on the environment. By reducing the number of vehicles there would be a decrease in carbon emissions. A study in New Zealand that promoted cycling and walking found a small decrease in

carbon emissions in the targeted communities (Keall et al., 2018). Scaling up this intervention to schools could result in significant reductions in carbon emissions if more students opt to walk to school, reducing the number of cars on the road during peak traffic hours. This can have a direct impact on improving air quality and the overall health of the community.

While we were unable to find a study on walking to school in Israel specifically, we believe the research we found from other areas was a good starting point for developing our data collection methods, such as our survey and interview instruments (Appendix A). A previous IQP done in the London Borough of Croydon helped determine possible reasons students would not walk to school and what might possibly motivate students to. While the areas of Croydon and Karmiel are not similar in terms of topographical features (Karmiel has significantly more elevation change), they both have possible weather problems that are not ideal for walking (extreme heat for Karmiel and extreme rain showers in London). However, one of the major reasons students didn't walk to school in Croydon was because parents did not allow it (Worcester, 2013). In comparison to London, Karmiel is a very safe area, and parents are less likely to disallow their children from walking to school.

Our research helped guide our data collection methods to best fit our focus on encouraging students to walk to school. It provided us with examples of gamification and incentivization effectively getting students to participate in class lectures. Additionally, the research we collected helped us develop our project methodology and data collection tools.

3. Methodology

This methodology section provides a detailed description of the data collection methods with rationales for each and our data analysis procedures. Additionally, the ethical considerations for the study are discussed, including the informed consent process and the measures taken to protect the confidentiality of participants' data. Specifically, when conducting research with minors, it is critical to adhere to certain ethical protocols. Our assent and consent forms for involving minors in this project are included in Appendix F. This section ends with a discussion of our work to create a mobile application to encourage students to walk to school.

3.1 Protocol for Minors

As previously mentioned, working with minors requires a higher level of care when obtaining consent. To make sure we followed all the proper guidelines, we utilized both a Parent Consent Form and a Participant Assent Form, which can be found in Appendix F. Additionally, when doing interviews with minors, a staff member or teacher from Ort Kramim was present, as well as our associate from Braude College, Bar Levy. The only other individuals in the interviews were members of our research team. We received permission from the school to perform these interviews on the students.

There were no major risks involved with this study, and all participation was completely voluntary. Participants did not have to answer a question if they did not feel comfortable and were able to leave the interview at any point in time. Audio recording occurred with permission, but no video footage of the students was kept. None of these audio recordings will be released to the public domain, and we ensured no data collected or utilized in our final proposal identifies the minors in any way.

All interactions with students at Ort Kramim were mediated by teachers, mostly Limor Dan and Inbal Arditi, along with other faculty members. Additionally, Braude College of Engineering professors Dr. Nirit Gavish and Dr. Anat Dahan were in attendance for some of the interactions with the students. The conversations with the students focused mainly on discussing the app and survey data.

3.2 Data Collection Methods

This project aimed to collect data to identify barriers to walking to school in Karmiel in order to develop effective strategies to encourage students to walk. The data collection methods included online questionnaire-based surveys, participant observations, and interviews. The online surveys gathered data from students, while the participant observations provided insights into natural features and pedestrian infrastructure. Interviews with high school students and school officials explored factors that influence commuting decisions and identified strategies to encourage walking to school.

Our first data collection method was an online questionnaire-based survey (Appendix A). This survey included both short-answer and multiple-choice questions designed to gather useful information about current walking habits, barriers to walking to school, and potential solutions to increase the number of students who walk. Surveys were sent to students at Ort Kramim. As mentioned in our Minor Protocol section, participants were informed of the purpose of the study and provided informed consent before completing the survey. All data collected was kept confidential and anonymous to protect the privacy of participants. The study was reviewed and approved by the Institutional Review Board to ensure that it met ethical standards for research with human participants.

The student surveys provided us with a comprehensive understanding of the specific challenges that Karmiel students face when it comes to walking to school. This information allowed us to focus our efforts on addressing the most critical issues that prevent students from walking to school. For instance, similar surveys conducted in other regions have revealed valuable insights into student behavior and preferences. For example, in a survey conducted in the London Borough of Croydon, the researchers were able to determine the percentage of students who walked to school, the reasons why they did not walk (living too far away, parents drive them, do not want to), and if they would be motivated to walk if offered a badge incentive (Worcester, 2013).

Another way we gathered data was by conducting interviews with individuals who fell into our desired demographics. Fostering in-depth discussions about topics related to walking to school yielded valuable data that was later coded. The first group interviewed were high school students, with questions aimed at determining what motivates their commuting decisions and what incentives might encourage them to walk to school. Additionally, the interviews explored how much weight students place on factors such as distance and parental pressure. Interviewing students helped us understand their transportation choices and allowed them a space to share any ideas they have on how to encourage more students to walk.

Interviewing schoolteachers provided additional data, such as past attempts to encourage students to walk to school and successful strategies used by other school districts. Additionally, the teachers had insight into what motivates students, such as class competitions. Faculty members also provided insight into school policies that may affect students' willingness to walk, such as strict late policies and punishments for tardiness. Overall, conducting interviews with

various stakeholders provided a comprehensive understanding of the factors influencing student transportation choices and helped develop effective solutions for promoting walking to school.

Lastly, participant observation played a crucial role in understanding contextual nuances and gathering relevant data for the project. While engaging in casual conversations with students, the observer was able to note natural features and pedestrian infrastructure, as well as observe the behavior of high school students. Accompanying students on their journey to school provided valuable insight into what active walkers experience. The observer used their surroundings to pose related questions to students, which led to a direct discussion about the pros and cons of walking and the student's preferences for walking. The observer also considered their observations as individual entities, noting prevalent barriers and identifying potential solutions.

3.3 Analyzing the Data

There were various options for recording survey responses, such as online survey tools or paper-based surveys. While online surveys may be more convenient and offer real-time data, paper-based surveys could be more suitable for populations with limited internet access or technology literacy. However, the biggest challenge with digital surveys was response bias, where people were less likely to respond if they could complete the survey digitally at their own pace compared to filling out a paper survey in person. This can lead to a misrepresentation of the surveyed population and an inaccurate analysis. Despite this, digital surveys remained the best option because of their convenience, and hopefully, the benefits of digital surveys will offset the response bias. Regardless of the type of survey, it is crucial to ensure that the questions are clear and concise to avoid any confusion or misinterpretation.

When conducting interviews, it was important to consider the various methods of recording responses, including written transcripts, audio recordings, and video recordings, each with its own advantages and disadvantages. The choice of transcription method should be tailored to the specific needs and objectives of the study. For formal interviews, written transcripts were essential and ideally involved both an interviewer and a scribe to ensure accuracy and thoroughness in analyzing the participants' responses. However, this method is prone to human error, such as transcription errors or missed responses. Formal interviews are best conducted with teachers in a professional setting where they feel comfortable sharing their thoughts and opinions.

For less formal data collection methods, such as participant observations, we used our phones or other recording devices to assist us in the data collection process. Since these interactions were casual, having a scribe was difficult. Instead, audio or video recordings will ensure that the entire conversation is captured, including non-verbal cues such as tone and other qualitative data that can support our idea that walking to school can be enjoyable. This form of data collection is suitable for ensuring that students are comfortable talking and is convenient for us as we will be on the move.
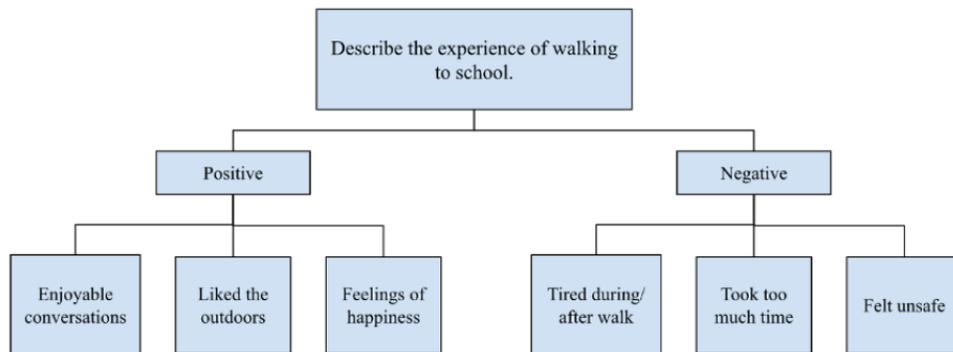
Figure 8: Example of coding a survey question.

The quality and usefulness of our data analysis depended on the responses we received from students. By coding students' feelings about walking to school, as shown in Figure 8, we were able to obtain quantitative data on how many students enjoyed it. By doing so, we used this data to support the positive impacts of walk-to-school days and encourage students to walk to school more often. This coding example provided us with quantitative data on the number of students who enjoy walking to school and informed us about which aspects of walking to school need improvement. With this information, we furthered our research and decided on the next steps to advance our walk-to-school campaign.

3.4 Application Development

We found that the most effective approach to promoting walking to school among students was to target those who are capable of walking but do not usually do so. While many Israeli students enjoy walking and recognize its health benefits, some find it inconvenient and choose not to. Our objective was to provide an incentive that would outweigh this perceived inconvenience. To this end, we developed a mobile application that students can download and use to track the distance they walk to school. Students earn points based on both the distance they cover and the number of consecutive days they walk. These points can be redeemed for rewards. Initially, we considered digital rewards like badges and trophies, but we realized that the rewards needed to be more substantial given the age of the students. After consulting with students at the school, we decided to offer coupons that can be used to purchase food in the school cafeteria or at local businesses as the most appealing reward option.

This application was developed using a Flutter framework, an Express backend hosted on Vercel, and a MongoDB database. We decided to use Flutter for our application because of its

ability to easily convert between Android and iOS development. However, due to the high usage

of Android users in Israel, we focused on producing an application that could be uploaded to the

Google Play Store. However, the application could possibly be uploaded to the Apple App Store

in the future with minimal changes.

The main purpose of the Walk2School application is to encourage students to walk to

school while also collecting data on their walking habits. For example, the app asks users to

indicate their gender and their age so we can get an idea of the demographics of the individuals

choosing to use the app. The app also keeps track of the speed at which a user moves, the total

distance they travel, and the average distance they travel during a walk. This will allow for future

conclusions about the app, such as whether a certain gender is more likely to use the app, or if

only students who live close by who walked before the implementation of the app are walking.

3.5 Limitations of Study

This paper would be incomplete without recognizing where gaps or limitations in this

project occurred. The scope of this project was limited by having only seven weeks to complete

the project and only being physically present in Israel for four of those weeks. To combat traffic

congestion, an ideal solution would have been to analyze the street infrastructure in an area to

determine where improvements could be made to create the most efficient traffic patterns. With

minimal time and access to the traffic area, a full-scale traffic study was not feasible, resulting in

our decision to focus on just the traffic congestion created from children receiving rides from

their parents instead of walking to school.

Additionally, a language barrier was present when attempting to gather data for this

project. While we had a translator present for our interviews, it is possible questions from our

surveys were misunderstood by the students. For example, one of our survey questions involved asking students how often they "walk" to school, which translates in Hebrew to simply how often do you "go" to school. This language barrier could possibly have created a source of error in our data collection process.

One additional limitation from this study was the lack of time to collect traffic data after our Walk-to-School Day. Because of the small amount of time we had in Israel, our ability to get a large amount of traffic data to work with was limited. This makes it difficult to see any long-term effects of either our Walk2School application or the Walk-to-School Day. Lack of time also inhibited our ability to perform additional data collection methods we wanted to, such as distributing a parent survey or conducting parent interviews, holding focus groups with students, and interviewing more faculty members. It may be a good idea for future teams to consider parental influence to further motivate students. An example of our parent survey and interview guide we originally planned to use can still be found in Appendix A.

Overall, despite these limitations, we feel we were able to collect enough data to ensure our results and conclusions are well supported. Most of our focus was on the students, and we received around two hundred responses from them, as well as being able to complete four interviews. Additionally, we had data collected from our observations during our less formal interactions with the students while visiting Ort Kramim. Therefore, we feel we have a sufficient amount of data to support our results and conclusions.

4. Results

For this study, we completed a variety of data collection methods to acquire information on ways to encourage students to walk. The results of these different methods include qualitative data gathered from observations and interviews, along with quantitative data collected from surveys. Additionally, in this section, we will discuss the results of our application development process and the Walk-to-School Day held at Ort Kramim high school on May 2nd, 2023.
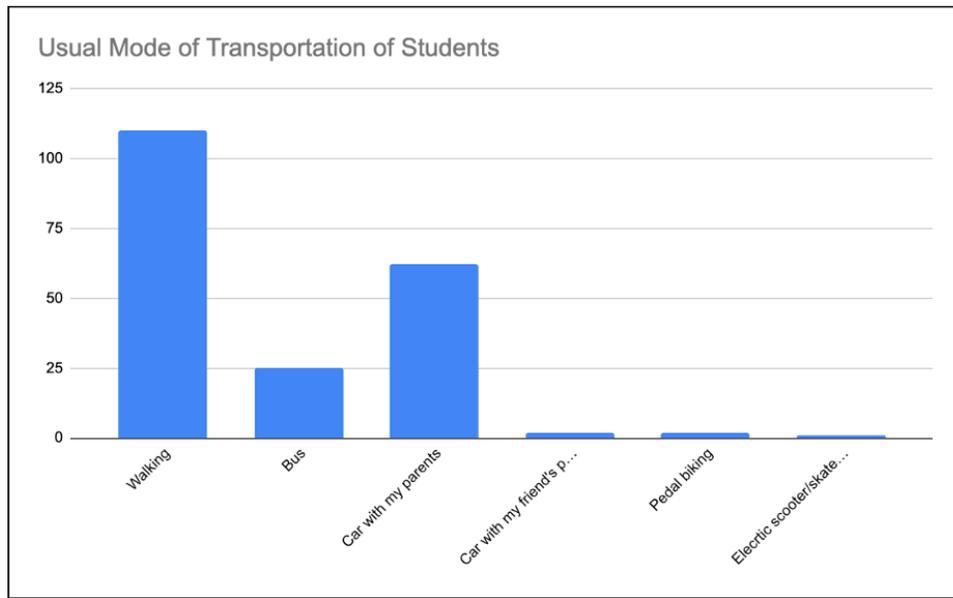
Figure 9: Modes of transportation students use to get to school based on survey data.

4.1 Observational Discoveries

What was immediately apparent about Karmiel was the hilly topography. The town slopes upward away from the highway, with the high school located halfway up the incline. The aesthetics of the area are excellent, with palm trees and lush shrubs lining the streets and low mountains rising in the distance. There is no shortage of natural sights to look at and walking in ideal weather conditions is a very pleasant experience. However, on the hotter, dryer days during

the year the Sun's rays can be overwhelmingly strong, and this, combined with large elevation changes, can make walking to school a taxing endeavor. On the days when temperatures are more extreme, public buses present a far more convenient option.

Figure 10: Walk to School group members walking to Ort Kramim high school.

Nevertheless, on days when the weather is mild enough, there are plenty of walkable features one can use to their advantage. The roads are well-paved and free of potholes, and while some sidewalks could use some maintenance, most streets have them at least on one side of the road. Additionally, many of these sidewalks have trees or other objects that provide shade.

Rotaries are prevalent and replace traffic lights at most intersections to prevent queues from forming at high-density intersections and establish a safer crossing situation for pedestrians. Pedestrian crossing areas are precisely marked, and most have crossing lights to indicate when it is safe to cross. At crosswalks without lights, motorists respect a walker's right of way. All in all, the area around Ort Kramim is walkable, with designated places for walking and crossing, shaded pathways, and crossing lights for safety.

Traffic is clear for most of the day. During the range relevant to our project, from seven to eight in the morning, cars seem to get stuck at rotaries and stoplights. A rotary near the college and high school is particularly problematic. Cars and buses struggle to make it into the circle and queues develop on all sides of the roundabout. The traffic is exacerbated by the presence of two bus stops located near the rotary. Cars must consistently watch out for buses entering and exiting the pickup areas. Parents also use these zones to drop their kids off for school. This slows down traffic flow even further and is compounded by parents who simply pull over to the side of the road to drop their kids off, effectively knocking out an entire lane of traffic in the process. Interestingly, large volumes of pedestrians also seem to slow down the intersection. If a lot of people are crossing, the traffic light that tells cars to stop for pedestrians will be red for a very long time. For the half-hour before school starts, the light will turn red frequently. This leads to substantial traffic in the morning, and it penetrates neighborhoods. Oftentimes, backups can extend as much as a half-mile away from the rotary.

4.2 Participant Opinions on Walking

After interviewing four students from Ort Kramim and gathering around two hundred responses from our survey, we have concluded that, in Israel, walking is viewed as healthy,

relaxing, and a time to build friendships. The students shared their opinions and experience which revealed a common theme of the benefits and drawbacks of walking. Some of the students expressed their appreciation for walking to stay active and enjoy the outdoors, while others discussed the challenges of walking in certain environments or situations. The interviews provided valuable insight into the perspectives of young people on the topic of walking to school, while the survey allowed us to understand the general opinions that represent most of the student body.
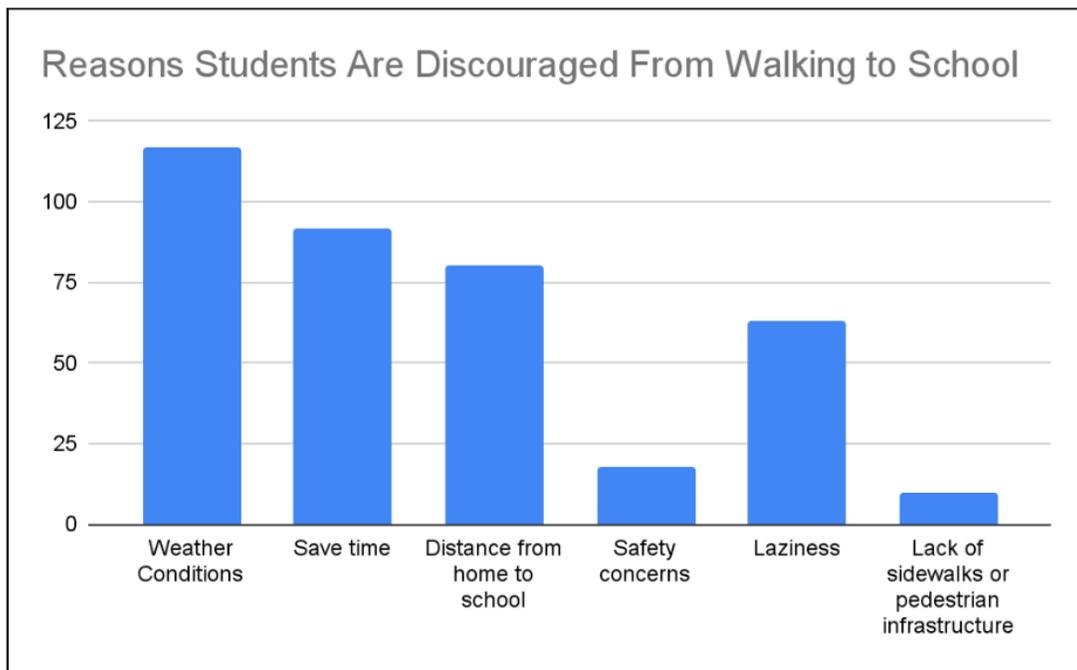
Figure 11: Factors that discourage students from walking to school based on survey data.

As it is part of Israeli culture to serve in the military after high school, nearly all of them have an internal drive to stay active. Israeli students strive to stay in shape as, "They want to get into the most prestigious units in the army [and must practice] in order to get into these units" (Appendix B, Teacher Interview). Walking to school can help keep Israeli teens in shape to

prepare them for serving in the army after high school. Additionally, the survey reports that only 8.8% of students dislike walking/sports, meaning most students enjoy engaging in an active lifestyle. While 54.5% of students reported walking to school already, the goal of this project is to encourage as many of the remaining 45.5% to walk as possible. While we can not change deterring factors like weather and distance, out of the students that do not walk, 37.0% of them reported that one of the reasons they do not walk is because of laziness. This is the group we think would be most convinced by extrinsic motivation methods such as incentives or gamification of walking.
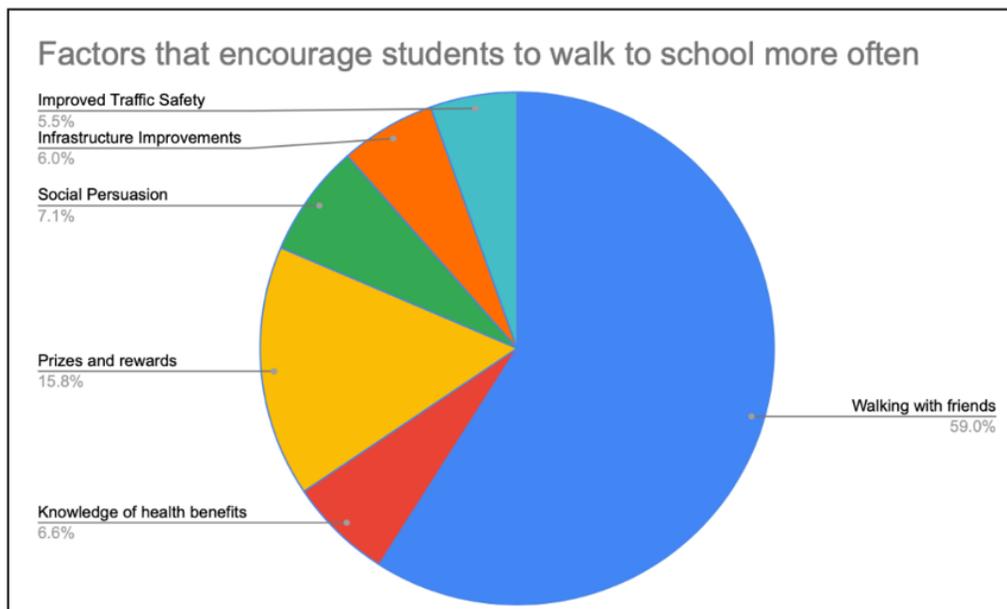
Figure 12: Factors that encourage students to walk to school based on survey data.

However, it is possible the only convincing we need is peer pressure. According to the survey, 59% of students claimed that walking with friends would encourage them to walk more (Figure 12). It is also important to note that 56.3% of those who do not walk to school said that walking with friends would encourage them to walk more.

Hagalil they get to school by: Bus	2	Hagalil with a detour of 11-15 min	2
Hagalil they get to school by: Car with my friend's parents	1	Hagalil with a detour of 15min +	3
Hagalil they get to school by: Car with my parents	2	Hagalil with a detour of 6-10 min	1
Hagalil they get to school by: Walking	2	Makosh with a detour of 0-5 min	9
Makosh they get to school by: Bus	2	Makosh with a detour of 11-15 min	5
Makosh they get to school by: Car with my parents	21	Makosh with a detour of 15min +	3
Makosh they get to school by: Walking	8	Makosh with a detour of 6-10 min	5
Rabin they get to school by:	1	Rabin with a detour of	2
Rabin they get to school by: Bus	3	Rabin with a detour of 0-5 min	24
Rabin they get to school by: Car with my parents	20	Rabin with a detour of 11-15 min	6
Rabin they get to school by: Pedal biking	2	Rabin with a detour of 15min +	2
Rabin they get to school by: Walking	80	Rabin with a detour of 6-10 min	19
Ram they get to school by: Bus	6	Ram with a detour of	1
Ram they get to school by: Car with my friend's parents	1	Ram with a detour of 0-5 min	12
Ram they get to school by: Car with my parents	10	Ram with a detour of 11-15 min	2
Ram they get to school by: Elecrtic scooter/skateboard/bicycle	1	Ram with a detour of 15min +	5
Ram they get to school by: Walking	12	Ram with a detour of 6-10 min	4
Southern they get to school by: Bus	6	Southern with a detour of 0-5 min	1
Southern they get to school by: Car with my parents	1	Western with a detour of 0-5 min	3
Western they get to school by: Bus	3	Western with a detour of 15min +	1
Western they get to school by: Car with my parents	5	Western with a detour of 6-10 min	2

<div align="center">A   B</div>

Figure 13: *(A) Number of students by neighborhood and mode of transportation. (B) Number of students by neighborhood and reported detour time.*

Overall, the data indicates that the mode of transportation depends on the distance students are from the school. Students who listed walking as their main mode of transportation live an average of 0.96 km away, students who listed taking the bus live an average of 1.39 km away, and students who listed getting a ride from a parent live an average of 1.5 km away. However, it is important to note that these averages could be skewed due to translation errors or inaccurate estimations.

If one splits the data with respect to gender, the resultant models are virtually identical to the distributions governed by the master data. In fact, splitting the dataset by gender fails to yield

any substantial conclusions. However, small idiosyncrasies still create deviations in the two datasets from the parent and each other. For example, females are less likely to be simulated by external factors. Walking was tolerable enough to the point where 13.5% of girls said they would not need extrinsic forces to get them to walk while only 6.1% of boys said an incentive would be unnecessary. On the flip side, male students expressed a slightly stronger affinity towards material rewards. Boys selected rewards and prizes as their incentive 15% of the time, while only 12% of girls said they were motivated primarily by material incentives. Surprisingly, social forces exert themselves equally upon both genders. Interviews conducted with students seemed to suggest girls would be more inclined to walk if their friends did as well. However, there proved to be no substance in these theories. On the whole, strong links correlating incentive and gender would be hard to forge with this distribution.
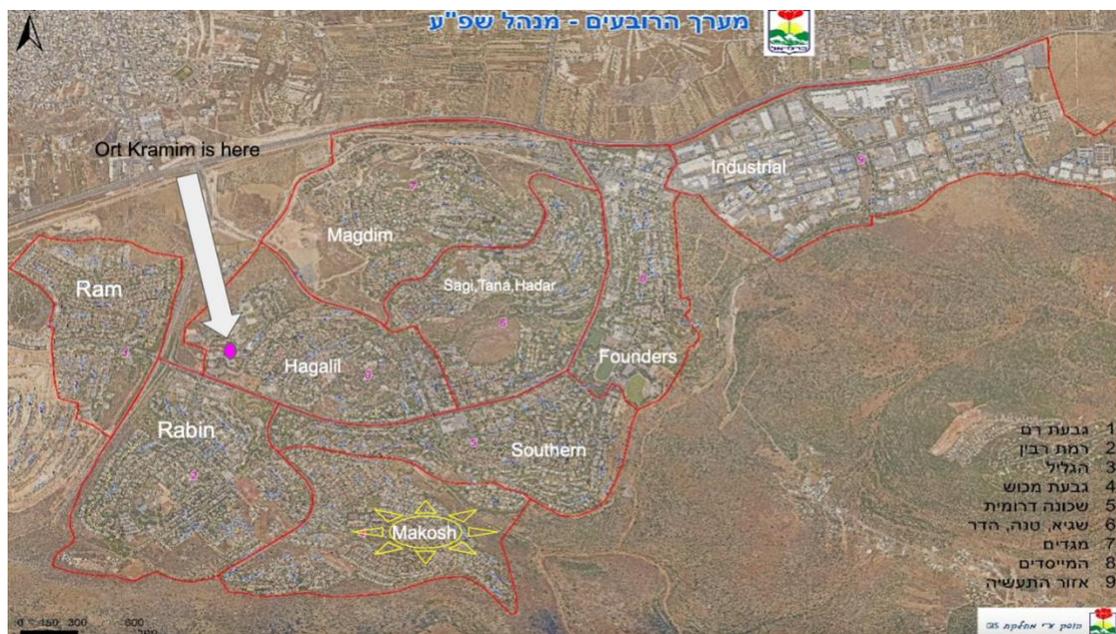
Figure 14: Map of Karmiel. Ort Kramim High School is denoted by a violet dot. Makosh, a neighborhood very important to our research is also highlighted.

One particularly interesting neighborhood is Makosh. A substantial percentage of automobile traffic hails from this sector. In fact, only 16% of survey respondents said they live in Makosh, yet residents of the area comprise 35% of students who get to school by car. Although Ort Kramim primarily serves the communities within Rabin, the high driving rate characteristic of Makosh stands out when compared to other outlying neighborhoods. The disparity likely has its root in affluence. The difference between a residential street in Rabin, the neighborhood located nearest to the school, and Makosh is striking. While Rabin is populated with large multi-story apartment complexes, Makosh boasts spacious single-family homes. Most homes are furnished with either a shady overhang about the size of a car or a personal garage. Clearly, owning a vehicle in Makosh is substantially more convenient than in other parts of Karmiel. Therefore, future efforts to discourage driving to school must be targeted at residents of Makosh. Incentives would be a good idea; the students of the neighborhood are 10% more likely to be intrigued by rewards and prizes when compared to the 'control' distribution. At any rate, the influencing factor must hold strong sway with the students as getting a ride from parents is, evidently, an easy decision to make.

Figure 15: *Comparing affluence of two neighborhoods. Rabin with apartments is on the left, Makosh is on the right.*

4.3 Walk2School Application

The Walk2School application, as mentioned before, was developed using a Flutter framework, an Express backend hosted on Vercel, and a MongoDB database to store data. Its features include a Login page with account creation capabilities, a Home page with the ability to perform a walk to school and see live data of your walk, a Stats page with the statistics collected for the app user, a Rewards page where students can claim rewards and see their redeemed rewards, and an Active Users page where users can see what other students are currently walking.

On our first visit to Ort Kramim, we presented the Walk2School application to two Data Science classes. Students were able to see a demonstration of a walk being made with live updates to the stats and points. One student also volunteered to try out the account registration feature for the class. The students seemed engaged in the app and excited about the possibility of using it. They had many questions about the constraints of the application, such as when you can collect points and how fast you're able to move to have a valid walk still. A full description of the application is included in Appendix D.

Unfortunately, due to time constraints and other complications, we were unable to upload the Walk2School application to the Google Play Store in time for the Walk-to-School Day. No user opinions or data were able to be collected on the final version of the app we created. However, our ability to create a full working app will help future groups from WPI focus on data collection and expanding features of the Walk2School app.

4.4 Effects of Walk-to-School Day

In the morning, traffic congestion in Karmiel is significant, with 44.9% of students noting that getting dropped off by their parents can add an additional zero to five minutes, 28.8% noting six to ten minutes, 13.6% noting eleven to fifteen, and 12.7% noting over fifteen minutes. However, 40.4% of survey respondents did not record a time for how much of a delay getting a ride from their parents would create.
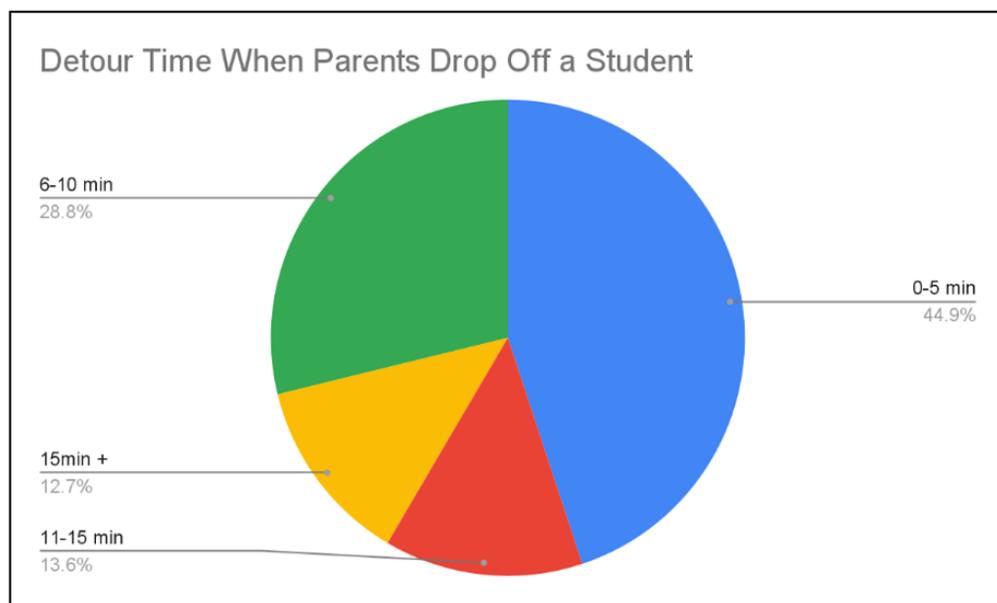
Figure 16: Estimated detour time when parents drop off a student.

To collect and analyze traffic data, a Software Engineering class at Ort Kramim was tasked with creating an application that would record what mode of transportation a user took to school that data. If a student were driven to school, the application would then analyze the traffic conditions of the drive. Unfortunately, the class ran out of time before they could finish the app entirely. To overcome this, our group decided to count cars in areas in which traffic congestion was heavier, specifically a rotary placed right outside Ort Kramim and Braude College.

Counting cars isn't the most reliable way to collect traffic data, and many sources of error are possible when considering the difference between the number of cars before Walk-to-School Day. According to the count, there were around forty more cars on Walk-to-School Day, meaning traffic would have increased. However, the execution of Walk-to-School Day wasn't as smooth as it could have been. Not as many students participated as we would have liked, and it was impossible to tell which students participating usually walked to school and which ones didn't.

Walk-to-School Day wasn't a total loss, as a discovery was made about possible causes of traffic congestion. Due to the nature of the rotaries in the area around the school, having students cross one by one when walking to school results in more traffic than there would be for cars entering or exiting the rotary. To combat this, it might be better to have gathering or meeting points right before rotaries where students can cross altogether. A new feature could be added to the application where bonus points are awarded to students who can meet up with a group of students before crossing the rotary.

5. Conclusions

The goal of this research paper is to answer the question, "What strategies can be implemented to increase the number of students who walk to school, thus reducing traffic congestion?" To address this research question, we have assessed the walkability of the area, identified the current solutions and obstacles, and discussed the potential benefits of walking to school. Through our research, we aim to uncover effective strategies to increase the number of students who walk to school and relieve traffic congestion in Karmiel. By analyzing our preliminary data and identifying the barriers preventing students from walking to school, we have proposed potential solutions such as implementing a walk-to-school program, providing incentives like a reward-based system within a mobile application, and addressing traffic concerns through community partnerships.

5.1 Optimal Conditions for Walking to School

Walking to school can be an enjoyable experience, but certain conditions are required to make the walking situation ideal. For example, many individuals find it inconvenient or uncomfortable to walk in extreme weather conditions such as heavy rain showers, thunderstorms, or extreme high or low temperatures. For this reason, we believe the ideal weather condition for walking is a mild temperature, somewhere around eighteen degrees Celsius (sixty-five degrees Fahrenheit) with no adverse weather conditions.

Additionally, certain terrain conditions are required to maintain an enjoyable experience when walking. A very hilly area can be tiresome to walk in for long distances, and it is not ideal to have the walk to school be such an intense workout that students are sweaty when they arrive

at school. A few minutes of walking with some to no elevation change or a longer walk with minimal elevation change would be a more ideal situation for walking.

The infrastructure in place for walking, such as sidewalks, crosswalks, and crossing lights, is also an important consideration when discussing ideal walking conditions. An area without proper infrastructure would be inconvenient and dangerous to walk in, and ensuring the safety of the individuals walking is necessary to create an ideal environment. In addition to infrastructure, the aesthetics of the environment can also affect the walking situation. Dirty and unmaintained walking paths with little to no foliage can be uninviting and dissuade individuals from wanting to walk. Keeping sidewalks clean and free of litter along with planting bushes or other greenery along the paths will create a welcoming environment. Also, trees or shrubs along the path can provide shade to help protect walkers from the heat from the Sun.

Additionally, the company you keep while walking can have a huge effect on the experience. Many people enjoy walking with friends, while others prefer the time to listen to music and reflect. It is important that individuals can walk either with or without people to ensure the most enjoyable walking situation. In Israel especially, community and social interaction is a big thing. During our stay, we witnessed shared meals amongst individuals, such as lunch and Shabbat dinner, and all of the people are very welcoming and inclusive. For many Israelis, walking as a group may be a more natural concept than walking alone, and finding a way to encourage peer interaction through walking is key.

5.2 Conditions Optimally Conducive to Walking to School

Convincing teenagers to do something they do not want to do is an age-old struggle. If a student does not want to walk to school, they are going to find every way possible to avoid it.

One way to attempt to get students to walk to school is by taking away one of the alternative options they use: rides from their parents. However, parents might not be willing to restrict the rides they give to their children, especially if the alternative is their child arriving to school late. While parents may attempt to encourage their children to walk to school, students may still find ways to avoid it.

To combat this, the best solution is to find ways to make students *want* to walk to school, or, at the very least, not despise it. In the survey we conducted at Kramim (Figure 12), 59.0% of students said that walking with friends would encourage them to walk to school. According to this survey, highlighting the social aspect possible from walking to school is the best way to encourage students to walk. If students found ways to meet up with their friends on their walk to school, the experience would seem like less of a chore. Introducing a sort of "walking school bus" where students plan to meet at a certain place and then walk together to school could help increase the number of students who decide to walk.

The next highest reason that students listed for ways they would be encouraged to walk to school was incentivization, with 15.8% of students claiming that rewards would encourage them to walk to school. If students are rewarded for walking with free or discounted foods, extra credit for gym classes, or other monetary means, it is likely they will be more willing to walk.

Additionally, informing students of the health and environmental benefits of walking to school could increase their willingness to walk. 6.6% of students listed health benefits as a reason to walk. Every Israeli citizen over the age of eighteen that is Jewish, Druze, or Circassian is required to serve in the Israel Defense Forces (with some exceptions) for a minimum of thirty-two months for men and twenty-four months for women (Israeli Defense Forces, 2023). Because

of this, many Israeli students are more conscious about their physical health, meaning many are likely to walk to school for the health benefits.

The remaining students listed a variety of reasons that would encourage them to walk, with 6.0% listing better infrastructure (such as sidewalks, bike lanes, etc), 7.1% listing encouragement from teachers, parents and/or peers, and 5.5% listing increased safety measures (such as crossing guards).

5.3 Next Steps and Community Action

As previously mentioned, the biggest obstacle to deal with when encouraging students to walk to school is finding ways to motivate them. In most cases, if teenagers do not want to do something, they are not going to do it. The most effective way to encourage students to walk is through posing it as a social engagement. Most individuals are more likely to do things when they know other people are doing them. This creates an opportunity to further expand the Walk2School application in the future to include features that would allow students to connect with each other to walk to school together. While users can currently view what users are actively walking, adding further socialization features like friends, or walking groups could help further the application's ability to promote walking.

Another area to pursue in the future is making the app more inclusive of different types of students. As the app stands, there is no benefit to students who are unable to walk to school, whether that be for distance or disability reasons. If features are added to connect with students in the app, it is possible to create group meeting points where students who live further from the school could meet with other students to walk together, but this still excludes individuals who

cannot walk at all. Future research should be done to try and determine ways to best include all individuals, such as putting the application on the Apple App Store.

For the heart of this project to endure long past our departure, we need to foster intimate connections with the community. Several things can be done to help encourage the community to embrace walking. The municipality could commit to educate people on the benefits of the activity and demonstrate how it may help one maintain an active and healthy lifestyle. Posters can be hung in strategic locations, like bus stops or supermarkets, where people are most likely to sit idly and have the time to ingest information. Furthermore, public parks are scattered across Karmiel. The local government can organize outdoor events at some of these locales and cultivate positive social engagement around healthy living. Most importantly, the municipality can help fund the rewards portion of the application.

In the grand scheme of things, the financial contribution our research cohort can make is minimal. Moving forward, a steady stream of rewards must be available to students. Rather than burden teachers with funding prizes, it would make sense to outsource this task to a larger and wealthier entity. Finally, the municipality can allow students to ride public transportation either for free or at discounted rates. Unfortunately, the harsh heat can turn even a short walk from the bus stop into an annoying ordeal. If students ride the bus, they may not be walking the whole way to school, but there will still be an incentive to exercise and decline a ride from their parents. All these possibilities have the same goal in mind: getting personal vehicles off the street at busy times.

Overall, our intervention at Ort Kramim failed to produce tangible effects. The application could not be released to the public in time and our headlining event, the Walk-to-School Day, produced unreliable and inconclusive results. However, we laid an excellent

foundation for any parties looking to complete further work in the area. The application, though largely untested outside of our development environment, boasts production-level code and works seamlessly for both users and administrators. Further, new incentivization principles can be applied with ease as new features are easy to attach to the existing codebase. Latent attempts to integrate socialization should be realized by future developers. An in-depth friend's page or a parental view, where guardians can keep track of their child's walking history, are just some features that could help strengthen a high-school community. In fact, the application framework lends itself well to scalability as any organization, be it a company, school, or local government, could implement our design if they wish to incentivize walking or reduce their carbon footprint.

Generally, with the principles integral to induce walking already outlined, subsequent data collection efforts will be straightforward affairs. They too can be integrated into our deliverable as basic trip data (time of walk, distance covered) is simple to track and log. Values stored in the database can then be combined with information from the data collection class's application upon its eventual completion. Further, future teams will hopefully have the time to hold several walk-to-school days and thus collect substantial traffic data over the course of many weeks or months. They can also devise creative ways to continue applying socialization, and more marginally, material rewards, to walking as those have been clearly identified as the most important factors by our team. Then, finally, direct links between application usage, traffic severity, and incentivization principles can be thoroughly examined and a fully formed conclusion can be presented. In short, we rejoice. By beginning this project, we have done our part to serve the public good in Israel. As this project moves into the future, we will remain proud of our accomplishments, and hope to proceed in fellowship with all who desire to follow in our footsteps and work for their community and the environment.

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Appendix A: Survey and Interview Instruments

Student Survey

1. How do you usually get to school?

    1. Car

    2. Bus

    3. Walking

    4. Pedal biking

    5. Electric scooter/ skateboard/ bicycle

    6. Other (please specify)

2. How much time (minutes) does it take you to get to school?

3. If you were to walk, how much time would it take you?

4. What is your distance (km) from school? (you can check with Google Maps)

5. How much does the detour of dropping you off to school add to your parents' trip to work?

6. How often do you walk to school?

    1. Every day

    2. 3-5 Days

    3. 1-2 Days

    4. Never

7. Select all of the reasons that you may choose not to walk to school.

    1. Safety concerns

    2. Weather conditions

    3. Distance from home to school

4. Lack of sidewalks or pedestrian infrastructure

5. Other (please specify)

8. What factors would encourage you to walk to school more often?

    1. Improved safety measures (e.g., crossing guards, increased lighting)

    2. Better pedestrian infrastructure (e.g., sidewalks, bike lanes)

    3. Encouragement from teachers, parents, or peers

    4. Incentives (e.g., prize drawings, recognition)

    5. Walking with friends

    6. Other (please specify)

9. What is your gender?

    1. Male

    2. Female

    3. Prefer not to say

10. What neighborhood do you live in?

    1. Ram

    2. Rabin

    3. Southern

    4. Makosh

    5. Western

    6. Hagalil

    7. Other (please specify)

11. How likely would you walk to school using a walking group, where students walk to school together?

1 (Not at all)	2	3	4 (Neutral)	5	6	7 (completely)

Parent Survey

1. How many children do you have in high school or younger?

2. What is the main form of transportation used by your child(dren) to get to school? Select 1 per child.

    1. Car (drive themselves)

    2. Car (get driven)

    3. Bus

    4. Walking

    5. Pedal biking

    6. Electric scooter/ skateboard/ bicycle

    7. Other (please specify)

3. Do you let your child walk to school?

    1. Yes

    2. No

4. If not, why?

    1. Crime rate concerns

    2. Dangerous traffic concerns

    3. Poor infrastructure (aka lack of sidewalks, crosswalks, etc)

    4. Lack of time

    5. Too young

    6. Other _____

    7. N/A

5. Why do you think your child doesn't walk to school more often?

      1. Safety concerns

      2. Dangerous traffic concerns

      3. Weather concerns

      4. Poor infrastructure

      5. Lack of time

      6. Other transportation methods are more convenient

      7. Other _____

      8. N/A, child already walks to school

      9. N/A, I don't allow my child to walk to school

6. If you drive your child to school, how long does it take (in minutes) to get to it from your home?

7. How much does the detour of dropping off a child add to your trip to work? If you are not currently working, please write N/A

8. Would you be willing to meet for a short time to be interviewed? If so, list your preferred contact method (ie. phone number, email).

9. Rate the severity of traffic in Karmiel during standard commuting hours.

1 (not an issue)	2	3	4 (bearable)	5	6	7 (horrible)

10. Rate the severity of traffic in and around the high school.

1 (not an issue)	2	3	4 (bearable)	5	6	7 (horrible)

Student Interview Guide

1) What do you find enjoyable about walking to school?

2) What do you find not enjoyable about walking to school?

   a) If this element was somehow different, how would you feel about your walk?

3) Is walking something you view as a social activity? Would you be more inclined to walk if you were in the company of friends?

4) In your opinion, do you live within walking distance of the school?

   a) If yes, do you walk to school?

   b) If no, what incentive would you need to walk to school?

5) To what extent how much time it takes to walk to school factor into your decision not to walk?

   a) Does having to wake up earlier to walk dissuade you from walking to school?

   b) Would your morning routine be disrupted if you had to allot extra time for a walk to school?

      i) Would you say there is flexibility to your routine? Are you comfortable with substantially changing it for the long-term?

6) How do your parents react to your choice of transportation to school?

   a) What is your preferred way of getting to school?

   b) Are your parents upset when you ask them for a walk to school? Would they prefer you take a bus or walk?

7) Would you be more willing to walk if there was an application that gamified and rewarded you for walking to school?

8) Do these rewards need to be material objects, or would digital tokens/points be a sufficient motivator?

   a) If you knew your friends were using such an app, would that encourage you to use it too?

   b) Something we're considering is a walking competition between classes. Any suggestions for types of prizes? *Interviewer provides some of the group's suggestions, pizza party, etc...*

Parent Interview Guide

1) Are there any specific safety concerns you have about your child walking to school that you would like to see addressed?

2) Do you have any other suggestions or ideas for how to increase the number of students who walk to school?

3) What is the primary reason your child might not walk to school more often?

   a) Do you put any restrictions on your child's mobility? Do these restrictions impact the student's ability to walk to school?

4) Looking back upon your time as a student, how did you get to school?

   a) Do these experiences help inform some life choices, parenting choices?

5) How bad is the traffic on your morning commute?

   a) Does dropping off your child make getting to work harder?

   b) In general, would it be more convenient if you were not responsible for the transportation of your child?

6) Describe the route you take when you travel to the school by car

   a) As you approach the grounds, when/where does traffic begin? Are there any intersections exacerbating congestion levels?

   b) Focusing on traffic near the school, how would you go about dropping off your child? Are there specific ways you try to avoid the traffic?

   c) What obstacles do you encounter?

Faculty Interview Guide

1) How would you characterize the traffic situation around the school?

2) Describe what you might typically experience as you approach the school by car.

   a) What obstacles do you encounter?

3) Do you see any students walking on the drive in? Is there anything suggestive in their facial

   expressions or body language?

   a) Are they enjoying themselves?

   b) Are they more likely to be walking alone or in a group?

4) More generally, how bad is the traffic on your morning commute?

   a) As you approach the grounds, when/where does traffic begin? Are there any intersections

   with large congestion levels?

5) Do you know anything about how your students get to school?

   a) From a broader perspective, are there any insights you have on student mobility?

6) How do you motivate your students to perform tasks in class? Do you use gamification in

   any of your teaching lessons?

7) To stimulate interest, we are looking to gamify walking and have created an app for the

   purpose. Do you believe this approach could convince kids to walk to school more often?

   a) Would you be comfortable endorsing such an application? Aka would you be willing to

   help us convince students to use this application?

8) Looking back upon your time as a student, how did you get to school?

9) *If we interview the Data Science teachers*

   a) How do you intend to collect data for the project? What methods will you apply?

   b) What software applications and tools will be used to create the application?

i)   Could you provide a detailed description of what it will do and how it will run?

Appendix B: Interview Transcripts

Members Present:

NOTE: For the safety of the study participants, any personally identifying information has been removed from the transcripts for the purpose of later publication.

Ben Brodeur: Main Interviewer
Andrei Ignatiev: Project Group Member
Serena Mower: Project Group Member
Dylan Nguyen: Project Group Member
Nathan Pollock: Project Group Member
Bar Levy: Braude College Student acting as a translator if needed
Student 1: Ort Kramim Student
Student 2: Ort Kramim Student
Student 3: Ort Kramim Student
Student 4: Ort Kramim Student

Transcript:
Ben: Recording.

Ben: Just letting you guys know that I have to let you know that I'm recording. It will just be audio because Zoom allows us to do audio and video capture, but I'm just going to delete the video one later on. Any questions that you don't want to answer, you don't have to, and you can leave any time. This is all just for professional stuff because we're hopefully going to publish it, but nothing, none of the information today will be able to be tracked to like, it will not be personally identifiable, and all of your names will not be said or published anywhere. Anything else before we start, guys?

Silence

Ben: Okay. First question. You guys can just jump in whenever I guess. We could go down the line because I would like to hear from all of you.

Bar: I think it would be better if you just addressed them by their names. I mean, point every question to whoever you want, and then you will get various answers from all the participants.

Ben: Okay, sure. First, then, I'll just go with Student 1. Do you walk to school?

Student 1: Yes. I walk five days a week to school. Every day.

Ben: How far is that walk?

Student 1: 1.5 kilometers. Approximately.

Ben: I see. Do you walk with anyone else?

Student 1: No. I walk alone, and maybe I see a friend every now and again, but I walk alone.

Ben: I see. Do you enjoy walking to school? Or what do you find enjoyable about walking to school?

Student 1: It's relaxing. It just costs money to go on the bus, and I live pretty close to the school, so there's no need to drive to school.

Ben: I see, I see. So do you think that if transportation was cheaper or even paid for, you would do that instead?

Student 1: No, because walking is healthy, and there's no need for me to drive. It's short enough where I don't need to drive in a bus or a car.

Ben: I see. I'll move on. That's all for right now. So I'll move on to the next. Student 2?

Student 2: Hi.

Ben: Hi. Do you walk to school?

Student 2: No. I go on the bus to school cause I live twenty minutes away and I don't have enough time to go on like a walk to school like it's not that close so I'd rather go on a bus.

Ben: Is that outside of Karmiel?

Student 2: No, no, that's inside Karmiel. It's from this area to the other area that the school is in. Anything else?

Ben: Yes. Is walking something you view as a social activity? Like would you be more inclined to walk if you were in the company of friends?

Student 2: Yeah. I like walking with friends. Like I get to meet friends and then I need to go from here to there with all my friends so yeah it's pretty fun.

Ben: You are like twenty minutes away so that is a long time, but is there anything that would incentivize you to walk? Such as, if it was walking with friends or if you're given rewards for walking.

Student 2: I don't think so cause I don't live next to my friends. Like I'm not neighbors with this friend, and then I can go with them in the car or walking. I don't live next to my friends. So I don't think so.

Ben: I don't know how much you guys were given about our project, but we're trying to create an app to gamify walking to school so we're trying to connect with your school.

Student 2: What's funny is that I don't wanna walk, but I'm here so yeah.

both laughing

Ben: That's fine, that's fine. We're trying to get like every opinion and voice, you know?

Student 2: I know, I know. Yeah.

Ben: Do you think that your parents would allow you to walk to school?

Student 2: Yes, of course. They let me out at like four o'clock at night, so why not in the morning?

Ben: I see, I see. Oh wait, so do you walk home?

Student 2: No. Taxi.

Ben: Oh, oh. I see.

Ben: Okay, I'll move on to the next. Student 3? Is that how you say it?

Student 3: Yes, *repeats name*.

Ben: Okay. Do you walk to school?

Student 3: Most of the time, I'm going to school, it's two kilometers from my home. The other times, if I get up early, I can go in the car with my mother because her job is close to the school.

Ben: Oh, that's nice. Do you enjoy walking to school?

Student 3: Yeah, most of the time, I'm going with my big brother or with other friends in the class. So like, I'm not going alone.

Ben: Oh. Does how much time it takes to walk to school factor into your choice of transportation? So like, if it was shorter, would you go more, or if it was longer, would you walk to school less?

Student 3: I think I would go like, if it was longer like four kilometers or five I most of the time I would go in the car because in the morning it's not so easy to walk with the bag and everything. And if it was closer I would still go to school, I think more times in the week.

Ben: Would you say there's like flexibility in your routine in the morning? So like are you comfortable with substantially changing it for the long term? Because like walking has

long-term benefits, and through incentivization, you might be able to get long-term benefits.

Student 3: What do you mean by long benefits?

Ben: So like if the app, you were able to get points every time you were walking to school and then you were able to use those points to get, say like pencils or something like that.

Student 3: I don't think it would help me, anything, because most of the time I'm going depends on if I wake up early or late because in Sunday/Monday I start at 9:30 o'clock, and the rest of the days I start at 8:00. So depends on that.

Ben: And then, we're actually thinking about trying to create, like, a competition between classes. Do you guys have like a homeroom class?

Student 3: Yeah, we have like nine, I think, home classes, and then we go in separate between our teachers at the start of the season, like physics and stuff like that.

Ben: Oh, I see. So do you think that a competition between classes and then like something like a pizza party or any other like bigger reward would incentivize you to walk?

Student 3: I think it will help us a little bit to like get a bit of teamwork in the class but I don't think it will change that much with people who are lazy and, like are four to five kilometers from the school or at the point or top of a hill.

Ben: Okay. Thank you, thank you. Moving on to Student 4, right?

Student 4: Yes.

Ben: Alright. Do you walk to school?

Student 4: Yes. About three times a week.

Ben: Why only three?

Student 4: Because sometimes my lessons are canceled in the morning so I can walk to school. But when they start at the normal time I drive with my mother.

Ben: How much of a detour does it take for your mom to drive you to school?

Student 4: About five to ten minutes.

Ben: Okay, that's not that bad. Do you find walking enjoyable?

 Student 4: Yes. I'm walking alone, but I listen to music.

Ben: Is there any negatives about walking that you find? Like is it tiring or?

Student 4: No. I think it's giving me energy for the rest of the day.

Ben: If you did live close to your friends and then you were walking with friends, do you think that you would wake up earlier to walk with your friends?

Student 4: Yes, yes.

Ben: How do your parents react to your choice of transportation to school? Are you allowed to make the decision independently?

Student 4: Yes. I can go by bus, but I prefer to walk.

Ben: I see. That was all I had specifically. Did [the rest of the project group] have any questions, or did [the students] have any questions for me?

Bar and students speak in Hebrew

Bar: No, Ben, they have nothing to ask you, but if you want to address the questions you addressed for, the questions you asked Student 1, if you want to ask any other of [the students], that's also a possibility. You have them until 7:00 IDT. So if you want to take this time, they're all yours. If you're finished, that's also good.

Ben: Alright. If anyone has any stories about walking to school? About fun times, negative times, literally anything.

Student 3: Like, I'm going with one of my best friends to school every day so it kinda like gives us more time together. And like we can talk a lot. It's kinda helpful for the friendship.

Ben: Another thing. Do you guys have cars? Like your personal car that you can drive to school yourself?

Bar: No, no, they don't.

Student 2: No, we don't have our license yet.

Student 1: We are fifteen to sixteen years old.

Student 3: *says something in Hebrew*

Ben: Okay, so then juniors and seniors, would they be able to drive themselves?

Bar: Can you repeat the question?

Ben: Sorry, would like a, is it common for students to drive themselves to school when they can?

Bar: Not that much, because they're able to get their license when they are seventeen/eighteen years old, and then they have time where they have to have a responsible adult with them when they drive. They can't drive themselves. At least, I think, for six months or a year, or something like that.

Student 3: *says something in Hebrew*

Bar: Oh, okay, they just reduced it to three months. So, no, it's not common at all to see students in high school bring a car to school. They also don't own their own cars, so usually their parents have their own car, and they use it to get to work and places. So no, it's not common at all.

Ben: Okay. Dylan, Nathan, Serena, Andrei, did you have any other questions that I missed?

Nathan: That sounds good to me.

Dylan: I would just say one thing. For the people that don't always walk to school, like obviously some of you can't/don't walk because of distance things, but if you were within walking distance, obviously there are certain people that choose not to walk to school even when they're within walking distance. Is there any sort of like reward that you think would convince these students, that are within walking distance and still choose not to, to walk to school?

Student 3: More money in the cafeteria, I think, would be good. Food is very healthy.

Student 1: Yeah, maybe coupons or something.

Dylan: Okay. Thank you.

Ben: So wait, is your cafeteria kinda like a store?

Student 2: Yeah, it's like a store. With like different kinds of pastries, snacks, drinks.

Bar: Student 2, can you explain to them the difference between a cafeteria in a high school in Israel in comparison to a high school in the states because I'm pretty sure there are some differences. It's not something that they know.

Student 2: I don't know how the cafeteria is there, but from my experience, I also have to pay for food. I think it's pretty much the same thing, but you have like a lot of options of like whatever you want. You know like if you're craving a snack, go out and go buy one. It's like a little convenience store. Like whatever you need. But, like, it's only food. They have whatever you need.

Ben: For cafeterias in the States, or at least my high school, it was like everyone got in a line, and you would get whatever they had. They had a menu that was like, every week, it would change, so whatever they served that day, you would get.

Student 2: Yeah, that's not it. It's like, there's a menu of a lot of different things with like prices, but it doesn't change. It's like the same thing. Maybe they add something new, or some things are not stocked, so you can't have it.

Bar: It's like a convenience store in a gas station.

Student 2: Yeah, it's the same thing. It's the same thing. Exactly like I said.

Bar: It's not like a buffet. It's different.

Student 2: No, no.

Ben: That's cool. And then do you guys just use cash to, um, or is it like a school credit thing?

Student 2: I think it's their own money, whoever is doing it. It's not students or anyone working there it's like two adults that they get the money. I don't know what happens there, but it's two adults that have it, use that as a convenience store, or maybe it's their payment I don't know.

Ben: Okay.

Andrei: About the cafeteria thing. I was wondering, are there some people who also maybe pack their own lunches who might not use the cafeteria?

Student 2: Yeah, of course.

Student 3: Yeah, there's a lot of people.

Bar: In Israel, it's very different from the States. It's very common for students to bring their own lunch box that their parents packed for them the day before and to use at school or to just when they finish they go back home and eat. It's not that common at all to have lunch in the cafeteria in the high school. Because they also serve mostly junk food, they don't serve healthy meals or anything like that.

Student 3: I can tell about myself that I pack my own lunch and everything because I count macros and stuff like that, so I don't know.

Ben: For you, Student 2, if people were using the walking to school app, where it would incentivize walking to school, how would it make you feel to see them getting rewards when like it's just too long of a walk for you?

Student 2: I don't know. I think I'd be a little bit annoyed that I can't get a coupon to the store, like thirty percent off of this or a different type of reward. Maybe I would try one or two times to walk for that. If it's worth it, you know? If it's worth it, then maybe I'd think about it twice. Seeing others—if others are really gonna do it, then maybe I would. Maybe. I don't know.

Ben: But you think the monetary value would be the best?

Student 2: It like depends, I don't know.

Ben: Because another idea that we had would be like a free homework pass or—

Student 2: That's a good idea. That's a really good idea. Not that I have like a problem but like others.

Interview concludes

Members Present:

NOTE: For the safety of the participants, personal identification such as names have been removed from the transcripts for the purpose of later publication.

Ben Brodeur: Main Interviewer
Andrei Ignatiev: Project Group Member
Serena Mower: Project Group Member
Dylan Nguyen: Project Group Member
Nathan Pollock: Project Group Member
Bar Levy: Braude College Student acting as a translator if needed
Teacher 1: Inbal Arditi
Teacher 2: Limor Dan

_____

Privacy disclaimer notifying teachers of their rights as interview participants

Ben: Lets get started. If you want to start with general introductions.

General introductions

Ben: First question, and I'll start with interviewing teacher 1 and then we'll move on afterwards. How would you characterize the traffic situation around the school?

Teacher 1: Mmmm okay, as I told before I live in Karmiel so I know the traffic well. I live in the western part of the city. There are a lot of bottlenecks around the school and it depends on the hour. Traffic is very high between 7 to 8. What else?

Ben: When you drive into school, do you see any students walking?

Teacher 1: Yes, of course

Ben: Do you have any memories of their facial expressions, are they enjoying themselves?

Teacher 1: During the walk to school?

Ben: Yeah during the walk, yeah

Teacher 1: I dont speak with them while they're walking, I'm driving hehe.

Bar clears up misunderstanding in Hebrew

Teacher 1: Ah okay, no.

Teacher 2: They are on the phone all the time.

Teacher 1: Yeah.

Teacher 2:Yeah, just…, in the phone

Ben: Just all on phones.

Teacher 2: Like my son.

Teacher 1:Yeah like both my sons.

Ben: You have been teaching a long time, how do you motivate your students to perform tasks in class?

Teacher 1: Motivate, uhm, I just, I can't say I'm doing anything special. So, I explain the task and ask them to do it. Ok? I don't do anything special, really.

Ben: It seems like they are very well behaved.

Bar: It is a dictatorship not a democracy in school.

Teacher 1: I just ask them nicely…
I'm kidding, I'm not nice.

Bar: She gives them the command and they obey.

Ben: Yeah I see, because one of the things we were thinking of doing is gamification. We want to use games to try to motivate students. So like making lessons into games, for example.

Teacher 1: Do you have an example, like a specific example?

Ben: Do you know what Pokemon Go is?

Teacher 1: Of course, I have three kids, haven't you heard?

Ben: So Pokemon Go gamifies walking. So, we are in the process of making an app to do something similar where students who walk to school would gain points and use those points to earn rewards.

Teacher 1: Which rewards?

Ben: Yes, this is a little bit of what we wanted to talk to you guys about. What rewards

would be feasible? Some rewards we thought of were something like a mechanical pencil or candy.

Teacher 2: Coupons.

Teacher 1: Coupons or ice cream.

Teacher 2: Get them to walk earlier from the school. I talked about this with my manager they said you can do it.

Teacher 1: Can I ask a question, Benjaminh, how old are you?

Ben: 21 actually today.

Teacher 1: 21 today? Congratulations!

Ben: Thank you.

Teacher 1: And Serena, how old are you?

Serena: Hi yeah, Serena, 21.

Teacher 1: And Dylan, how old are you?

Dylan: Yeah, I'm also 21.

Teacher 1: So young.

Teacher 1: So young and beautiful, oh another one. Andrei how old are you?

Andrei: Andrei, yeah, I'm still 20.

Teacher 1: Still 20 okay. So, may I ask, what interests you 21 and 20 year olds?

Serena: Free food probably.

Dylan: I agree with that.

Teacher 1: My students are 15 to 16 years old, they like

Lengthy Discussion in Hebrew about video games: GTA, Mik Mak, Fortnite, Minecraft, and Clash of Clans are mentioned

Ben: Yeah, we had an interview with the students yesterday and that is what they said as well. They talked about the coupon stuff.

Teacher 1: For what?

Bar: The cafeteria, school cafeteria.

Teacher 1: Cafeteria in our school? Bad choice. Okay. There are a lot of businesses in the city. Why limit yourselves to the cafeteria?

Ben: That is a very good idea. We could get sponsosred by one of the local businesses

Teacher 2: We've already talked to a sponsor, and they want to be with us. It's some hamburger place.

Teacher 1: Ice cream! Coffee!

Ben: Is there a contact *we* could have with the sponsor?

Teacher 2: Maybe when you come here you can speak with them.

Serena: But they are on board, right? So we could plan for them to be on board with giving us coupons?

Teacher 2: We need to talk to them and convince them, okay?

Ben: How does the school schedule work? When we were talking to students yesterday, some of them said they went to school at different times depending on the day. Like, in an American high school you'd go to school from 6 to 2 every single day.

Teacher 1: 6am?

Ben: Yeah 6 am to 2.

Bar: Wow.

Teacher 1: Here we begin at 8 to 9 in the morning and finish 2,3,4 okay? It depends, every student has his/her own schedule.

Ben: So different students will start at different times?

Teacher 1: Yep.

Ben: Yeah because something we were thinking about for the app, we want to promote walking to school specifically and not walking in general. Thus, we want to implement a cutoff time so if students walk to school at different times that will mess it up a little. How did either of you get to school, when you were a kid, when you were a student?

Teacher 2: In the bus.

Teacher 1: By foot.

Teacher 2: I live in some village and go to the kibbutz. I need to drive in the bus about 10, 20 minutes.

Teacher 1: I walked of course, 20-25 minutes every morning.

Ben: Did you enjoy walking and what about walking did you enjoy?

Teacher 1: The air. The time alone to think. To see the view. Anything else? I had no phone. I had no phone when I was a student; it was a very long time ago. I'm not 20 or 21.

Teacher 2: Time to think about other things. I think the student want to come to school and walk. Because they go to the gym, most of them want to maintain a healthy life

Teacher 2: They like that, they eat very good. I saw them at school they eat things that are healthy, they go to the gym, some of them come to the school where they walk. We want to get out the students who don't do this.

Teacher 1: The spoiled ones.

Ben: Yeah, that's why we want to gamify walking to school. Would you believe this approach would get the 'lazy ones' to walk?

Teacher 1: We need to try.

Teacher 2: I think that if we do something like that, someone will walk to school and in that way they will take their friends with them. That is the way we can take them, by getting more and more people to convince their friends to walk to school.

Conversation about Mik-Mak, the Israeli equivalent of Club Penguin

Bar: I already know Dora the explorer.

Ben: I know that one.

Teacher 2: Maybe if they go like that, they can take with them a littler student. In seventh grade or eighth grade.

Hebrew

Teacher 2: We spoke with them when we deal with them in the classroom. They asked us if they can take a littler student, a younger student with them.

Ben: Yeah that is what we were thinking with the Walk-to-School day. We would be taking students and walking and seeing what would happen.

Teacher 2: I think it's a great idea. We spoke about this in the meeting with Braude. I think our manager will take this. We can try this as a format to springboard other things.

Ben: What do you think the next steps to get to that event would be?

Teacher 2: Right now we need to do the first step. We need to get to the ball rolling and next year we can do more of this application. We have big data, driver data from the cloud.

Ben: But so, if we were trying to create the Walk-to-School day for when we will be coming on April 10th.

Teacher 2: Yeah, you can do it.

Ben: What would be our next steps to schedule that?

Continued misunderstanding. Ben is asking about who we should contact and how should we schedule the Walk-to-School day, but the teachers do not offer any clarification on the subject

Teacher 2: With this day, we want to see how many students go. If they make a connection with this project, we can do more. They understand it is good, it is healthy. In fact, I met with students and they told me it is a good idea, they want you to do this. They are waiting for this opportunity.

Teacher 1: They want to cooperate. They are interested in this project, they are curious.

Teacher 2: Listen, come to Israel. We will show you our beautiful country, our beautiful students. They want to meet you and work with you. When you see them, we can think about the next steps. You can speak with them, ask them, and understand how the culture across the US and Israel is different. At your age, kids are in the army. Now, they prepare them for the army. They want to get into the best millitary units.

Bar: Ben, I sent you a WhatsApp. I explained to you at your age, people are in the army. You haven't responded to it, but I explained it to you.

Ben: Yeah, I remember it yeah.

Teacher 2: So they do a lot of sports to be in.

Teacher 1: Good shape, they want to be in good shape.

Bar: They want to get into the most prestigious units in the army. Like you have the marines, and navy seals, they want to get into the best units in Israel. They are practicing in order to get

accepted into these units. Some of them want to be fighters, some of them want to do intelligence force, some want to be pilots, or whatever.

Teacher 1: And they want to look good, like all teenagers. Tell the truth!

Ben: Thats all I had. Did you have any questions for me?

Teacher 1: I wanted to know, when you get here, what you do here, what is your schedule?

Ben: For us, when we get to Israel, we don't have a super set schedule. That is why we wanted to schedule things ahead of time. Like stuff like the walk-to school day, we wanted to schedule it as soon as possible so we don't interfere with other groups. I know we are doing some tours, like some touristy things as well when we get there.

Teacher 1: Do you know what days, how many days, like one day?

Ben: We're doing a couple of tours. One before we get to Braude and Karmiel.

Teacher 1: Will you be here on the 13th of April?

Ben: Yeah. After we arrive, we are trying to plan more interviews and do some data collection stuff. But the main things is to work on the app and develop the app and use it in the schools.

Teacher 2: I think that you need to come to the classroom.

Teacher 1: Be part of us.

Teacher 2: I think this is the best way to get what you want.

Ben: For sure. So I will definitely keep in contact with you guys.

Bar: I will send phone numbers.

Ben: I will keep in contact, and notify you when things solidify.

Teacher 1: Will you be in the dorms at the college?

Ben: Yeah. Thank you guys.

Interview concludes

Appendix C: Survey Data

Timestamp	How do you usually get to school?	Do you enjoy doing exercise/sports?	How often do you walk to school a week?	How much time in minute does it take you to get to school? (check with google maps)	What is your distance in km from school? (you can check with google maps)	How much does the detour of dropping you off to school add to your parents trip to work?	Select all the reasons that you may choose not to walk to school	What factors would encourage you to walk to school more often?	What is your gender?	In which neighbrhood you live?	How old are you?
2023/03/23	Walking	Occasionally	5	7-10	0.5km - 0.6km	Irrelevant	Weather conditions;Save time	Walking with friends	Female		14-15
2023/03/23	Bus	Yes	1-2 days	11-14	0.9km - 1km	0-5 min	Distance from home to school;Save time		Female	Ram	16-17
2023/03/23	Walking	Yes	5	15+	1.5km - 1.6km	Irrelevant	Weather conditions;Distance from home to school	Walking with friends	Male	Rabin	14-15
2023/03/26	Walking	Yes		11-14	1.1km - 1.2km	11-15 min	Save time	Walking with friends	Male	Rabin	14-15
2023/03/26	Bus	Yes	never	7-10	1.7km - 1.8km	Irrelevant	Distance from home to school;Save time	Walking with friends	Female	Southern	16-17
2023/03/26	Walking	Yes	5	1-3	0.1km - 0.2km	Irrelevant	Safety concerns	Knowledge of health benefits	Male	Rabin	16-17
2023/03/26	Walking	Yes	5	15+	1.1km - 1.2km	6-10 min	Weather conditions	Walking with friends	Male	Rabin	14-15
2023/03/26	Walking	Yes	3-4 days	11-14	0.9km - 1km	6-10 min	Weather conditions	Incentives (e.g. prize drawings, recognition)	Female	Rabin	14-15
2023/03/26	Walking	Yes	5	11-14	2km +	Irrelevant	Weather conditions	Incentives (e.g. prize drawings, recognition)	Male	Makosh	16-17
2023/03/26	Walking	Yes	5	11-14	0.7km - 0.8km	0-5 min	Safety concerns;Weather conditions;Distance from home to school;Lack of sidewalks or pedestrian infrastructure;Save time	Walking with friends	Male	Rabin	14-15
2023/03/26	Walking	Yes	5	15+	0.9km - 1km	Irrelevant	Weather conditions;Save time	Walking with friends	Female	Rabin	16-17
2023/03/26	Car with my parents	Yes	1-2 days	15+	0.9km - 1km	6-10 min	Weather conditions;Distance from home to school;Save time;Laziness	Knowledge of health benefits	Female	Rabin	16-17
2023/03/26	Walking	Yes	5	11-14	0.3km - 0.4km	11-15 min	Weather conditions	Incentives (e.g. prize drawings, recognition)	Female	Rabin	14-15
2023/03/26	Walking	Yes	5	1-3	0.1km - 0.2km	Irrelevant	Distance from home to school	Walking with friends	Male	Rabin	16-17
2023/03/26	Car with my parents	Yes	never	15+	2km +	6-10 min	Distance from home to school		Female		14-15
2023/03/26	Car with my parents	Yes	1-2 days	15+	1.5km - 1.6km	11-15 min	Distance from home to school;Save time;Laziness	Encouragement from teachers, parents, or peers	Female	Makosh	16-17
2023/03/27	Bus	Occasionally	never	15+	2km +	Irrelevant	Distance from home to school		Male		16-17
2023/03/27	Walking	Yes	5	15+	1.7km - 1.8km	Irrelevant	Weather conditions;Save time	Walking with friends	Male	Rabin	16-17
2023/03/27	Car with my parents	Occasionally	1-2 days	15+	2km +	Irrelevant	Weather conditions;Distance from home to school	Incentives (e.g. prize drawings, recognition)	Male	Western	16-17
2023/03/27	Bus	No	never	15+	2km +	0-5 min	Distance from home to school		Female		16-17
2023/03/27	Bus	Yes	never	15+	2km +	15min +	Weather conditions;Lack of sidewalks or pedestrian infrastructure	Better pedestrian infrastructure (e.g. sidewalks, bike lanes)	Male	Western	16-17
2023/03/27	Walking	Yes	5	1-3	0.1km - 0.2km	6-10 min	Weather conditions;Lack of sidewalks or pedestrian infrastructure	Walking with friends	Male	Rabin	14-15
2023/03/27	Bus	Yes	1-2 days	15+	1.1km - 1.2km	0-5 min	Distance from home to school	Incentives (e.g. prize drawings, recognition)	Male	Makosh	16-17
2023/03/27	Walking	No	3-4 days	15+	0.5km - 0.6km	6-10 min	Weather conditions;Save time	Walking with friends	Male	Makosh	16-17
2023/03/27	Walking	Yes	5	15+	0.7km - 0.8km	Irrelevant		Incentives (e.g. prize drawings, recognition)	Male	Rabin	14-15
2023/03/27	Walking	Yes	5	15+	1.5km - 1.6km	Irrelevant	Weather conditions;Distance from home to school	Walking with friends	Male	Rabin	14-15
2023/03/27	Car with my parents	Yes	1-2 days	11-14	1.9km - 2km	0-5 min	Laziness	Walking with friends	Female	Rabin	16-17
2023/03/28	Car with my parents	Occasionally	1-2 days	15+	1.3km - 1.4km	6-10 min	Distance from home to school;Save time;Laziness			Rabin	17+
2023/03/28	Car with my parents	Yes	never	15+	2km +	0-5 min	Weather conditions;Distance from home to school;Save time;Laziness	Walking with friends	Male	Western	17+
2023/03/28	Walking	Yes	5	15+	2km +	Irrelevant			Female	Makosh	16-17
2023/03/28	Car with my parents	Occasionally	3-4 days	11-14	0.7km - 0.8km	Irrelevant	Weather conditions;Save time;Laziness	Walking with friends	Male	Ram	16-17
2023/03/28	Car with my parents	Yes	5	7-10	2km +	11-15 min	Distance from home to school	Walking with friends	Female	Makosh	16-17
2023/03/28	Car with my parents	Occasionally	never	15+	2km +	11-15 min	Weather conditions;Distance from home to school;Save time;Laziness	Walking with friends	Female	Makosh	16-17
2023/03/28	Walking	Yes	5	7-10	0.7km - 0.8km	Irrelevant	Safety concerns;Weather conditions;Save time	Walking with friends	Male	Rabin	17+
2023/03/28	Bus	Yes	never	11-14	0.1km - 0.2km	6-10 min	Save time	Improved safety measures (e.g. crossing guards, increased lighting)	Prefer not to say	Western	17+
2023/03/28	Walking	Yes	5	11-14	0.5km - 0.6km	6-10 min	Weather conditions;Distance from home to school;Lack of sidewalks or pedestrian infrastructure;Save time	Improved safety measures (e.g. crossing guards, increased lighting)	Prefer not to say	Ram	16-17
2023/03/28	Walking	Yes	5	15+	2km +	Irrelevant	Weather conditions	Walking with friends	Female	Makosh	16-17
2023/03/28	Bus	Occasionally	3-4 days	15+	1.1km - 1.2km	15min +	Weather conditions;Save time;Laziness	Walking with friends	Female	Ram	16-17
2023/03/28	Bus	Yes	5	11-14	0.7km - 0.8km	15min +	Weather conditions;Save time;Laziness	Walking with friends	Female	Ram	16-17
2023/03/28	Car with my parents	No	1-2 days	15+	2km +	6-10 min	Weather conditions;Distance from home to school;Laziness	Walking with friends	Female	Western	17+

	A	B	C	D	E	F	G	H	I	J	K	L
42	2023/03/28	Walking	Yes	3-4 days	7-10	0.5km - 0.6km	Irrelevant	Weather conditions;Save time	Walking with friends	Male	Rabin	16-17
43	2023/03/28	Walking	Yes	5	7-10	0.9km - 1km		Weather conditions;Laziness	Walking with friends	Female	Rabin	17+
44	2023/03/28	Walking	Occasionally	5	15+	2km +	Irrelevant	Safety concerns;Save time;Laziness	Walking with friends	Male	Rabin	16-17
45	2023/03/28	Walking	Yes	3-4 days	11-14	1.1km - 1.2km	0-5 min	Save time	Walking with friends	Female	Ram	16-17
46	2023/03/28	Walking	Yes	5	11-14	1.1km - 1.2km	6-10 min	Weather conditions;Save time	Walking with friends	Female	Rabin	16-17
47	2023/03/28	Walking	Occasionally	3-4 days	11-14	1.3km - 1.4km	0-5 min	Weather conditions;Distance from home to school;Save time;Laziness	Encouragement from teachers, parents, or peers	Male	Rabin	17+
48	2023/03/28	Walking	Yes	3-4 days	15+	0.9km - 1km	11-15 min	Laziness	Walking with friends	Female	Makosh	17+
49	2023/03/28	Car with my parents	Occasionally	1-2 days	15+	1.3km - 1.4km	15min +	Weather conditions;Distance from home to school;Save time	Incentives (e.g. prize drawings, recognition)	Female	Makosh	17+
50	2023/03/28	Bus	Occasionally	3-4 days	15+	1.9km - 2km	Irrelevant	Weather conditions;Save time	Walking with friends	Female	Southern	16-17
51	2023/03/28	Walking	Occasionally	5	4-6			Weather conditions;Distance from home to school;Save time;Laziness	Walking with friends	Female	Hagalil	16-17
52	2023/03/28	Walking	Occasionally	5	4-6			Weather conditions;Distance from home to school;Save time;Laziness	Walking with friends	Female		16-17
53	2023/03/28	Bus	Occasionally	never	15+	2km +	Irrelevant	Weather conditions;Distance from home to school;Save time		Female	Southern	17+
54	2023/03/28	Walking	Yes	5	11-14	0.7km - 0.8km	Irrelevant	Weather conditions;Distance from home to school	Walking with friends	Female	Rabin	17+
55	2023/03/28	Walking	Occasionally	5	11-14	0.9km - 1km	0-5 min	Weather conditions;Laziness	Walking with friends	Male	Ram	17+
56	2023/03/29	Walking	Yes	3-4 days	15+	1.1km - 1.2km	Irrelevant	Weather conditions;Distance from home to school;Save time;Laziness		Female	Rabin	16-17
57	2023/03/29	Walking	No	5	11-14		Irrelevant	Weather conditions;Save time;Laziness	Walking with friends	Female	Rabin	16-17
58	2023/03/30	Walking	Yes	5	15+	1.1km - 1.2km	6-10 min	Weather conditions	Walking with friends	Female	Rabin	16-17
59	2023/03/30	Walking	Yes	3-4 days	15+	1.9km - 2km	6-10 min	Weather conditions;Distance from home to school	Walking with friends	Male	Rabin	16-17
60	2023/03/30	Car with my parents	Yes	never	15+	2km +	11-15 min	Distance from home to school;Save time	Walking with friends	Male		16-17
61	2023/04/12	Walking	Yes	5	11-14	1.5km - 1.6km	Irrelevant	Weather conditions;Distance from home to school	Walking with friends	Male	Rabin	14-15
62	2023/04/12	Car with my parents	Yes	5	15+	1.5km - 1.6km	Irrelevant	Weather conditions;Distance from home to school;Save time;Laziness	Walking with friends	Male	Makosh	16-17
63	2023/04/12	Walking	Yes	5	15+	1.1km - 1.2km	15min +	Weather conditions	Walking with friends	Male	Rabin	14-15
64	2023/04/12	Walking	Yes	5	15+	2km +	Irrelevant	Weather conditions;Distance from home to school	Incentives (e.g. prize drawings, recognition)	Male	Rabin	14-15

	A	B	C	D	E	F	G	H	I	J	K	L
65	2023/04/12	Car with my parents	Yes	never	15+	2km +	Irrelevant	Weather conditions;Distance from home to school;Save time	Walking with friends	Male	Western	16-17
66	2023/04/12	Car with my parents	Occasionally	5	4-6	1.3km - 1.4km	6-10 min	Safety concerns	Walking with friends	Female	Rabin	16-17
67	2023/04/12	Walking	Yes	5	1-3	0.1km - 0.2km	6-10 min	Weather conditions;Lack of sidewalks or pedestrian infrastructure	Knowledge of health benefits	Male	Rabin	14-15
68	2023/04/12	Car with my parents	Yes	1-2 days	15+	1.5km - 1.6km	0-5 min	Safety concerns;Weather conditions;Distance from home to school;Laziness	Walking with friends	Male	Makosh	16-17
69	2023/04/12	Car with my parents	Yes	3-4 days	15+	2km +	6-10 min	Weather conditions	Incentives (e.g. prize drawings, recognition)	Male	Makosh	16-17
70	2023/04/12	Walking	Occasionally	5	11-14	1.1km - 1.2km	Irrelevant	Weather conditions	Walking with friends	Male	Rabin	16-17
71	2023/04/12	Car with my friend's parents	Yes	3-4 days	15+	2km +	0-5 min	Weather conditions;Distance from home to school;Save time;Laziness	Walking with friends	Male	Ram	16-17
72	2023/04/12	Car with my parents	Yes	1-2 days	7-10	1.5km - 1.6km	6-10 min	Save time	Walking with friends	Female	Ram	14-15
73	2023/04/12	Walking	Yes	5	15+	1.3km - 1.4km	Irrelevant		Walking with friends	Female	Rabin	14-15
74	2023/04/12	Walking	Yes	3-4 days	4-6	0.1km - 0.2km	0-5 min	Distance from home to school;Save time	Incentives (e.g. prize drawings, recognition)	Male	Rabin	16-17
75	2023/04/12	Car with my parents	Occasionally	1-2 days	15+	0.9km - 1km	Irrelevant	Laziness		Female	Rabin	14-15
76	2023/04/12	Walking	Occasionally	5	4-6	0.5km - 0.6km	Irrelevant			Female	Rabin	16-17
77	2023/04/12	Car with my parents	Yes	1-2 days	11-14	2km +	0-5 min	Weather conditions;Save time;Laziness	Walking with friends	Female	Ram	16-17
78	2023/04/12	Walking	Yes	5	11-14	1.3km - 1.4km	0-5 min	Weather conditions;Distance from home to school;Save time	Walking with friends	Male	Rabin	16-17
79	2023/04/12	Car with my parents	Yes	never	15+	2km +	Irrelevant	Distance from home to school;Laziness	Walking with friends	Male	Makosh	14-15
80	2023/04/13	Walking	Yes	5	15+	1.1km - 1.2km	Irrelevant		Improved safety measures (e.g. crossing guards, increased lighting)	Male	Ram	16-17
81	2023/04/18	Walking	Yes	5	15+	1.3km - 1.4km	Irrelevant		Walking with friends	Male	Rabin	14-15
82	2023/04/18	Walking	Yes	5	4-6	0.3km - 0.4km	6-10 min	Lack of sidewalks or pedestrian infrastructure	Walking with friends	Male		12-13
83	2023/04/18	Bus	Yes	never	15+	1.7km - 1.8km	0-5 min	Weather conditions;Distance from home to school;Laziness	Walking with friends	Male	Western	12-13
84	2023/04/18	Walking	Yes	5	7-10	0.1km - 0.2km	Irrelevant		Encouragement from teachers, parents, or peers	Male	Rabin	14-15
85	2023/04/18	Walking	Occasionally	5	4-6	0.1km - 0.2km	Irrelevant	Safety concerns;Distance from home to school;Save time	Walking with friends	Female	Rabin	14-15

#	Date	Mode	Allowed	Frequency	Range	Distance	Time	Reasons	Encouragement/Improvement	Gender	Region	Age
86	2023/04/18	Walking	Yes	5	1-3	0.3km - 0.4km	0-5 min	Safety concerns;Save time	Improved safety measures (e.g. crossing guards, increased lighting)	Male	Rabin	12-13
87	2023/04/18	Car with my parents	Yes	1-2 days	15+	1.7km - 1.8km	6-10 min	Save time	Walking with friends	Male	Rabin	12-13
88	2023/04/18	Walking	Occasionally	5	15+	1.1km - 1.2km	11-15 min	Weather conditions	Walking with friends	Female	Rabin	14-15
89	2023/04/18	Walking	Yes	5	15+	1.5km - 1.6km	6-10 min	Weather conditions	Encouragement from teachers, parents, or peers	Male	Ram	14-15
90	2023/04/18	Car with my parents	Yes	never	11-14	0.9km - 1km	Irrelevant	Weather conditions	Walking with friends	Male	Rabin	14-15
91	2023/04/18	Walking	Yes	5	11-14	0.5km - 0.6km	Irrelevant	Weather conditions	Walking with friends	Male	Rabin	14-15
92	2023/04/18	Walking	Yes	5	11-14	0.5km - 0.6km	0-5 min	Weather conditions;Save time	Walking with friends	Male		14-15
93	2023/04/18	Car with my parents	Yes	never	4-6	0.1km - 0.2km	Irrelevant	Safety concerns;Weather conditions	Improved safety measures (e.g. crossing guards, increased lighting)	Prefer not to say	Rabin	14-15
94	2023/04/18	Walking	Yes	5	7-10	1.5km - 1.6km		Weather conditions;Distance from home to school;Laziness	Encouragement from teachers, parents, or peers	Female	Rabin	14-15
95	2023/04/18	Car with my parents	Yes	5	4-6	2km +	0-5 min	Weather conditions;Distance from home to school;Save time	Encouragement from teachers, parents, or peers	Female	Makosh	14-15
96	2023/04/18	Car with my parents	Yes	3-4 days	7-10	2km +	0-5 min	Distance from home to school	Walking with friends	Female	Makosh	14-15
97	2023/04/18	Walking	Yes	5	1-3	1.3km - 1.4km	Irrelevant	Weather conditions;Laziness	Improved safety measures (e.g. crossing guards, increased lighting)	Female	Rabin	14-15
98	2023/04/18	Car with my parents	Yes	5	7-10	2km +	0-5 min	Weather conditions;Distance from home to school;Save time	Improved safety measures (e.g. crossing guards, increased lighting)	Female	Ram	14-15
99	2023/04/18	Walking	Yes	5	11-14	2km +	Irrelevant	Weather conditions;Laziness	Improved safety measures (e.g. crossing guards, increased lighting)	Female	Rabin	14-15
100	2023/04/19	Walking	No	5	7-10	0.1km - 0.2km	Irrelevant	Distance from home to school;Laziness		Male	Rabin	12-13
101	2023/04/19	Bus	Yes	never	15+	2km +	Irrelevant	Weather conditions	Better pedestrian infrastructure (e.g. sidewalks, bike lanes)	Prefer not to say	Southern	14-15
102	2023/04/19	Car with my parents	Yes	1-2 days	15+	1.7km - 1.8km	0-5 min	Save time	Incentives (e.g. prize drawings, recognition)	Female	Makosh	16-17
103	2023/04/19	Car with my parents	Yes	5	4-6	0.5km - 0.6km	0-5 min	Save time		Male	Rabin	12-13
104	2023/04/19	Car with my parents	Yes	3-4 days	15+	1.3km - 1.4km	0-5 min	Weather conditions	Walking with friends	Male	Rabin	14-15
105	2023/04/19	Walking	Yes	5	7-10	0.3km - 0.4km	15min +	Save time	Incentives (e.g. prize drawings, recognition)	Male	Ram	12-13
106	2023/04/19	Bus	Yes	1-2 days	15+	1.3km - 1.4km	15min +	Distance from home to school;Save time;Laziness	Walking with friends	Male	Hagalil	12-13
107	2023/04/19	Walking	Yes	5	15+	1.3km - 1.4km	0-5 min	Weather conditions	Walking with friends	Male	Rabin	14-15
108	2023/04/19	Walking	Yes	5	11-14	2km +	15min +	Weather conditions;Save time	Walking with friends	Male	Ram	14-15
109	2023/04/19	Car with my parents	Yes	5	4-6	0.9km - 1km	0-5 min	Laziness	Encouragement from teachers, parents, or peers	Female	Ram	12-13
110	2023/04/19	Car with my parents	Yes	5	15+	1.5km - 1.6km	Irrelevant	Weather conditions	Walking with friends	Male		14-15
111	2023/04/19	Car with my friend's parents	Yes	5	7-10	0.3km - 0.4km	15min +	Lack of sidewalks or pedestrian infrastructure	Better pedestrian infrastructure (e.g. sidewalks, bike lanes)	Male	Hagalil	14-15
112	2023/04/19	Walking	Yes	5	1-3	0.1km - 0.2km	Irrelevant	Lack of sidewalks or pedestrian infrastructure	Encouragement from teachers, parents, or peers	Male	Rabin	12-13
113	2023/04/19	Walking	Yes	5	4-6	0.5km - 0.6km	0-5 min			Female	Rabin	12-13
114	2023/04/19	Car with my parents	Yes	5	11-14	1.9km - 2km	0-5 min	Distance from home to school;Save time		Female	Makosh	14-15
115	2023/04/19	Car with my parents	Yes	never	4-6	1.9km - 2km	0-5 min	Distance from home to school;Save time		Male	Makosh	12-13
116	2023/04/19	Walking	Yes	3-4 days	15+	1.9km - 2km	15min +	Distance from home to school;Save time;Laziness	Walking with friends	Male	Makosh	14-15
117	2023/04/19	Car with my parents	Yes	1-2 days	15+	1.7km - 1.8km	0-5 min	Distance from home to school;Save time	Walking with friends	Male	Ram	12-13
118	2023/04/19	Walking	Yes	5	15+	1.3km - 1.4km	Irrelevant	Weather conditions	Walking with friends	Male	Rabin	14-15
119	2023/04/19	Walking	Yes	5	7-10	0.7km - 0.8km	Irrelevant	Weather conditions;Save time;Laziness	Walking with friends	Male	Rabin	14-15
120	2023/04/19	Walking	Yes	5	1-3	0.1km - 0.2km	Irrelevant	Distance from home to school	Incentives (e.g. prize drawings, recognition)	Prefer not to say	Rabin	12-13
121	2023/04/19	Walking	Yes	5	7-10	0.3km - 0.4km	Irrelevant	Weather conditions;Distance from home to school	Incentives (e.g. prize drawings, recognition)	Male	Ram	14-15
122	2023/04/19	Car with my parents	Yes	1-2 days	15+	1.9km - 2km	Irrelevant	Weather conditions;Save time;Laziness	Walking with friends	Male	Makosh	14-15
123	2023/04/19	Car with my parents	No	never	4-6	2km +	0-5 min	Distance from home to school	Walking with friends	Female	Western	14-15
124	2023/04/19	Car with my parents	Yes	1-2 days	11-14	1.5km - 1.6km	0-5 min	Weather conditions;Save time	Walking with friends	Female	Rabin	12-13
125	2023/04/19	Bus	Yes	1-2 days	7-10	0.9km - 1km	6-10 min	Weather conditions	Incentives (e.g. prize drawings, recognition)	Male	Rabin	12-13
126	2023/04/19	Bus	Occasionally	3-4 days	15+	1.5km - 1.6km	Irrelevant	Weather conditions;Save time;Laziness	Incentives (e.g. prize drawings, recognition)	Female	Southern	14-15
127	2023/04/19	Walking	Occasionally	5	11-14	0.7km - 0.8km	Irrelevant	Save time;Laziness	Walking with friends	Male	Rabin	14-15

#	Date	Mode		Days	Range	Distance	Time	Barriers	Motivator	Gender	Region	Age
128	2023/04/19	Walking	Yes	5	15+	1.3km - 1.4km	Irrelevant	Weather conditions;Distance from home to school	Walking with friends	Male	Rabin	14-15
129	2023/04/19	Car with my parents	Yes	5	7-10	2km +	15min +	Distance from home to school;Save time	Walking with friends	Female	Hagalil	14-15
130	2023/04/19	Walking	Yes	3-4 days	15+	1.9km - 2km	11-15 min	Weather conditions;Distance from home to school;Laziness	Walking with friends	Female	Hagalil	14-15
131	2023/04/19	Car with my parents	Yes	5	7-10	2km +	15min +	Distance from home to school;Save time	Walking with friends	Female	Ram	14-15
132	2023/04/19	Car with my parents	Yes	never	7-10	1.5km - 1.6km	6-10 min	Weather conditions;Distance from home to school;Save time;Laziness	Incentives (e.g. prize drawings, recognition)	Female	Rabin	14-15
133	2023/04/19	Car with my parents	Yes	1-2 days	7-10	1.1km - 1.2km	11-15 min	Laziness	Walking with friends	Male	Rabin	12-13
134	2023/04/19	Car with my parents	Yes	1-2 days	11-14	1.9km - 2km	11-15 min	Laziness	Walking with friends	Male	Rabin	12-13
135	2023/04/19	Walking	Occasionally	5	7-10	0.7km - 0.8km	Irrelevant	Weather conditions;Save time;Laziness	Incentives (e.g. prize drawings, recognition)	Male	Rabin	14-15
136	2023/04/19	Walking	Yes	5	1-3	0.1km - 0.2km	0-5 min	Laziness	Incentives (e.g. prize drawings, recognition)	Male	Rabin	14-15
137	2023/04/19	Walking	Yes	never	15+	0.9km - 1km	0-5 min	Weather conditions	Incentives (e.g. prize drawings, recognition)	Female	Rabin	16-17
138	2023/04/19	Walking	No	5	11-14		6-10 min	Laziness	Walking with friends	Prefer not to say		14-15
139	2023/04/19	Car with my parents	No	5	15+	0.7km - 0.8km	15min +	Save time	Incentives (e.g. prize drawings, recognition)	Male	Makosh	14-15
140	2023/04/19	Bus	No	5	11-14	0.1km - 0.2km	11-15 min	Weather conditions;Distance from home to school;Save time	Knowledge of health benefits	Male	Ram	12-13
141	2023/04/19	Car with my parents	Occasionally	never	15+	1.1km - 1.2km	15min +	Weather conditions;Laziness	Walking with friends	Female	Rabin	14-15
142	2023/04/19	Car with my parents	Occasionally	3-4 days	15+	1.5km - 1.6km	0-5 min	Distance from home to school;Save time	Walking with friends	Male	Rabin	12-13
143	2023/04/19	Walking	Occasionally	5	7-10	0.9km - 1km	Irrelevant	Safety concerns;Weather conditions	Walking with friends	Female	Rabin	14-15
144	2023/04/19	Walking	Yes	3-4 days	15+	1.7km - 1.8km	0-5 min	Weather conditions	Walking with friends	Male	Rabin	12-13
145	2023/04/19	Car with my parents	Yes	5	4-6	1.7km - 1.8km	0-5 min	Distance from home to school;Save time;Laziness	Incentives (e.g. prize drawings, recognition)	Male	Makosh	14-15
146	2023/04/19	Bus	Yes	5	15+	1.5km - 1.6km	Irrelevant	Save time;Laziness	Walking with friends	Male	Rabin	12-13
147	2023/04/19	Car with my parents	Yes	1-2 days	11-14	1.9km - 2km	6-10 min	Laziness	Walking with friends	Female	Makosh	14-15
148	2023/04/19	Walking	Yes	5	11-14	0.9km - 1km	Irrelevant		Walking with friends	Male	Ram	14-15
149	2023/04/19	Car with my parents	No	1-2 days	7-10	0.9km - 1km	0-5 min	Laziness	Walking with friends	Female	Southern	14-15
150	2023/04/19	Car with my parents	Yes	5	4-6	1.5km - 1.6km	0-5 min	Safety concerns	Better pedestrian infrastructure (e.g. sidewalks, bike lanes)	Male	Ram	14-15

#	Date	Mode		Days	Range	Distance	Time	Barriers	Motivator	Gender	Region	Age
151	2023/04/19	Pedal biking	Yes	5	7-10	0.3km - 0.4km	Irrelevant	Weather conditions	Better pedestrian infrastructure (e.g. sidewalks, bike lanes)	Male	Rabin	16-17
152	2023/04/19	Car with my parents	No	1-2 days	15+	1.3km - 1.4km	11-15 min	Weather conditions;Distance from home to school	Walking with friends	Female	Makosh	16-17
153	2023/04/19	Walking	No	3-4 days	7-10	0.7km - 0.8km	0-5 min	Distance from home to school;Laziness	Incentives (e.g. prize drawings, recognition)	Female	Rabin	12-13
154	2023/04/19	Car with my parents	Yes	3-4 days	11-14	0.7km - 0.8km	6-10 min	Distance from home to school	Better pedestrian infrastructure (e.g. sidewalks, bike lanes)	Female	Rabin	12-13
155	2023/04/19	Walking	Yes	3-4 days	4-6	0.5km - 0.6km	Irrelevant	Distance from home to school;Save time	Better pedestrian infrastructure (e.g. sidewalks, bike lanes)	Male	Rabin	12-13
156	2023/04/19	Walking	Yes	5	15+	0.9km - 1km	6-10 min	Weather conditions	Walking with friends	Female	Rabin	14-15
157	2023/04/19	Bus	Yes	never	15+	1.5km - 1.6km	6-10 min	Distance from home to school;Save time;Laziness	Incentives (e.g. prize drawings, recognition)	Female	Hagalil	14-15
158	2023/04/19	Bus	Yes	1-2 days	15+	1.3km - 1.4km	6-10 min	Weather conditions	Encouragement from teachers, parents, or peers	Male	Rabin	12-13
159	2023/04/19	Car with my parents	No	never	7-10	0.3km - 0.4km	11-15 min	Weather conditions;Distance from home to school	Incentives (e.g. prize drawings, recognition)	Female	Ram	14-15
160	2023/04/19	Car with my parents	Yes	3-4 days	15+	1.1km - 1.2km	6-10 min	Weather conditions;Save time	Walking with friends	Female	Rabin	14-15
161	2023/04/19	Electric scooter/skateboard/bicycle	Occasionally	never	15+	0.5km - 0.6km	0-5 min	Weather conditions;Distance from home to school;Save time;Laziness	Incentives (e.g. prize drawings, recognition)	Female	Ram	14-15
162	2023/04/19	Bus	Yes	1-2 days	7-10	0.9km - 1km	Irrelevant	Weather conditions	Encouragement from teachers, parents, or peers	Male	Ram	12-13
163	2023/04/19	Car with my parents	Yes	1-2 days	15+	1.9km - 2km	11-15 min		Incentives (e.g. prize drawings, recognition)	Prefer not to say	Hagalil	17+
164	2023/04/19	Bus	Yes	5	11-14	1.9km - 2km		Lack of sidewalks or pedestrian infrastructure	Encouragement from teachers, parents, or peers	Female	Ram	16-17
165	2023/04/19	Walking	No	1-2 days	15+	1.1km - 1.2km	0-5 min	Weather conditions	Walking with friends	Female		12-13
166	2023/04/19	Car with my parents	No	never	15+	1.5km - 1.6km	Irrelevant	Distance from home to school;Save time;Laziness	Walking with friends	Female	Makosh	12-13
167	2023/04/19	Walking	Yes	1-2 days	11-14	1.9km - 2km	0-5 min	Safety concerns;Weather conditions;Distance from home to school;Save time	Walking with friends	Male	Ram	14-15
168	2023/04/19	10:52:33 AM GMT+3	Yes	5	7-10	0.5km - 0.6km	Irrelevant	Laziness	Walking with friends	Female	Rabin	12-13
169	2023/04/19	Car with my parents	Occasionally	5	15+	1.1km - 1.2km	6-10 min	Safety concerns;Distance from home to school	Walking with friends	Female	Ram	12-13

#	Date	Mode				Distance	Time	Barriers	Encouragement	Companion	Gender	Region	Age
170	2023/04/19	Walking	No	5	15+	1.3km - 1.4km	Irrelevant	Weather conditions;Distance from home to school;Laziness	Walking with friends	Female	Makosh	16-17
171	2023/04/19	Walking	Occasionally	5	15+	0.5km - 0.6km	0-5 min	Weather conditions	Walking with friends	Female	Ram	12-13
172	2023/04/19	Walking	Occasionally	1-2 days	11-14	1.1km - 1.2km	Irrelevant	Weather conditions;Save time	Incentives (e.g. prize drawings, recognition)	Female	Rabin	16-17
173	2023/04/19	Walking	Occasionally	3-4 days	15+	1.9km - 2km	6-10 min	Weather conditions;Distance from home to school;Save time	Knowledge of health benefits	Female	Rabin	17+
174	2023/04/19	Walking	Yes	5	11-14	1.1km - 1.2km	11-15 min	Weather conditions;Save time	Knowledge of health benefits	Female	Rabin	14-15
175	2023/04/19	Car with my parents	Occasionally	never	7-10	1.1km - 1.2km	6-10 min	Save time	Encouragement from teachers, parents, or peers	Female	Makosh	12-13
176	2023/04/19	Walking	Yes	5	11-14	0.5km - 0.6km	Irrelevant	Save time	Walking with friends	Male	Rabin	14-15
177	2023/04/19	Walking	Yes	5	15+	1.1km - 1.2km	Irrelevant	Weather conditions	Better pedestrian infrastructure (e.g. sidewalks, bike lanes)	Female	Rabin	16-17
178	2023/04/19	Bus	Yes	1-2 days	11-14	0.7km - 0.8km	0-5 min	Distance from home to school	Knowledge of health benefits	Male	Makosh	12-13
179	2023/04/19	Bus	Yes	1-2 days	15+	1.9km - 2km	Irrelevant	Weather conditions;Save time	Knowledge of health benefits	Female	Southern	16-17
180	2023/04/19	Walking	Yes	5	7-10	0.3km - 0.4km	Irrelevant	Weather conditions	Better pedestrian infrastructure (e.g. sidewalks, bike lanes)	Male	Rabin	16-17
181	2023/04/19	Pedal biking	Yes	5	4-6	1.1km - 1.2km	0-5 min	Laziness	Better pedestrian infrastructure (e.g. sidewalks, bike lanes)	Female	Rabin	16-17
182	2023/04/19	Car with my parents	Yes	never	15+	2km +	15min +	Distance from home to school;Save time		Female		14-15
183	2023/04/19	Walking	No	5	11-14	0.9km - 1km	Irrelevant	Weather conditions	Walking with friends	Female	Rabin	16-17
184	2023/04/19	Car with my parents	Occasionally	never	7-10	2km +	6-10 min	Weather conditions;Distance from home to school;Save time	Walking with friends	Female	Makosh	17+
185	2023/04/19	Walking	Yes	5	11-14	0.9km - 1km	0-5 min	Weather conditions	Knowledge of health benefits	Female	Rabin	16-17
186	2023/04/19	Car with my parents	Yes	1-2 days	7-10	0.5km - 0.6km	6-10 min	Save time	Walking with friends	Male	Rabin	12-13
187	2023/04/19	Bus	Occasionally	never	15+	2km +	Irrelevant	Distance from home to school		Male		17+
188	2023/04/19	Walking	Yes	5	11-14	0.3km - 0.4km	Irrelevant	Weather conditions;Laziness	Walking with friends	Female	Rabin	12-13
189	2023/04/19	Walking	Occasionally	5	15+	1.1km - 1.2km	0-5 min	Safety concerns;Weather conditions	Knowledge of health benefits	Male	Rabin	12-13
190	2023/04/19	Walking	Yes	5	7-10	0.1km - 0.2km	Irrelevant	Safety concerns	Improved safety measures (e.g. crossing guards, increased lighting)	Male	Rabin	12-13
191	2023/04/19	Walking	Yes	5	7-10	1.1km - 1.2km	Irrelevant	Weather conditions;Save time;Laziness	Walking with friends	Female	Rabin	14-15
192	2023/04/19	Car with my parents	Yes	never	7-10	1.1km - 1.2km	Irrelevant	Save time;Laziness	Walking with friends	Male	Rabin	12-13
193	2023/04/19	Walking	Yes	5	15+	1.3km - 1.4km	0-5 min	Safety concerns;Weather conditions	Improved safety measures (e.g. crossing guards, increased lighting)	Male	Rabin	12-13
194	2023/04/19	Walking	Occasionally	5	15+	2km +	Irrelevant	Safety concerns;Weather conditions;Distance from home to school;Lack of sidewalks or pedestrian infrastructure;Save time;Laziness	Walking with friends	Female	Makosh	12-13
195	2023/04/19	Walking	Yes	5	11-14	1.1km - 1.2km	0-5 min	Weather conditions	Knowledge of health benefits	Male	Rabin	12-13
196	2023/04/19	Walking	Yes	3-4 days	4-6	0.3km - 0.4km	0-5 min	Safety concerns;Weather conditions;Save time	Knowledge of health benefits	Female		12-13
197	2023/04/19	Walking	Yes	5	7-10	0.7km - 0.8km	Irrelevant	Save time	Better pedestrian infrastructure (e.g. sidewalks, bike lanes)	Male	Rabin	16-17
198	2023/04/19	Car with my parents	Yes	1-2 days	11-14	2km +	0-5 min	Weather conditions;Distance from home to school		Female	Rabin	12-13
199	2023/04/19	Walking	Occasionally	5	15+	0.5km - 0.6km	Irrelevant	Weather conditions;Distance from home to school;Save time;Laziness	Walking with friends	Female	Rabin	12-13
200	2023/04/19	Walking	Yes	5	15+	0.9km - 1km	0-5 min	Weather conditions;Save time;Laziness	Walking with friends	Female	Rabin	12-13
201	2023/04/19	Walking	Yes	5	11-14	0.9km - 1km	Irrelevant	Weather conditions;Save time	Incentives (e.g. prize drawings, recognition)	Male	Ram	14-15
202	2023/04/19	Walking	Yes	3-4 days	15+	0.9km - 1km	0-5 min	Distance from home to school	Encouragement from teachers, parents, or peers	Female	Rabin	12-13
203	2023/04/19	Walking	Yes	3-4 days	7-10	2km +	Irrelevant	Weather conditions;Save time	Walking with friends	Female	Rabin	12-13
204	2023/04/19	Walking	No	1-2 days	4-6	1.5km - 1.6km	Irrelevant		Walking with friends	Female	Rabin	12-13

Appendix D: Walk2School Application Overview

Walk2School

Walk2School is an innovative mobile app designed to encourage high school students to choose walking over driving. This app not only promotes physical activity, but also allows users to earn tangible rewards as they achieve various milestones. By turning walking into a social activity, the app connects students with their peers and fosters a sense of community. With the ability to log daily walks, track progress over time, and compete with friends on a leaderboard, Walk2School provides an engaging and interactive experience for its users. Overall, Walk2School is an effective tool for improving the health and well-being of high school students while also promoting sustainable transportation.

App Suite

Walk2School

- Home Page: The home page serves as the foundation of this app, serving as both the starting and ending point for walks. However, to ensure the integrity of the app's purpose, several conditions must be met before a walk can be initiated. These include it being a weekday, at a time before school starts (to prevent tardiness), and no previous walks on that day. At the end of each walk, further conditions must be met to verify its validity, such as maintaining a speed limit of 25mph to ensure the user truly walked, a minimum distance of 50m traveled, and a distance of at least 100m from the school upon completion. To avoid ending a walk prematurely and invalidating points, the app prompts the user to confirm their intention to end the walk and meet all necessary conditions. Once a walk is successfully initiated, the user can view a percentage indicator showing their progress towards the school, as well as essential data points such as the distance traveled during their current trip, their all-time walking distance, current streak, and all-time points.

- Active Users Page: The Active Users page is a key feature that highlights the social aspect of walking. Through this page, users can view a list of other individuals who are also using the app, and easily identify those who are currently walking. By seeing which

friends are walking at the same time, users can connect and coordinate to form walking groups, which adds to the overall sense of community and accountability. This feature is designed to encourage users to engage with others, foster new relationships, and make walking a fun and social activity.

- Rewards Page: The Rewards page is a powerful tool that directly incentivizes students to participate in the program. Any rewards that teachers or administrators add to this page can be purchased by students using the points they earn from walking. To motivate students who live further from the school, each meter walked is worth one point. Additionally, if a student walks for multiple days in a row, their streak increases and acts as a multiplier on their points (e.g., a two-day streak is worth 2x points). The streak resets every week. The Redeemed Rewards page displays all items that students have purchased and whether or not the teacher has fulfilled the request. This page also provides a full purchase history, allowing students to track their progress and celebrate their achievements.
- Leaderboard Page: The Leaderboard page is a simple yet powerful feature that allows students to see the point totals of their peers, ranked in order from the highest to the lowest. By showcasing the top performers, this page promotes healthy competition among students and encourages them to walk more frequently to increase their point totals. The leaderboard also fosters a sense of community by providing a platform for students to celebrate their achievements and compare their progress with others.

Admin Panel

The Admin Panel is a powerful tool designed for teachers and administrators to manage the rewards system and orders from students. With this panel, teachers and administrators can add or remove rewards, set point values for each reward, and approve student orders. This feature streamlines the process of managing the rewards program, allowing teachers to focus on the needs of their students. By giving educators control over the rewards system, the Admin Panel fosters a collaborative environment where teachers and students can work together to promote healthy habits and achieve wellness goals.

- Shop Status Page: The listings page is a powerful tool that enables admin users to create and manage listings for the rewards program. When creating a new listing, admins must provide several important details, including the name, price, quantity, image URL, and description. With these fields, admins can create detailed and engaging listings that motivate students to participate in the program. Additionally, admins can choose to create a listing and make it invisible to users until a later date, providing flexibility and control over the rewards system.

- Orders Page: The Orders page is an essential feature that allows teachers to manage and fulfill orders made by students in the rewards program. On this page, teachers can view a queue of orders that have been redeemed, each with a variety of attributes such as the student username, item name, item price, item quantity, item description, date of purchase, and status (fulfilled or not). With this comprehensive view of student orders, teachers can stay on top of fulfilling requests and maintaining an accurate inventory. Moreover, the page includes a button on each order, allowing teachers to mark the item as fulfilled once it has been distributed to the student.

Technologies Used

- Flutter framework for mobile app development
- Express.js framework for backend development
- MongoDB database for storing user data
- Vercel for hosting the backend API

Screenshots
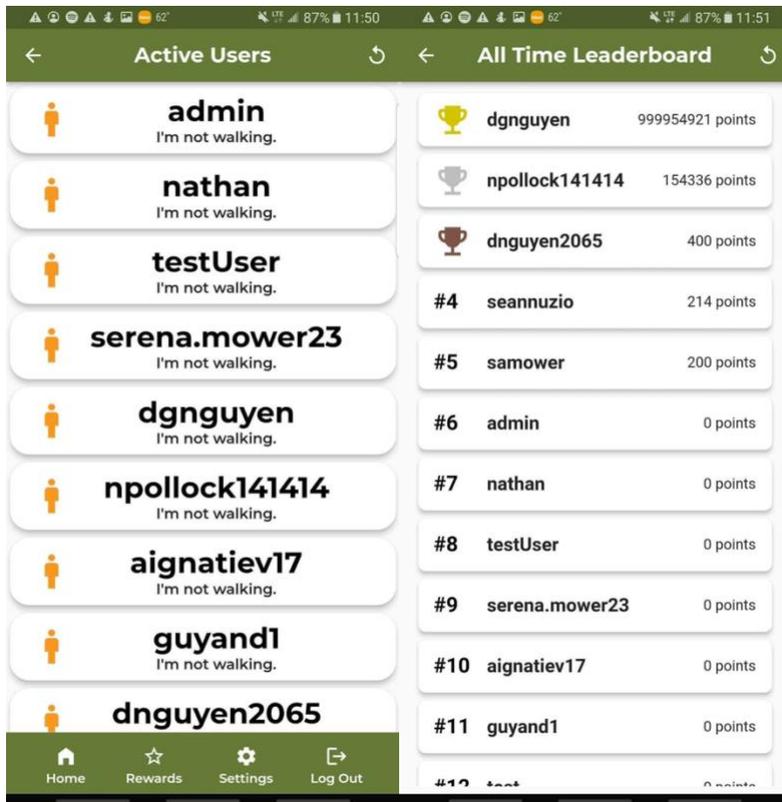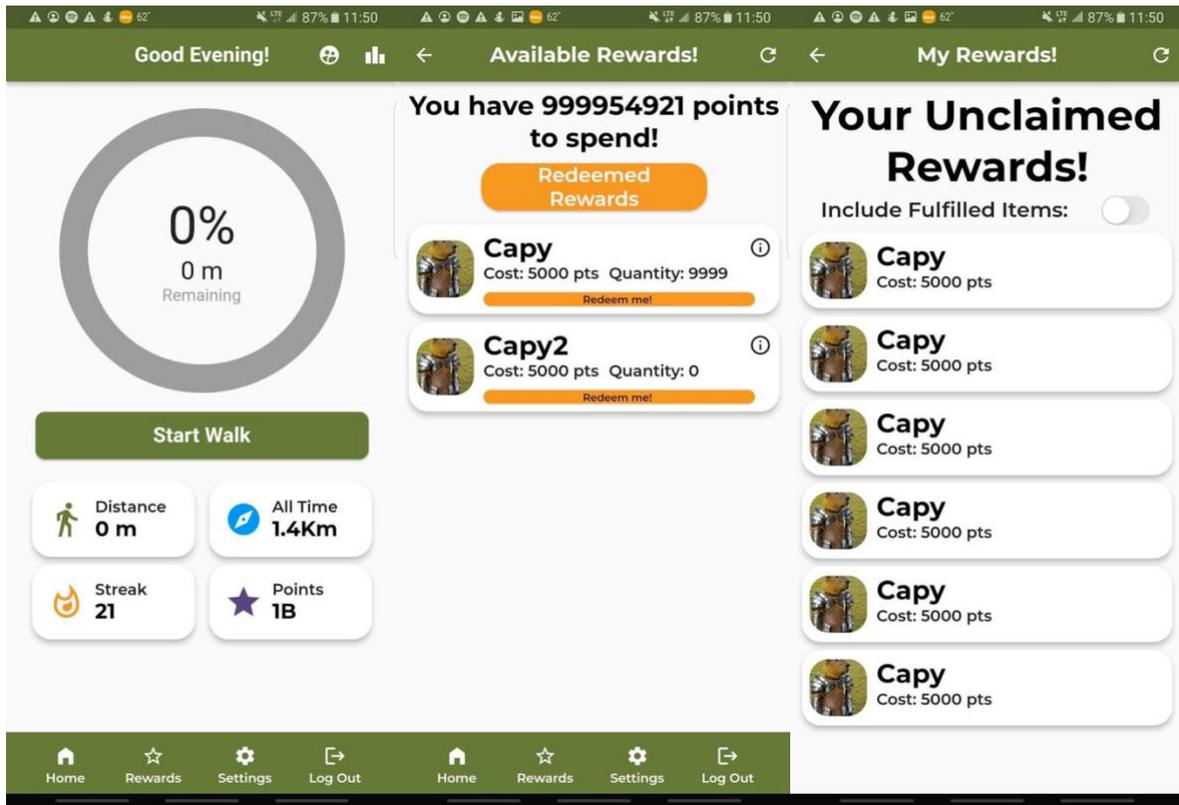
Installation

1. Clone the repository to your local machine

2. Install dependencies using npm install

3. Run the server using npm run start

4. Run the app on an Android or iOS device using flutter run

Usage

To use the Walk2School app, follow these steps:

1. Create an account or log in using your existing credentials.

2. Log your daily walks using the app's built-in tracking feature.

3. Earn points by walking and use them to purchase rewards from the Rewards page.

4. Connect with friends and form walking groups on the Active Users page.

5. Check your progress and all-time walking data on the Home page.

6. Check the leaderboard on the Leaderboard page to see how you rank among your peers.

API Documentation

The app's backend API provides endpoints for retrieving user data, logging walks, and updating user profiles.

For detailed documentation of the API endpoints, see the API.md file in the project repository.

License

TBD

Authors

- Dylan Nguyen
- Nathan Pollock

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Appendix E: Timeline

Before Arrival	Week 1	Week 2	Week 3	Week 4
Surveys with Students				
Surveys with Parents				
Data Analysis				

After Arrival	Week 5	Week 6	Week 7	Week 8
Participant Observation				
Student Focus Groups				
Parent Focus Groups				
Student Interviews				
Data Analysis				

Appendix F: IRB Forms

Informed Consent Agreement

Study Investigator: Ben Brodeur, Andrei Ignatiev, Dylan Nguyen, Serena Mower, Nathan Pollock

Contact Information: gr-WalkToSchoolD23@wpi.edu

Title of Research Study: Walk to School

Sponsor: Braude College of Engineering

Introduction: You are being asked to participate in a research study. Before you agree, however, you must be fully informed about the purpose of the study, the procedures to be followed, and any benefits, risks, or discomfort that you may experience as a result of your participation. This form presents information about the study so that you may make a fully informed decision regarding your participation.

Purpose of the study: To measure the effect walking to school has on traffic congestion in Karmiel, Israel.

Procedures to be followed: Individuals who participate in this study will be asked a variety of questions about their commute to school and the traffic congestion in Karmiel. This may be in the form of survey questions, focus groups, or interviews. Surveys won't take more than ten to fifteen minutes to complete, and both focus groups and interviews shouldn't last more than an hour.

Risks to study participants: Although best practices to ensure security over passwords will be used. There is a minimal risk of application data being breached which will result in usernames and hashed passwords being leaked.

Benefits to research participants and others: Health benefits of walking such as reduced body fat, stronger bones, improved balance, and reduced risk of heart disease and stroke. Our objective is to reduce traffic in the morning when traveling to work and school, which benefits Karmiel as a community.

Record keeping and confidentiality: Records of your participation in this study will be held confidential so far as permitted by law. However, the study investigators, the sponsor, or its designee, and, under certain circumstances, the Worcester Polytechnic Institute Institutional Review Board (WPI IRB) will be able to inspect and have access to confidential data that identify you by name. Any publication or presentation of the data will not identify you.

Compensation or treatment in the event of injury: This study involves minimal risk of injury or harm. You do not give up any of your legal rights by signing this statement.

For more information about this research or about the rights of research participants, or in case of research-related injury, contact:
Study Investigator: Ben Brodeur, Tel. (774) 437-9553, Email: bdbrodeur@wpi.edu
Study Investigator: Andrei Ignatiev, Tel. (978) 493-3393, Email: alignatiev@wpi.edu
Study Investigator: Serena Mower, Tel. (207) 402-1910, Email: samower@wpi.edu
Study Investigator: Nathan Pollock, Tel. (619) 991-1547, Email: ndpollock@wpi.edu
Study Investigator: Dylan Nguyen, Tel. (443) 370-5791, Email: dgnguyen@wpi.edu
IRB Manager: Ruth McKeogh, Tel. 508 831- 6699, Email: irb@wpi.edu
Human Protection Administrator: Gabriel Johnson, Tel. 508-831-4989, Email: gjohnson@wpi.edu

Your participation in this research is voluntary. Your refusal to participate will not result in any penalty to you or any loss of benefits to which you may otherwise be entitled. You may decide to stop participating in the research at any time without penalty or loss of other benefits. The project investigators retain the right to cancel or postpone the experimental procedures at any time they see fit.

By signing below, you acknowledge that you have been informed about and consent to be a participant in the study described above. Make sure that your questions are answered to your satisfaction before signing. You are entitled to retain a copy of this consent agreement.

_____ Date: _____
Study Participant Signature

_____
Study Participant Name (Please print)

_____ Date: _____
Signature of Person who explained this study

Special Exceptions: Under certain circumstances**,** an IRB may approve a consent procedure which differs from some of the elements of informed consent set forth above. Before doing so, however, the IRB must make findings regarding the research justification for different procedures (i.e. a waiver of some of the informed consent requirements must be necessary for the research is to be "practicably carried out.") The IRB must also find that the research involves "no more than minimal risk to the subjects." Other requirements are found at 45 C.F.R. §46.116.

Parental Consent Form

<p align="center">Worcester Polytechnic Institute Consent to Participate in Research
Walk to School Project</p>

This is a research study conducted by Worcester Polytechnic Institute (WPI) students. We are a group of students researching the traffic congestion in Karmiel. Your child will be asked a series of questions in an interview or focus group style related to traffic in Karmiel and walking to school. Your child's participation will require approximately an hour of time.

There are minimal to no risks involved in participating in this study. The data collected in this research project will be kept confidential. Your child's name will not be stored with the data, and this consent form will be stored separately from your child's data. Reports of this study will not include individual data in a form by which your child could be identified. The WPI students will be the ones conducting these interviews, but staff from WPI or the participant's school may be present. Depending on the timing and availability, these interviews may take place over Zoom or, if the school allows it, within the participant's school building.

If successful, this study may contribute to our understanding of how encouraging more students to walk to school may decrease traffic congestion during commute hours in Karmiel. Walking to school may also benefit a participant's mental and physical health.

Your child's participation in this study is entirely voluntary. Your child may refuse to answer individual questions or to engage in individual activities. Your child may also discontinue all participation in this study at any time. You will not be provided information as to your child's performance on any of the study tasks, but you may request a transcript of the interview if you would like.

Our group would be glad to answer any questions about the procedures of this study. We can be contacted at gr-WalkToSchoolD23@wpi.edu.

Concerns about any aspect of this study may be referred to our advisor Professor Svetlana Nikitina at svetlana@wpi.edu, the WPI IRB Manager Ruth McKeogh at irb@wpi.edu, or the WPI Human Protection Administrator Gabriel Johnson at gjohnson@wpi.edu.

I voluntarily consent for my child to participate in this study. I will be given a copy of this consent form.

_____   _____

Signature of Parent/Legal Guardian   Date

_____

Name of Child

Assent Form for Minors

Assent Form for Minors: Walkability and Promoting Walking to School Study

Title of the Study: Investigation of the Effects Walking to School has on Traffic Congestion in Karmiel, Israel

Introduction: Hello! We are conducting a study to understand the challenges related to traffic congestion around Ort Kramim and explore ways to promote walking to school. The study will involve surveys, interviews, focus groups, and observations of the area around the school. We have designed a fun app to encourage students to walk to school and may potentially be hosting a Walk to School Day. We hope that walking to school will help reduce traffic, improve students' health, and give you a chance to socialize with friends.

Purpose: The purpose of this assent form is to ask for your permission to participate in our study. You are being invited to participate because you are a student at Ort Kramim and your opinions and experiences are important to us.

Procedures: If you agree to participate, you may be asked to do one or more of the following:

1. Complete a survey about your opinions on walking to school.
2. Participate in an interview to discuss your thoughts about walking to school.
3. Join a focus group with other students to talk about walking to school and your experiences.
4. Participate in a Walk to School Day event and provide feedback about your experience.

Risks and Benefits: There are no major risks involved in participating in this study. Some questions in the survey, interviews, or focus groups may make you feel a little uncomfortable, but you can choose not to answer any question that you do not want to. The benefits of participating in this study include helping your school and community address traffic congestion and promoting a healthier lifestyle for students.

Confidentiality: Your participation in this study will be kept confidential. We will not use your name or any other information that could identify you in any reports or presentations. However, we may keep records documenting your participation (audio recordings, notes) in the study.

Voluntary Participation: Participating in this study is completely voluntary. You can choose not to participate, and you can also stop participating at any time without any negative consequences.

Questions: If you have any questions about the study, you can ask the researchers or a trusted adult, such as a teacher or parent.

Assent to Participate: By signing below, you agree to participate in the study:

Student Name (printed)

_____

Student Signature

_____

Date

If you have any questions about this study or your rights as a participant, you may contact:

Study Investigator: Ben Brodeur, Tel. (774) 437-9553, Email: bdbrodeur@wpi.edu
Study Investigator: Andrei Ignatiev, Tel. (978) 493-3393, Email: alignatiev@wpi.edu
Study Investigator: Serena Mower, Tel. (207) 402-1910, Email: samower@wpi.edu
Study Investigator: Nathan Pollock, Tel. (619) 991-1547, Email: ndpollock@wpi.edu
Study Investigator: Dylan Nguyen, Tel. (443) 370-5791, Email: dgnguyen@wpi.edu
IRB Manager: Ruth McKeogh, Tel. 508 831- 6699, Email: irb@wpi.edu
Human Protection Administrator: Gabriel Johnson, Tel. 508-831-4989, Email: gjohnson@wpi.edu

Photo Consent Form

Photo Release Form for Minors

I, _____, the parent or legal guardian of

_____ [Child], grant _____ the Walk

to School Research Project my permission to use the photographs taken of my child during the

Walk-to-School Day for any legal use, including but not limited to: publicity, copyright

purposes, illustration, advertising, and web content. Furthermore, I understand that no royalty,

fee, or other compensation shall become payable to me by reason of such use.

Parent/Guardian's Signature: _____

Parent/Guardian's Name: _____

Date: _____

Child's Signature: _____

Child's Name: _____ _____

Date: _____