Design of a Database Platform for Eilat

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Abstract

The Municipality of Eilat, Israel wants to foster a community of innovation by attracting startup companies and researchers to do work in their city. The goal of this project was to create and implement the design for a database platform that would be used to present the smart city data being collected in Eilat. The final deliverables of this project were guidelines for organization and formatting of the data, descriptions of features to be included in the first iteration of the platform, and wireframes of the platform's user interface. We included our recommendations to the Municipality for the future expansion of the platform. Our intent is for these findings to be used by the Municipality to build the first iteration of this platform and begin to promote their community of innovation.

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1. Introduction

Across the globe, cities and urban areas are recognizing the benefits of increasing their technology-based projects. These types of technology initiatives gather information and data about the lives and needs of city residents, in order to increase efficiency and quality of life for those living in the area. These projects are also referred to as Smart City Initiatives (SCIs), and rely quite heavily on data collection (He et al, 2014). Areas of such data collection in cities include energy efficiency, waste management, transportation, and water usage (Maddox, 2018).

In many of the cities implementing SCIs, collected data becomes a valuable resource in attracting startup companies and researchers of both universities and Non-Governmental Organizations (NGOs) to the city (Alawadhi et al, 2012). These organizations can bring much valued economic activity and good workplaces to the city. While doing so, startups and researchers can benefit from the open data in order to progress their own products and research. For cities to continue attracting start-ups and researchers, it is important that they can evaluate the value of the data they are offering. One system for evaluating the value creation for data has been categorized in an article from the *International Journal for Information Management* into the 'Nine-Factor Framework for Data-Based Value Creation" written by Chiehyeon Lim, et al. (Lim et al., 2018). This framework describes avenues of value creation including supplemental information on data and data sources, analysis of the data presented, and the mechanisms of presenting data on a provider network (Lim et al., 2018).

The city of Eilat, Israel is moving towards a more efficient and sustainable future through the means of SCIs. The Eilat Municipality has spear-headed this movement, implementing sensors across the city which have since been collecting data on a large scale in the area. Although the city is collecting data through many streams, including energy efficiency, water usage, and transportation, 98% of the data being collected lacks value and is currently not being used as it is unorganized and the city has no avenue of data distribution (Topel, E. & Admon, A. (2020, January). Personal Interview.). Thus, one of the goals of the Eilat Municipality is to give the unusable data value through the creation of a centralized data platform.

Centralized data platforms can give value to data in three ways (Cheng et al, 2015). The first is by presenting the data in an easy-to-use way. This includes providing multiple options for downloading data, sufficient platform accessibility, and supplemental visuals that correspond with datasets. Giving the user options of language preference and file type, such as CSV vs. PDF, allow for more individuals to view the data successfully. The next way that the platform creates value for data is by presenting it among supplemental information that helps the user gain context and clarity around the dataset being presented. For example, this can mean presenting meteorological data alongside data on renewable solar energy, as meteorological data influences the results of the later dataset. The third way a platform can assist in creating value is by providing supplemental data analysis and reports that go along with the presented data. For example, if a dataset on building energy consumption was presented on a platform and the data was analyzed for energy efficiency by an organization, presenting this supplemental report alongside the raw data would give additional value as this analysis can be used in future work.

The goal for this project was to assist the Eilat Municipality in the design of a centralized data collection platform that will allow value to be added to data that is being collected in the city. The Municipality will be able to use this platform to grant potential partners and colleagues access to specific datasets, for use in assisting the city. In order to achieve this goal, we narrowed our scope to focus on energy data collected in the region. In the future, the objectives can be applied to all streams of data collection. The final deliverable for this project is a set of user

requirements, data guidelines, and mockups that the Municipality can provide to a software developer in order to create the desired data centralization platform. This design plan consists of user requirements represented through platform features and data categorization, and iterations of possible user interface mockups.

2. Background Chapter

This section reviews the literature that informs and supports the technical and social foundations of our project. First, we review literature pertaining to the city of Eilat, followed by an introduction to smart cities, which sets the context of our project. Then the team reviews literature defining how value is created for collected data and an explicit case study of this. The current challenge of data collection and value creation in Eilat is discussed, and a solution to the challenge in the form of a centralized data collection platform is reviewed. Supplemental information on these types of platforms is given, involving potential users and a case study of a successful platform.

2.1 Eilat, an Oasis in the Desert

Eilat, located on the Red Sea and sandwiched in the Negev desert between Egypt and Jordan, is Israel's southernmost city. As of 2018, the estimated population of Eilat was 51,935 people, and this number continues to increase as the surrounding areas are developed (Brinkhoff, 2019). Eilat capitalized on its access to the Red Sea by becoming a significant destination for both domestic and foreign tourism. The city is home to dozens of hotels totalling over 12,000 rooms, and both hospitality and tourism are a major subsection of the local economy, with the city's official tourism website boasting it welcomes over three million visitors annually (Eilat City, n.d.). The city is also the country's only access to the Indian Ocean, serving as the primary inlet for oil required to power the national electric grid stations in the north of Israel.

Although on a sea, Eilat's location in the Negev desert region poses challenges of water acquisition for its population. Over the years, the city has established desalination plants as a means to combat this challenge. Additionally, the hyper-arid climate of Eilat requires use of cooling systems for residents. The solution to both of these issues involves energy. Eilat receives an average of 11 hours of sunlight per day year round, making it an excellent location for solar based renewable energy production and off-grid energy implementation to support the city and the Arava region (Meteogram, 2020).

2.1.1 The Role of the Eilat Municipality

Eilat's Municipality is charged with managing the different activities occurring within the city, while also preparing the city for any future challenges that it might face. The department of Planning and Engineering Administration, handles the design and implementation of various expansion projects and improvement initiatives being considered for the city. Within the engineering division, Smart City Coordinators such as our sponsor, Elad Topel, are tasked with preparing Eilat for its projected future growth by partnering with companies in the region to implement smart city initiatives. These objectives will develop Eilat into a more efficient city with its growing population, capable of readily responding to the needs of its citizens and improving their quality of life through new innovations and technology (Topel, E. & Admon, A. (2020, January). Personal Interview.).

2.2 An Introduction to Smart Cities

The term 'smart city' refers to a city or urban areas that use sensors to collect data, which can be analyzed and interpreted to allow municipality officials to make changes that can improve the city resident's daily lives by addressing challenges to public transportation and utilities (He et al, 2014). The sensors utilized in these initiatives provide underground, ground level, and aboveground data collection in areas such as, but not limited to, energy, waste management,

transportation, and water usage (Maddox, 2018). Further, smart cities work to improve the quality of life and efficiency in the area by using the implemented sensors to gather data-based knowledge, in order to gain a more in-depth and accurate understanding of the challenges the city faces. The solutions in this continual process of city improvement can combat issues in areas such as growing urbanization and tourism. For example, data collected in buildings on heat or air conditioning production may reveal inefficiencies, whether loss of heat/AC or high energy consumption. These issues may be addressed by providing supplemental insulation and/or energy saving HVAC systems to such buildings, which in turn may result in less energy used, less emissions produced, and more money saved.

Smart cities can also be ideal locations to pilot and test future products, technologies, and/or other amenities by startup companies and firms. Simultaneously, local governments can use the data that they collect as an incentive to attract outside companies to bring new innovative technologies to their city or internally implement new initiatives. These new technologies and initiatives can be influential in improving the quality of life for both residents and visitors (Scuotto, Ferraris, & Bresciani, 2016). Below are some examples of smart city projects around the world that benefited their communities in meaningful ways.

Table 1: A Table of Smart City Initiatives Across the Globe

City	**Partner**	**Project**	**Benefits**
Jakarta, Indonesia	PetaJakarta	Real-time crowdsourced map that alerts citizens to flooding in the city	Reduces loss-of-life and loss of property from seasonal flooding in the region
Seoul, South Korea	SoCar	Car-sharing app that allows citizens to share rides/cars	Reduces emissions and congestion by reducing the number of cars on the roads
San Jose, CA, USA	Intel	Installed air quality, sound, and climate sensors to provide the city with continuous data	Policies have been put in place to reduce air and noise pollution and improve traffic flow
Reykjavik, Iceland	Better Reykjavik	Website where citizens can submit and vote on initiatives to implement	Citizens have an active voice in decisions-making in their home city
Eilat, Israel	SolView	AI that analyzes roof size, utility rates, weather patterns to calculate savings from adding Solar Panels	Increased participation in residential solar panel usage

2.3 How Value is Created from Data

While many cities, including Eilat, have already been successful in the collection of vast amounts of data, the tangible benefits of applying smart city initiatives cannot be achieved unless the data has value. Data is considered to have value when an entity is capable of using that data

to create or add value to something else. One method used to assess the value that a certain set of data has is through the *nine-factor framework* (Lim et al., 2018). These nine value creating factors include: providing the data source, method of data collection, accompanying datasets, data analysis, interpreted information (such as from the analysis), information delivery methods, information on users, previous examples of value creation from the use of datasets, and finally, information on the provider network of the data (Lim et al., 2018). The more factors that are present, the more value is added.. These factors create value by clarifying the setting in which the data exists and is collected, allowing a greater understanding of the data due to the contributing factors. For example, the nine supplemental factors provide the where, when, why, and how data is collected. Supplemental research relating to such data provides descriptive information which gives details on the current state of the data, the future state of the data, and recommendations of what to change due to this and why, respectively (Lim et al., 2018). Figure B below, shows five different avenues of data streams in order to provide a better understanding of the nine factor system for value creation in data. For example: a car's infotainment system collects data from vehicle and driving processes by using onboard sensors and telematics to produce sets of vehicle condition and driving data. Supplemental information on fuel efficiency, consumables, etc. is added and that data is analyzed to understand the vehicle's condition. This analysis is delivered to the user (drivers) via onboard display and emails in order to promote safer driving. This process of identifying how the data is used and why gives the data meaningful value. The nine-factor process can be applied to any dataset in order to evaluate the value that that data has to any potential users.

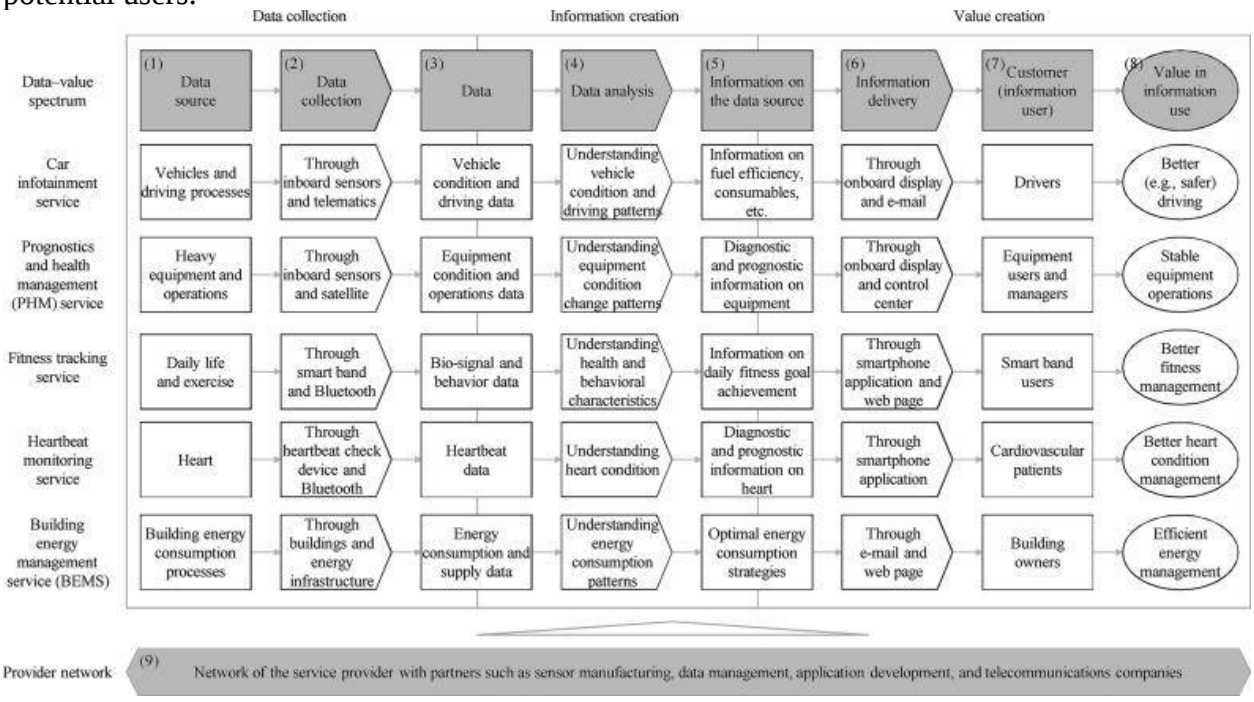


Figure A: Examples of data collection and their corresponding information relating value creation in the nine-factor framework (Lim et al., 2018).

2.3.1 Case Study: Value Creation for Energy Data in Bloomfield, IA

The nine-factor evaluation outlined above can be applied to real world examples to demonstrate the amount of value a dataset has. As part of its energy independence plan, the city

of Bloomfield, Iowa created an interactive map of all energy use throughout the city. The map serves as a great example for how value can be given to data, as it presents data both visually and numerically, with accompanying supplemental information. For each building in the city the square footage of space, the gas consumption, the electricity consumption from the grid, the year it was built, and its energy intensity can be seen (Residential Energy Use Map). In accordance with the nine-factors of value creation, this map gives context for any particular building by visually indicating how well or poor the building's energy intensity is. The map also gives context in regards to the building's construction date, which often impacts insulation and heating efficiency. The city of Bloomfield succeeds in not only compiling data from various sources, but also of creating value for the data it has.Knowledge of energy use can motivate customers to promote more efficient habits, and the map created has a contextual representation that residents, the city, and industry can use (Räsänen, Ruuskanen, & Kolehmainen, 2008).

2.3.2 Current State of Data Collection in Eilat: The Challenges

Currently, the Eilat Municipality collects hundreds of different datasets that cover the spectrum of categories that data can be collected from. However, according to Eilat's Smart City Coordinators, over 98% of these datasets cannot be used by companies or the city as they are inaccessible, unorganized, and lack analysis or anonymization, and therefore cannot have any appreciable value. These datasets are also stored or located in many different areas of the municipality, as well as separate government-funded companies, thus making the process of obtaining specific data difficult and rigorous to do. Obtaining data may take weeks at a time, as the process depends solely on how fast the individual with the data can get back to the individual inquiring. Even further, if the data needed lacks privacy protection or is unanalyzed, it may not be able to be shared (Topel, E. & Admon, A. (2020, January). Personal Interview). All of these factors leave the data in a state where it is almost impossible to add any value to the data, if it is usable at all.

2.4 Centralized Data Collection Platforms: The Possible Solution

Centralized Data Collection Platforms (CDCPs) are one way to add value to data collections. These platforms have the ability to provide a wide range of datasets in one virtual location , thus giving the user a much better experience in obtaining the data for whatever they may be working on (Olavsrud, 2017). These datasets also provide contextual information as discussed in section 2.3, thus providing the means to better understand the data presented, and giving the data context which creates value in the platform as well (Lim et al., 2018). Many times, this contextual information is given in the form of interactive visuals, reports, and supplemental statistics. These displays are often aesthetically appealing and help convey information in an easy to understand manner, providing a user friendly experience and a higher retention rate of possible users.

2.4.1 Users of Centralized Data Platforms

The most important factor in the success of a centralized platform for data collection lies in how effectively the platform meets the needs of the potential users. A centralized platform can be accessible to a wide range of people that will all have unique needs. Some examples of the different users of the platform are municipality officials, startup companies and startup hubs, and non-governmental organizations (NGOs) and researchers. Municipality officials consist of officials that need access to the data for policy creation and/or other means, as well as colleagues

from other city municipalities that request data access for comparison and collaboration. . The group consisting of companies and organizations are possibly interested in using the data collected within regions covered by the platforms in order to test and validate the designs or products they have created, which the city hopes can benefit quality-of-life within the city in some way. The final categorization refers to independent researchers working for universities or NGOs looking to conduct studies about a city that need access to regional datasets in order to complete their research (Topel, E. & Admon, A. (2020, January). Personal Interview.). These three distinct groups all have unique needs for data collection and could potentially benefit from access to a centralized platform of the caliber that the municipality has in mind. Part of the challenge in the design of a centralized platform that these different groups would use, is creating a final product that each group of users will be able to use successfully. When a centralized platform is created with users in mind, it can be used effectively to provide many benefits for the host city.

2.4.2 Case Study: The Effects of a Centralized Platform in Boston, MA

London, Copenhagan, Barcelona, and Boston all have some form of a platform that is used to access the data that the city collects. Boston's platform, called Analyze Boston, is a good example of how the data can be presented effectively. This platform is hosted as an open public website in which the user may search through many different topics and sets of data that are presented. Datasets are constantly being added and are related to a range of topics including the environment, building facilities, finances, and the economy (Analyze Boston, n.d.). One of the unique aspects of this platform, which can be seen below in Figure C, is that it explicitly showcases the benefits of past and current projects that have occurred or are ongoing in the city today, through the open data that the platform presents. This gives the data that is shown on the platform more value, as it provides details and information of how the datasets were used by specific users and what was accomplished due to having access to them. This relates to seven of the nine-factors of data value creation as discussed previously. The data goes through a process of collection, information creation through interpretation and analysis, and finally value creation as it is beneficial for its users. Users, such as other municipalities, may gain value from the platform as they can understand the technological impact of smart initiatives in the city of Boston to help shape their own cities. With this valuable open data presented, potential users can impact the city in a positive manner and provide further information, analysis, and value to such datasets presented on the centralized data platform.

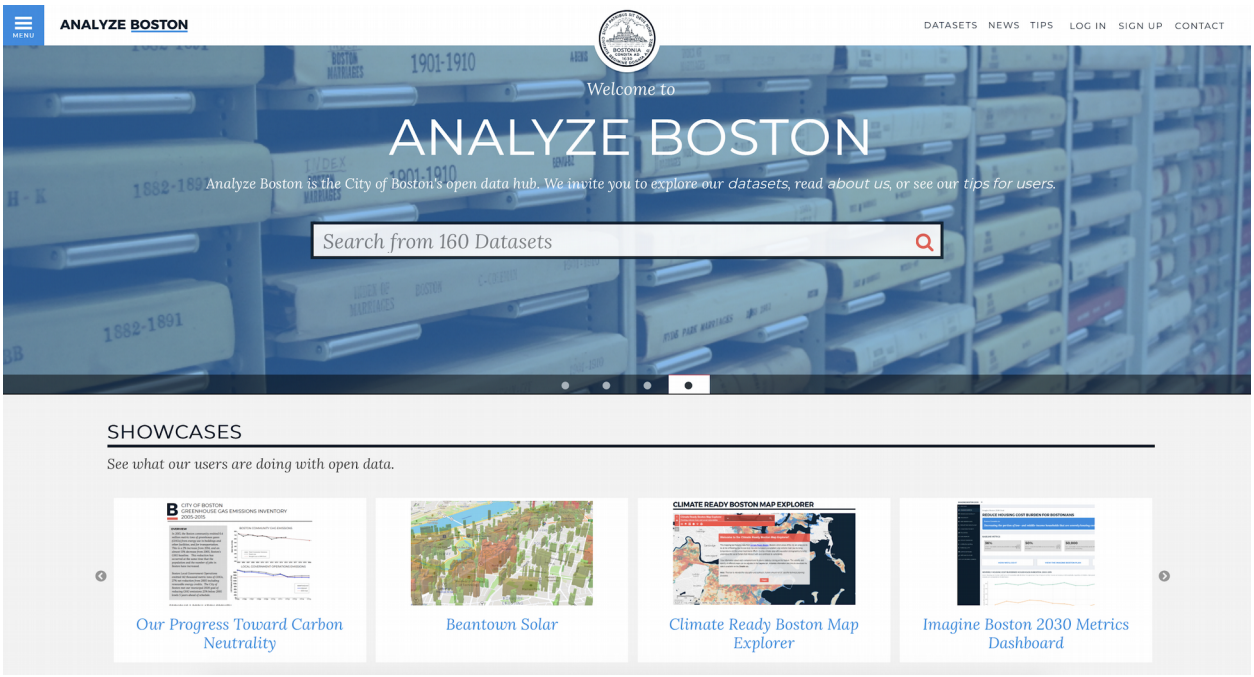


Figure B: User interface of the 'Analyze Boston' centralized data collection platform. The website showcases the projects that have worked with the sites' open data, thus creating value for the data (Analyze Boston, n.d.).

3. Review of Existing Database Platforms

This section describes outcomes from our review of forty database platforms and analysis of them to reveal features or attributes of importance and value created based on the Nine-factor framework. We analyzed features and how often they occur on sites. Based on this we determined how useful they are for users of these platforms and the technical feasibility of their implementation. Value scoring of the platforms evaluates information presented about the data on the reviewed platforms.

3.1 Feature attributes

Table 2 shows the most and least commonly occurring features on researched database platforms. This analysis reveals the importance of features based on ease of data access and type of data representation most useful.

Table 2: Most/Least Commonly Occurring Features

Feature	Percentage of Platforms	Notes
Most Common:		
Search bar	75	Useful, Easy to Implement
Reports	72.5	Useful
Statistics (Tables, Charts, Raw data)	70	Useful, Easy to Implement
Least Common:		
Interactive Maps	40	Difficult to Implement
Advanced Filters	40	Difficult to Implement
Future Projections	27.5	Less Useful, Difficult to Implement

Search bars allow for quick search across a database with keywords and produce results that can be sorted based on relevance, most searched and the highest match of keyword. Reports are of two types: prepared by the platform or referenced to external platforms. In the first case, platforms demonstrate the credibility of their sources and analysis of information allowing organizations or corporate entities to reference their findings. The second case reveals collaboration and cooperation among organizations that handle data. Statistics are visible in a number of ways, the most common of which include data representations as tables, with subtypes for each category of data, static or minimally customizable charts, and downloadable raw data for each set.

The least commonly occurring features represent limited use and/or increasing technical effort to implement. Future projections depend on dynamically changing variables such as environmental conditions and weather, requiring multiple factors to produce outcomes. Interactive maps, while helpful to understand data, are only applicable to certain types of data

that show distribution across a geography. Coupling with the costs associated in producing dynamic visuals, interactive maps are high-cost, low-outcome representation types.

3.2 Value creation from platforms

Table 3 shows the highest and lowest ranking web platforms when scored with the Nine-factor framework. The high scoring platforms produce value by having clear indication of the following

1. Sources of the data collected
2. Means of analysis or filtering the collected data
3. Multiple types and representations of data
4. Clear user information pertaining to the data

By indicating the source/methodology of data collection, the user is informed of the source and means of the information which adds credibility to the data. An example of a website that includes detailed information about the source of data is *Tracking SDG7*. The organization presents a webpage describing the methodology of data sources and mathematical models used in data analysis (Lim et al., 2018).

Table 3: Highest and Lowest Value Scoring Platforms

Data Platforms	Value Score
Highest Scoring:	
City of Bloomfield	9
RTE	9
PortlandMaps	9
Tracking SDG7	8
Lowest Scoring:	
Opendata.swiss	5
Data Platform Utrecht	5
Opendata utah	4

Platforms that scored the least lacked information in each of the four mentioned categories above. These platforms primarily lack information on the source of data and user information. This is because data streams are often diverse and encompass a large source of collection methods through partnerships with other organizations or governments. They are also analyzed by mathematical models with a combination of human and automated outcomes. Multiple layers of security surrounding the source of data are also present, in order to remove any links to human factor information. User information plays an important role in understanding who the platform is designed for. The lack of this information can lead the visitors to the platform astray in finding relevant data (Lim et al., 2018).

4. Results to Inform Design Decisions

This section includes the results and analysis of our research, interviews, surveys, and design sprint. These results were used to inform our design choices in our final mock-ups and design suggestions. This section has been broken into two key insights, namely the identification of users, and the review of features considered in the creation of the design plan.

4.1 Identified Primary Users

The type of users identified as most important for designing this platform around were start-up companies. CEOs, CTOs, and start-up entrepreneur types running a company on their own were considered as the core users to consider from start-up companies.
Other types of users considered were:

1. Citizens
2. Companies (both nonprofit and startups)
3. Researchers
4. Municipalities
5. NGOs
6. Universities
7. Accelerators/Hubs
8. Tourists
9. Reporters/Politicians

While all of the above mentioned were potential users of the platform, they were not identified as important for the design process. A platform designed for start-ups is still usable for all other types of users.

4.1.1 Use Cases

The team created two hypothetical use cases for the platform based on stories told to us during the interview process. The first was a company trying to improve industrial chillers in the city of Eilat. The second was a company helping residents install solar panels on roofs. For each, what specific types of data would be useful to their company was considered. In the case of the industrial chiller company, this included data such as:

1. Building specifications
2. Current technical specifications
3. Weather data
4. Energy consumption
5. Heat/energy production
6. System distribution

For the solar roof company, datasets included:

1. Direction and size of roof
2. UV rating, temperature
3. Cloud coverage
4. Solar radiation
5. Energy consumption

The reason each data set would be useful to each company was identified to further understand the use cases. These reasons were also based off of the interviews we conducted. All reasons fell into one of two categories: gaining feedback on their product, or assessing their market potential. Reasons could include:

1. Saving money

2. Saving resources (Energy)
3. Saving time
4. Determining competition
5. Determining potential customers
6. Improving efficiency of their product

The analysis of why a dataset could be useful helped to highlight what data was relevant to energy companies. This helped to create the list of data types to implement in the platform. This also prompted the team to think about possibilities of comparison between data sets, which will be discussed later in this paper.

4.1.2 Persona Analysis

For the process of persona creation, the team used the main users identified previously within start-ups, specifically, a CEO, a CTO, and an independent entrepreneur. Three more personas were created outside of the main user scope: a researcher, a student, and a policy maker. All six personas were considered while designing the site, however the personas outside of the scope were not used as a focus for designing the platform.

The primary persona chosen was CEOs. A primary persona is the primary focus for the design process and is chosen based upon the highest number of design goals met (O'Connor, 2011). The primary persona is not an average user. To exemplify this, when designing an in-flight entertainment system, personas could range from teens to army troops to seniors. While the average user is an adult, the primary persona would be a senior. This is because they require the most accessibility and if their needs are met then the most design goals are met. In the case of this project, CEOs were selected as the primary persona due to their assumed lack of technical understanding when compared with both other types of users. Thus the CEO would stand to lose accessibility if the platform was created for the CTO or entrepreneur.

Table 4: User Personas

Persona	Traits	Needs
CEO	1. Entrepreneurial 2. Middle aged (40-50) 3. Big thinker 4. Competitive 5. Street smart 6. Networker 7. Knows their market 8. Wants results 9. Wants speed	User/customer information (in order to spread product distribution) Success Verification Market potential in a region Data relating to solar fields: meteorological data (UV, Radiation, weather, etc.), possible data on competitors
Entrepreneur	1. Young (25-30) 2. Might not have finished higher education 3. Technically gifted 4. Determined 5. Friends in similar	How is his product working in different scenarios (sectors of Eilat, population demographics, efficiency, points of improvement)? Where can he find more customers? Are there people he can collaborate with to get more people into his business? This

	field 6. Hyper focused, not paying attention to market 7. Guarded - Fearful of ideas being exposed 8. Passionate and charismatic	could include VCs, communities (Kibbutzim), Hubs, researchers What are some pilot opportunities? What's some new technology he can leverage? Where can he implement his product so that there is a very small initial cost?
CTO	1. Technically savvy 2. Younger /middle aged (30-40) 3. Focused on efficiency 4. Analytical 5. Early adopter 6. Thinking in parallel 7. Lots of initiative 8. Stubborn/persistent 9. Believes their approach will be right	Technical data sets with both raw data and perhaps interpolated or analyzed models Reports on customer use/interaction (user experience) Data regarding HVAC systems currently in place, customer trends in HVAC system use throughout the year, Energy consumption data, emissions productions due to this, meteorological data (especially temperature, weather), building specification information (insulation, construction material, year built) Reports about new technologies
Researcher	1. Middle aged (40-50) 2. Technical 3. Advocate for their research 4. Highly knowledgeable in their field 5. Motivated	Energy data from Eilat to look at potential for use in research Detailed information about the environment or conditions of implementation of technologies (all kinds of analytics) Assessing future trends in Eilat to see how viable the technology is Technical reports on advances in renewable technologies

4.2 Reviewed Platform Features to Implement

Our design of the database platform is centered around the features that will be included. These features can be separated into four general categories named for what those features accomplish:

1. Access to Data
2. Data Analysis
3. Community, and
4. Communication with Users

Features from category one are instrumental in allowing users to access the data. Category two features give users tools that can be used to conduct further analysis of data. Features in category three are intended to raise awareness about the community aspects of the platform that we feel are important to include. Finally, category four will focus on features that

facilitate communication and feedback between the Municipality and users. Each of these sections is important in the creation of a database platform that meets the needs of its users.

4.2.1 Organized Access to Data

Data access needs of users on centralized platforms differ depending on their specific use case. Data from one source can also be represented in a number of ways. Table 5 discusses users' data access needs and preferences.

Table 5: Data Access Preferences

Data Access Preference	Users
Raw Data	Researchers, Technical users in startup companies
Reports	Non-technical startup users
Browsing	All
Filtering	All
Searching	All

For researchers and technical corporate users, raw data holds the highest value on database platforms for specific analysis or queries. They prefer to handle large volumes of data and conduct self-analysis to extrapolate results. In an interview, the Academic Director of the Arava Institute stated that in order to determine the efficiency of solar panels, they prefer to self-analyze all related data, including weather patterns, shading on solar panels, production and inverted data. From the Municipality's standpoint, raw data is the easiest to deliver. Data is collected from meters and sensors, in varying frequencies, and cleaning this data to reveal information of value is a multi-step and often tedious process (Jeffery et al., 2006). This makes raw data valuable to deliver on the platform. CEOs, municipalities and other less technical users also use reports to make decisions for strategic planning, business expansion, and analysis of a region. As mentioned in section 3.1, reports provide credible sources of compiled information with implications and pre-performed analysis, allowing individuals make decisions with minimal analysis time.

For first-time users and those inclined to navigate the platform to address their specific needs, a browser performs an important function. In conversation with an experienced researcher at WPI, we found that browsers are effective in directing users to areas of the website that organization wishes to emphasize. This allows the Municipality to draw attention to specific datasets and aspects of the website.

Coupled with browsing, searching and simple filtering also constitute fundamental elements of platforms. The following include the most important classifications for filtering:

1. Topic of data (energy consumption, energy production, etc.)
2. Type of data publication (report, dataset, project, etc.)
3. File formats (csv, excel, pdf, etc.)
4. Year of publication

4.2.2 Personalized Data Analysis

The primary users we identified use data for two main purposes: Market analysis to expand the scope of their product or business and direct product feedback to analyze performance of their technology. As identified previously, the user interests for the platform have subtle differences in their needs. For example, CTOs may require high performance analysis tools while CEOs may prefer to understand information in the form of visualizations. This means the platform must be robust in accounting for various user preference which can be achieved by

1. Providing relevant suggestions for individual users
2. Customized browsing layouts
3. User specific access for individuals
4. User type specific access for varying groups of users

We believe that providing user specific access also allows the Municipality to collect and analyze user trends. This could reveal information about user groups in terms of the interest in different types of data, preferences in type of data (visuals, raw, tables etc) and areas of work in the city of Eilat.

In addition to personalized access, functionalities of the platform can also be customized to allow various user types to analyze or use data in preferred ways. In conversation with the Vice President of Business at CapitalNature, and a Researcher and Associate Professor at Ben Gurion University, we understood that mathematical models form the backbone of their analysis. These models thus present value to more technical user groups and can aid in drawing them to the platform. This could be achieved by including a tool set that allowed users to select multiple datasets, run predefined mathematical models to generate desired outcomes and view them in more than one format.

4.2.3 Community Creation/Opportunities

One of the goals of the Eilat Municipality is to harbor a community of innovation through the platform. This involves enabling startups and researchers to leverage open data and collaborate in a meaningful way. The city of Eilat has also been involved in a number of smart-city development projects that involve startups, start-up hubs/incubators and cooperation of the Municipality. EilatEilot, a renewable energy organization has been working on the Green Neighborhood Pilot Project as part of the Eilat Smart City initiative (Eilat smart city project.) EilatEilot also runs many initiatives in partnership with other companies and organizations, which other cities would benefit from knowing. These efforts, if showcased, could attract startups for further collaboration and piloting efforts that are intended to mutually benefit both the city and the organization.

In conversation with Eilat’s Smart City Coordinator Elad Topel we understood that value for the city is created when there exists means to share data. Elad Topel also revealed that organizations including startups and researchers have previously approached the Municipality in request of data (Topel, E. (2020, January). Personal Interview.) Therefore, functionalities that allow data to be requested by any individual to the Municipality or a third-party can enable this open contribution and centralize data requests. Further, the value of data increases by revealing the source of the information published as discussed in section 3.2.

4.2.4 Open Communication Between Municipality and Users

The last set of features which were reviewed were those related to communication between the platform’s owners and the platform’s users. These features do one of four things:

1. Address user concerns or problems
2. Allow the platform owners to understand what features are most important for users while expanding the platform
3. Reinforce the idea of the platform owners caring about their user base
4. Having users feel a sense of ownership with the platform to increase retention of use

Some features the team encountered and brainstormed which relate to this include having a municipality contact form, survey for site users to determine satisfaction with the site, ability to request features, ability to request datasets, having contact to owners of specific datasets, and users providing feedback on datasets.

By implementing some or all of these features, we hope to forge a strong link between the community of users and the Municipality. This functionality further enables individuals to contribute and request data in an open manner as stated in section 4.2.3.

5. Implementation of Design Decisions

The implementation of the decisions that we made during the design process can be categorized into three sections that will go into the construction of the first iteration of the platform.

1. Minimum Viable Product (MVP)
2. Data Guidelines
3. Final User Interface Wireframes

The MVP details the features that we feel are critical towards the completion of the platform's initial release. The data guidelines that we compiled will inform the Municipality on the ideal organization and formatting that can best support ease of use throughout the platform. The final User Interface wireframes outline the visualization and navigation of the platform pages, as well as specific features that we selected for the MVP. Combining these three sections, the Municipality will have the ability to guide software developers in implementing the Municipality's vision for this platform.

5.1 Minimum Viable Product

The functionalities and features that we identified as necessary and important in section 4.2 were organized by difficulty of implementation and importance for each iteration of the platform's release. Each feature to be included in the minimum viable product was selected by us according to it being necessary for the platform to meet its basic user needs. The first release, or minimum viable product, was identified as having five necessary features, which are explained in further detail in section 5.3:

1. Filtering of datasets
2. Basic searching and browsing
3. The ability to log-in through user accounts
4. A showcase page for current/future projects
5. The ability to submit feedback on the platform

While not mandatory to be included in the first release, seven additional important features were identified:

6. The ability to request missing data
7. A "call to action" page for needed datasets or initiatives to participate in
8. A survey page for opinions on future expansion
9. A "recommend to a friend" page
10. The ability to save/bookmark datasets
11. The collection of user analytics such as views and clicks
12. The ability to submit personal datasets

The log-in feature was identified as being necessary to an initial release with the assumption that the Municipality would not allow the first iteration to be publicly accessible, and thus user accounts were needed to control access. Additionally, pages which provide feedback, requests, surveys, and analytics will provide the Municipality the proper tools for ensuring user needs are met early on. The "recommend to a friend" and dataset submission features were included to help promote growth of the platform and instill a sense of ownership of the platform for the users that take advantage of these features. The "call to action" page and project showcase page were both added to help the Municipality achieve its goals of promoting a community of innovation within Eilat. These features have the ability to create a comprehensive product capable of meeting the goals of a data sharing platform and can be scaled for future expansion.

5.2 Data Guidelines

This section outlines our guidelines for how data should be organized within the platform. This covers what types of data to include and how to organize them, what formats are acceptable, and what metadata to include. Metadata refers to all accompanying information about a dataset, which will be outlined in more detail below. These recommendations were compiled from research on common data types with other platforms, research on what will help create the most value, data requirements mentioned in interviews, goals of our sponsor, and our expectations of what will positively impact the user experience.

5.2.1 Data Sets and Organization

The first aspect of data guidelines involves what data types will be included on the platform and how they will be organized. This was done by analyzing the core user group and assessing what startup companies would find most necessary to create a product, maintain a product, or assess market potential. For the first iteration of our platform, energy data will be the main focus, while being accompanied by supplemental descriptive datasets that can help clarify aspects of the energy data. An example of this would be having meteorological data accompanying renewable solar energy production data. The meteorological data could be used to explain if there is a noticeable drop in energy production due to, for example, a cloud or change in weather.

Interviews with individuals involved in energy-based startup companies and research revealed that these energy categories were the most important. These individuals also responded to a quantitative survey about data needs, which revealed that 71% of respondents find all consumption data useful and 86% of respondents find all production data useful. Further, 100% of respondents agreed that solar production data is useful and necessary for their work. Due to this, the data on the platform will be organized into four main categories, as outlined in Table 6 below.

Table 6: The four main data categories of the platform with examples of accompanying subcategories and specific examples of these.

Four Main Categories	Examples of Sub-Categories	Specific Examples Under Sub-Categories
1. Energy Production	Renewable Energy	Solar PV
2. Energy Consumption	Public Building Energy Usage	HVAC Systems
3. Dynamic Descriptive Data	Meteorological Patterns	Cloud Coverage
4. Constant Descriptive Data	Building Specifications	Insulation Material

Energy consumption includes energy data at all levels of consumption such as household consumer, industrial, transportation, and public buildings. Energy production includes highly focused renewables, specifically solar energy production both commercially and residential, as well as generation by fossil fuels, which are slowly being phased out. Dynamic descriptive data includes meteorological data such as solar radiation and UV, cloud coverage, weather patterns

and temperature, as well as other information that relies on changing factors such as maintenance of equipment, transmission efficiency, and efficiency of production. Constant descriptive data includes building specifications such as roof size and orientation, building size, and year of construction, as well as others that should remain the same such as consumer or user information, sectors based on geographical data (residential neighborhoods vs. tourist areas), and maximum energy storage.

5.2.2 Preferred Formatting

The following section outlines formatting guidelines for datasets on the platform, including necessary metadata and file expectations. Metadata will be highly important for the value of each dataset. To that extent, any and all metadata available should be included when possible. Metadata includes:

- Units of measure for each data set
- Time of collection for each datapoint or for the series
    - To be useful, the data must be collected at a minimum of a yearly frequency
    - Our sponsor's goal is to get data every 15 minutes for the city
- The source of the data collection
- Methods of data collection
- Method of data delivery
- Intended users of the dataset (if applicable)
    - An example of this is data from research, who funded the research/sees the results
- Time the dataset was published and updated
- Number of times the dataset was viewed or downloaded
- Any categories which the dataset falls under

When it comes to file expectations, it is best if every dataset is available in a standard format such as CSV or geoJSON, which can be used readily. Upon further expansion of the platform, additional file types could be accepted like PDFs, SHPs, photos (JPG or PNG), embedded files, or Excel documents. These may require formatting or parsing to take the data out, and are thus less useful for raw data, which is the primary focus of this platform's initial release. To clarify, these guidelines are for datasets; reports should remain in a PDF or word document. For datasets with timestamps, time should always occupy the first column of a CSV. Also, for CSVs, each column should include a title/descriptor on the first row, and units on the second row.

It is important to note that these guidelines are for the data published to the platform by the Municipality and also for any independent publications. Both types should follow these guidelines, and user submissions should be rejected by the Municipality if they do not, in order to maintain consistency across datasets.

5.3 Final User Interface Wireframes

The final deliverables in our design implementation are final iteration wireframe designs of the user interface, and a PowerPoint slideshow of these wireframes in order to show realistic navigation of the platform. In the platform, there are nine main pages to navigate:

1. 'Login Page' to login or request access
2. 'Request Access'
3. 'Create Account'
4. 'Home Page' to display featured reports, projects, and datasets

5. ‘Community Opportunities Page’ to display opportunities, project showcases, and data requested to be published on the platform
6. ‘Data Results Page’ to display all datasets, reports, and projects depending on the keyword search and filters selected
7. ‘Data Viewing Window’ to view a specific selected dataset, report, or project
8. ‘Personal Profile Page’ to give the user the ability to edit their profile, change settings, and access bookmarked data
9. ‘Contact Us Page’ to allow for open communication between the Municipality and users

The use, navigation, and specific features of these nine pages will be explained in each subsection below.

5.3.1 Login Page

The first page any user will see is the login page, which can be seen on Page 1 in Appendix A. This page displays the Municipality of Eilat Logo on the left, and a section to log into an existing account on the right. Coupling this, there is an option to retrieve a forgotten password, and if the user is not a member they are prompted to click, ‘Not a Member Yet?’, in order to create an account.

5.3.2 Request Access Page

In order to become a member, users must first request access to the platform from the Municipality. This platform page can be seen on Page 2 of Appendix A. The page prompts the user to fill out a few boxes of information including their name (first and last), email, phone number, employer, and location. They are also required to give their intended use of the platform from a drop-down menu that includes personal work, business, research, and other, which they are cued to explain if chosen. As added security, this page also requires the user to submit an image of a valid ID, for the Municipality to verify their identity. After filling out the reCAPTCHA, the user can submit the page for review.

5.3.3 Create Account Page

The Municipality will determine if access is granted or denied to a potential user. Once chosen, an email will be sent to that user informing them of the decision. If access is granted, a link will also be sent in this email bringing the user to a create account form, which can be found on Page 3 of Appendix A. This form has the user’s name and email prefilled and unable to be edited, as this was from the information given when the user requested access. They are prompted to enter a password for this site and click the ‘Create Account’ button to finalize their details.

5.3.4 Home Page

The home page will be the first page that users get to see once creating their account, which can be found on Page 4 of Appendix A. This page allows users to navigate anywhere on the platform, while also having a few unique features such as options to browse data and sliding featured reports. All the features of the Home Page can be seen in Table 7 below.

Table 7: Features of the Home Page and their accompanying descriptions.

Feature	Description
Navigation Bar	● The Municipality of Eilat Logo which links back to the home page when clicked ● Data button which links to the Data Results Page ● Community button which links to the Community Opportunities Page ● Contact Us button which links to the Contact Us: Feedback Page ● Hamburger menu which will have a dropdown of future pages such as ‘FAQs’ and ‘About Us’ ● Language accessibility dropdown to format the website in different languages ● Profile image which links to the Personal Profile Page
Sliding Information Showcase	● Highlights featured projects, facts, and/or statistics that the Municipality would like to showcase to all users on the platform
Search Bar	● Allows user to search from all datasets/reports/projects which will prompt the Data Results Page
Browse Data by Topic	● Allows users to browse all data relating to main topics on the site, these include Energy Consumption, Energy Production, Dynamic Descriptive Data, Constant Descriptive Data, and can feature supplemental important topics such as Renewables. Once a topic is clicked, that filter will be applied, and the Data Results Page will display all data files that correspond.
Featured Reports	● Shows sliding featured reports that the Municipality would like to display.

5.3.5 Community Opportunities Page

The Community Opportunities Page can be seen on Page 5 of Appendix A and is used to display different opportunities that are available or have arose from using this platform and/or fostering a community of innovation in the city. This page presents featured, past, or new projects at the top and, depending on which project is selected, expands upon it in the window below. It is also home to the ‘data on demand’ section, which has the ability to display data needed by different users on the platform, and asks those who have access to this data to publish it in order to help others and promote community.

Table 8: Features of the Community Opportunities Page and their accompanying descriptions.

Feature	Description
Navigation Bar	● See Table 7, above
Project Showcase	● Highlights featured projects that the Municipality would like to showcase, showing users how the open data from the platform is used
Data on Demand	● Displays a list of data that is currently being requested by users of the platform. When a data file is clicked, more information on the data pops up. In this window, the user also has the option to publish data, if they have what is being requested.

5.3.6 Data Results Page

The Data Results Page, that can be seen on Page 6 of Appendix A, is shown when the user selects the ‘data’ button in the navigation bar, searches for a keyword, or browses by topic from the Home Page. Here, the user can apply or remove filtering options to their search, view supplemental suggested data files, and navigate all displayed results based on their searches. If too many filters are applied and/or a keyword is too specific, the page may yield no results, thus displaying the Data Results Page Edge Case as shown on Page 7 of Appendix A. This page prompts the user to broaden their search or submit a data request form for the data required.

Table 9: Features of the Data Results Page and their accompanying descriptions.

Feature	Description
Navigation Bar	● See Table 7
Filter & Sort	● Filters include by type (report, dataset, or project), topic (energy consumption, energy production, dynamic descriptive data, and constant descriptive data), file format (csv, excel, pdf, etc.), and publication date. ● Sorting options include by relevance, alphabetically A-Z, alphabetically Z-A, most viewed, least viewed, and by publication date.
Selected Filters	● Filters chosen from the section above are included at the top of the page under the search bar next to checkboxes, to allow easy navigation of filters.
Result Number	● The number of results retrieved from the keyword search and applied filters displays here. Guides users to narrow or broaden their search.
Suggested	● Gives supplemental datasets, reports, and projects based on analytics of what others have viewed with the results generated
Search Bar	● Allows user to search from all datasets/reports/projects which will prompt the Data Results Page
Display Preference	● Allows users to display data horizontally with descriptions or horizontally and vertically with icons.
Retrieved Data Display	● Displays all data files that are retrieved based on the keyword search and filters applied.
Page Sort Navigation	● Shows the user how many datasets are being displayed out of how many there are and allows for navigation through pages
Request Data	● Brings user to the Contact Us: Data Request Page to fill out a data request form. More information in Section 5.3.9

5.3.7 Data Viewing Window

When a user clicks on a data file anywhere in the platform, such as on the Data Results Page, from featured or suggested data files, or on a learn more button under projects or reports, the Data Viewing Window corresponding with the data file clicked will open. This window can be viewed on Page 8 of Appendix A. The main aspect of the page is to display the data file's title, description, and all additional information given with this file.

Table 10: Features of the Data Viewing Window and their accompanying descriptions.

Feature	Description
Navigation Bar	● See Table 7
Analytics	● Displays page analytics such as number of views, number of bookmarks, and the percentage increase or decrease of views in the past week or month.
Suggested	● Gives supplemental datasets, reports, and projects based on analytics of what others have viewed with the results generated
Bookmark	● Allows user to bookmark the data file for use in the future
Back to Results	● Allows user to navigate back to the results page
Preview	● Allows user to preview the data file before downloading
Download	● Allows user to download the data file
Publications	● Displays supplemental publications that this data file was used in, or cites

5.3.8 Personal Profile

A very important aspect in platform personalization is the Personal Profile Page, which can be found on Page 9 of Appendix A. This page displays all user bookmarked data, data viewing history, profile editing, and account settings. When the ‘manage settings’ button is clicked, the Personal Profile: Manage Settings Page will launch, which can be seen on Page 10 of Appendix A. This is where the user may edit profile information, adjust accessibility features, and change account settings.

Table 11: Features of the Personal Profile and Manage Settings Pages, and their accompanying descriptions.

Feature	Description
Navigation Bar	● See Table 7
Bookmarked Data	● Slider which displays all data files that the user bookmarked
History	● Slider which displays the recent data file history of the user
Publish Data	● Brings user to the Contact Us: Publish Data Page to publish their data data. More information in Section 5.3.9
Request Data	● Brings user to the Contact Us: Data Request Page to fill out a data request form. More information in Section 5.3.9
Launch Comparison Tool	● For future expansion, this is where users will be able to compare bookmarked datasets
Share Site Link	● Copies platform link to share with a friend who can request access to become a member
Sort	● Sorting options include by relevance, alphabetically A-Z, alphabetically Z-A, most viewed, least viewed, and by publication date.
Display Preference	● Allows users to display data horizontally with descriptions or horizontally and vertically with icons.
Manage Settings	● Opens Personal Profile: Manage Settings Page
Edit Profile	● Allows user to edit profile items such as about and location, to change name, email, and employer, they must fill out a request that the Municipality will review
Change Password	● User can change password
Freeze Account	● User can temporarily freeze account, to notify when they will be inactive for more than a certain period of time
Delete Account	● Users can delete their account
Accessibility	● Language ● Font size ● Invert colors ● Greyscale ● Voiceover ● Zoom

5.3.9 Contact Us Page

The final main page of the platform is the Contact Us page, which can be found on Page 11 of Appendix A. This page is extremely important as it allows for open communication from users to the Municipality. This has the ability to give users a sense of ownership over the platform, thus keeping them active and engaged on the site. The Contact Us page has three forms that users can fill out. First is the ‘feedback form’ that can be used for general feedback, issues with the interface/platform, and complaints that the users have. The second form is the ‘data request form’, seen on Page 12 of Appendix A, that can be used to request new data, which the Municipality then can upload to the ‘data on demand’ section of the Community Opportunity Page, discussed in section 5.3.5. The final form on this page is the ‘publish data form’, found on Page 13 of Appendix A, which can be used to publish data that the user would like to share with others on the platform.

Table 12: Features of the Contact Us Page and their accompanying descriptions.

Feature	Description
Navigation Bar	● See Table 7
Contact Information	● Gives contact information such as the email and phone number of different sectors or ministries of the municipality
Feedback Form	● Allows users to fill out the reason for their feedback from a dropdown menu (general feedback, interface issue, complaint), and their feedback comments. The user’s name, email, and phone will be autofilled in this form from their profile.
Data Request Form	● Allows users to fill out a form to request new data. They must fill out the potential data title, data type from a dropdown menu (dataset, report, or project), and description of this data. Additional fields to include are why the user wants this data and supplemental information or comments on the data. The user’s name, email, and phone will be autofilled in this form from their profile.
Publish Data Form	● Allows users to publish their data. They must fill out the data title, data type from a dropdown menu (dataset, report, or project), detailed description of this data, data source, and collection frequency. The actual data file to be published must also be uploaded to this form. Additional information and comments on the data can also be included. The user’s name, email, and phone will be autofilled in this form.

6. Future Work/Next Steps

To aid the Municipality in preparation for the expansion of the platform, our recommendations for the next steps are discussed. These recommendations include our work on and analysis of the scalability of platform features, additional data to incorporate on the platform, and additional considerations that may be impactful on the future success of the platform.

6.1 Scaling of Platform Features

Here we have outlined our vision of the two next iterations of the platform and the features to be included, as well as an estimate of each feature's difficulty to implement. The estimate of the feature's difficulty to implement is based on "T-shirt sizing", which is a common practice in agile development, and meant to be a rough estimate (Kremic, n.d.). In this case, the team didn't have the technical background to affirm each feature as having a certain implementation cost but needed an estimate to effectively plan for the release sequencing. The features are organized by their difficulty of implementation where small is easy to implement and large is laborious.

The minimum viable product produced in the first iteration will not fully encapsulate the feature-rich platform the team envisions. Many of the features which improve user experience have been pushed to later versions. It is our hope that an initial release will be a good way to gather users and interest, as well as gain insights and feedback for future iterations. It will also be quicker to implement an initial version and get data out to those interested more quickly. The following two iterations add:

- Features to improve the usability of the site
- The ability to interpret the data
- Features which assist in community creation
- Improvement of core functionalities like browsing or searching

The split between the two releases was based off a combination of considering how important the features were to the value of the site, and how difficult they were to implement.

6.1.1 Second Release: Additional Important Features

The following, Table 13, indicates the features to be added in the second release, organized by implementation cost.

Table 13: Implementation Cost and Features of Second Release

Implementation Cost	Features
Small	● "Call to action" for collaborative projects / initiatives ● History tab for recently searched datasets and reports
Medium	● Analytics on how many times a dataset was viewed, downloaded, or mentioned in publications ● Recommended or suggested datasets and reports when viewing a result ● Recommending contacts on a dataset ● Upvoting in the Data on Demand files
Large	● Improved keyword search algorithm ● Verification from the municipality for a published data set ● Report options for datasets which are unverified by the municipality ● An interactive map with multiple data sets
Extra Large	● In site data viewer with basic graphing ● Ability to select multiple data sets for comparison ● Basic statistical analysis tools (trends, mean, etc.)

Each feature is described below, in Table 14.

Table 14: Features and Description of Second Release

Feature	Description
"Call to action" for collaborative projects / initiatives	Like the call for action of data sets, but for projects or initiatives which people or the municipality can post.
History tab for recently searched datasets and reports	Self-explanatory. To appear in the profile screen.
Analytics on how many times a dataset was viewed, downloaded, or mentioned in publications	Self-explanatory. To appear when reviewing a result.
Recommended or suggested datasets and reports when viewing a result	Self-explanatory.
Recommending contacts on a dataset	Self-explanatory. To appear when reviewing a result.
Upvoting in the Data on Demand	Ability to 'upvote' requested data being displayed in the

files	‘data on demand’ section of the Community Opportunity Page. Allows admins know which data is more requested than others.
Improved keyword search algorithm	Using more complex algorithms to search for datasets and reports, accounting for misspellings or similar words
Verification from the municipality for a published data set	A badge of approval for publicly submitted data to be granted by the municipality
Report options for datasets which are unverified by the municipality	Ability to positively commend data or negatively review it before it is certified, to be taken into account when it is reviewed
An interactive map with multiple data sets	A map which visualizes multiple types of data that can be interacted with (zooming in and out, moving position, selecting different types of data to view)
In site data viewer with basic graphing	This feature would be an initial version of the suite tool described in the third release. It would offer basic graphing (line and bar) of datasets in the browser for the user.
Ability to select multiple data sets for comparison	This feature expands the viewing tool to be able to view two or more different data sets simultaneously. Here, a common axis could be selected between each data set, and separate streams of data graphed together.
Basic statistical analysis tools (trends, mean, etc.)	This feature also expands the viewing tool by adding basic analysis options to it.

This release focuses heavily on community interaction, both with data and with one another. It expands upon the goal of creating a community of innovation for the city.

6.1.2 Third Release: Public Release & Quality of Life

The following, Table 15, indicates the features to be added in the third release, organized by implementation cost.

Table 15: Implementation Cost and Features of Third Release

Implementation Cost	Features
Small	● Ad page for people who need projects/data or projects who need people ● Pilot project inquiry page for start-ups interested in working in Eilat ● Quick view of search/filter results
Medium	● Dataset/report sharing (email, copy link, etc.) ● Customizable download of specific graphs or part of data, or file formats
Large	● Ability to upload personal datasets for use within the comparison tool ● Forums under datasets for commenting
Extra Large	● Personalized landing page ● Ability to publish surveys on the site ● Full studio analysis tool with multiple types of graphing, comparison, statistical analysis, etc.

Each feature of the third expansion release is described in Table 16 below.

Table 16: Features and Description of Third Release

Feature	Description
Ad page for people who need projects/data or projects who need people	This page should be a basic forum where posts can be made like a bulletin board, with interests and contact info postings.
Pilot project inquiry page for start-ups interested in working in Eilat	This would be a form for startups to send to the municipality to highlight their product and why they want to pilot in Eilat. This way the municipality can more easily bring in innovation.
Quick view of search/filter results	While scrolling through results, if a user's cursor goes over a result, a pop up would give more information (a longer description, tags associated with the dataset/report, etc.)
Dataset/report sharing (email, copy link, etc.)	Self-explanatory.
Customizable download of specific graphs or part of data, or file formats	This would allow users to download graphs they make in the data analysis tool along with the data they represent. It would also allow download of certain columns within a dataset. For example, in a dataset about a solar field containing time, output of energy, efficiency of panels etc. a user could download just time and production. This feature would also allow the user to specify file types for downloads.
Ability to upload personal datasets for use within the comparison tool	This feature would let users upload datasets only visible to their account for use with the data interpretation tool on the site.
Forums under datasets for commenting	Allowing comments under datasets so users can provide feedback, relay information, or voice concerns.
Personalized landing page	Allowing users to customize their landing page so they can decide what initially shows up after login.
Ability to publish surveys on the site	Letting users publish surveys for other users of the site, specifying them to a certain audience, and make the data publicly available.
Full studio analysis tool with multiple types of graphing, comparison, statistical analysis, etc.	This is the complete version of the analysis tool mentioned in the second release. It will include multiple types of data representation/visualization, statistical analysis tools, formatting options, customization, etc.

This release focuses on features which are more far-fetched. These features are valuable to users and/or the Municipality.

6.2 Incorporating Additional Data

When the Municipality sees fit to begin expanding the scope of the platform beyond energy related data, we recommend that their next focus should be on introducing water usage and wastewater related data to the platform. The topics of energy and water are intricately connected (Decade, Water for Life), overlapping in ways that make its inclusion the next logical step for the expansion of the platform. Especially in a resource-strapped region like the Arava, access to water usage data from Eilat can catalyze new innovations to be introduced to the city. This could benefit water and energy conservation efforts, reduce greenhouse gas emissions, and benefit public health (Sokolow et al). This aligns itself with the goals of the Municipality to foster a community of innovation within the city that can improve the lives of its residents. Following the incorporation of data related to water, some additional topics to consider for addition would be:

- Transportation
- Environment
- Agriculture

These categories appeared in a majority of platforms we researched, and the inclusion of these datasets on the platform can encourage a broader scope of innovation within the city.

6.3 Additional Considerations

Some additional considerations to discuss include information that was gained through our research, interview, and design sprint process that we believe to be important to consider in the creation, upkeep, and expansion of this platform.

One additional consideration is the verification of datasets mentioned in the above future releases. We believe this is a key feature for fostering the community aspect of the site. The intent of this feature is that the Municipality can take an active role in the curation of the platform’s datasets. While the intent of the publication process is that the Municipality approves each individual dataset, as the platform expands this will be difficult to do with the growing number of users. The hope of the verification tool is to act as a new differentiator, where the Municipality can approve of certain datasets and verify them as being well constructed, full of accurate data, and relevant to the goals of the platform. Thus, when users browse through the datasets of the platform, they can choose to only see the datasets which the Municipality deems accurate.

Another consideration is the security of data. It is important that all data uploaded has been properly anonymized and doesn’t put anyone’s personal information at risk. Beyond personal information, it is important the platform try to limit as best as possible any data which could be used maliciously. Furthermore, it is important to consider upon a public release if verification will be required for accounts, and if anyone can publish any amount of information on any topic. Our team has no technical background in security, and thus doesn’t want to make specific recommendations, but feels it is an important factor to consider.

One final consideration would be the addition of minor pages, such as ‘Frequently Asked Questions’ or an ‘About Us’ page. Although secondary, these are pages may give the user more context and peace of mind when using the platform. We included a hamburger menu in the top

navigation bar for this very reason, as supplemental platform pages may be added here, during the expansion of the platform.

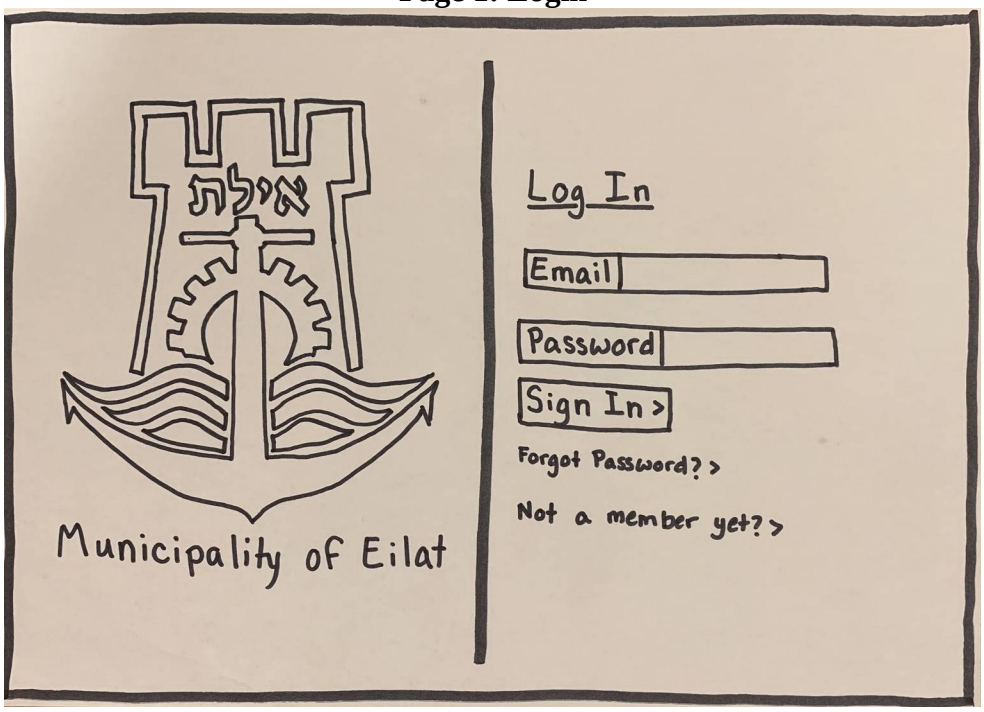
7. Conclusion

The project that we completed for the Eilat Municipality was the creation and implementation of the design for a database platform that would be used to centralize and present the smart city data being collected in the city. This platform would allow easier access to the data for startup companies, researchers, and municipality officials. The goal in designing this platform was to foster and promote a community of innovation within the city. The residents of Eilat would benefit from this through the creation of new technologies that could provide solutions to the challenges facing the city. These challenges include harnessing the energy of the Sun in the form of solar production and off-grid technology, battling the challenges of water scarcity and wastewater, and more. The platform that we have designed could prove to be the catalyst that brings the desired innovation and creativity to the Arava region.

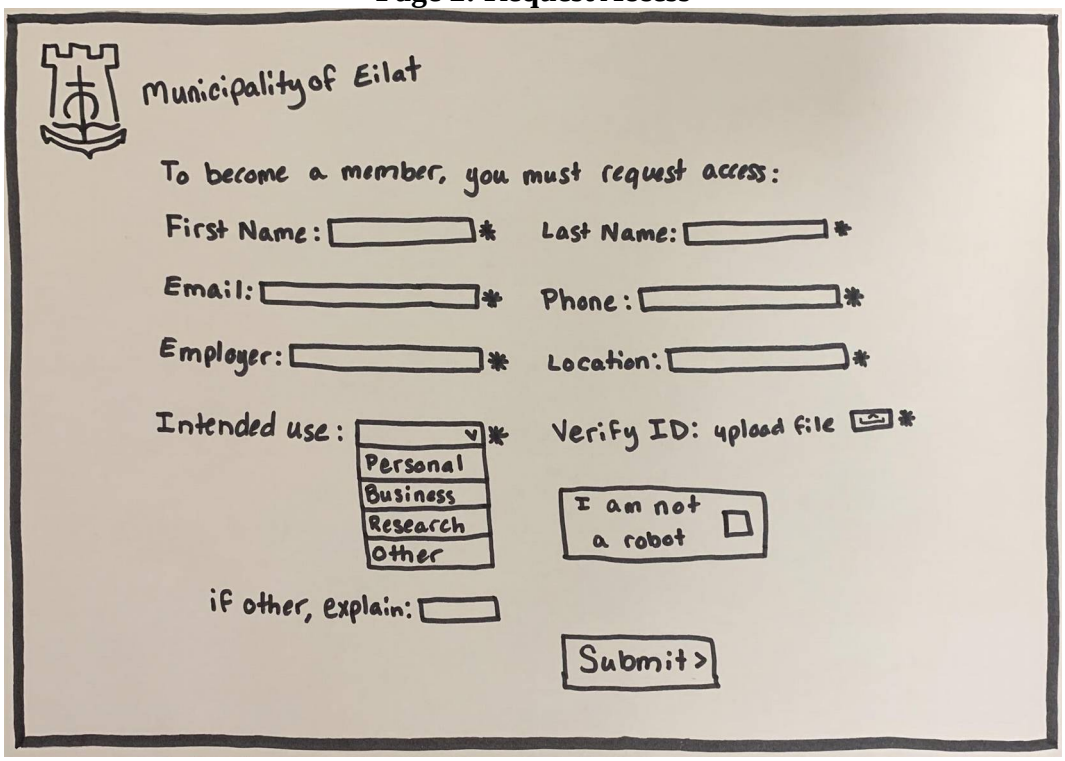
Appendix A: Final User Interface Wireframes

These are the final User Interface Wireframes that act as the example platform.

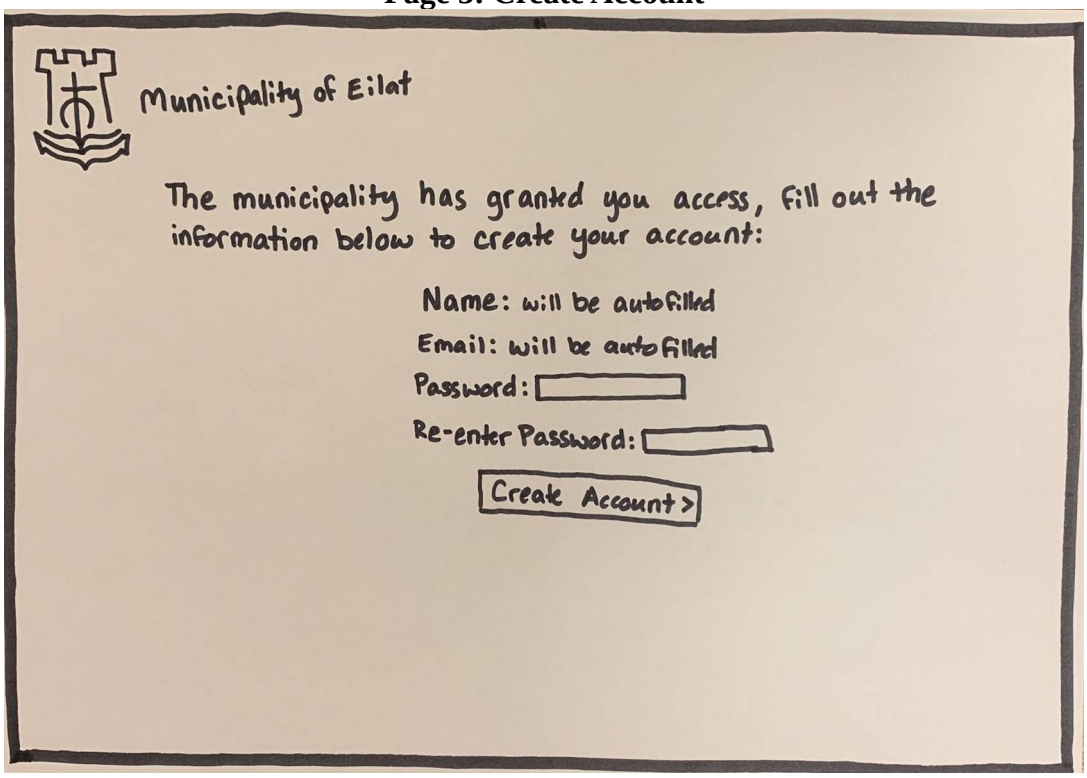
Page 1: Login



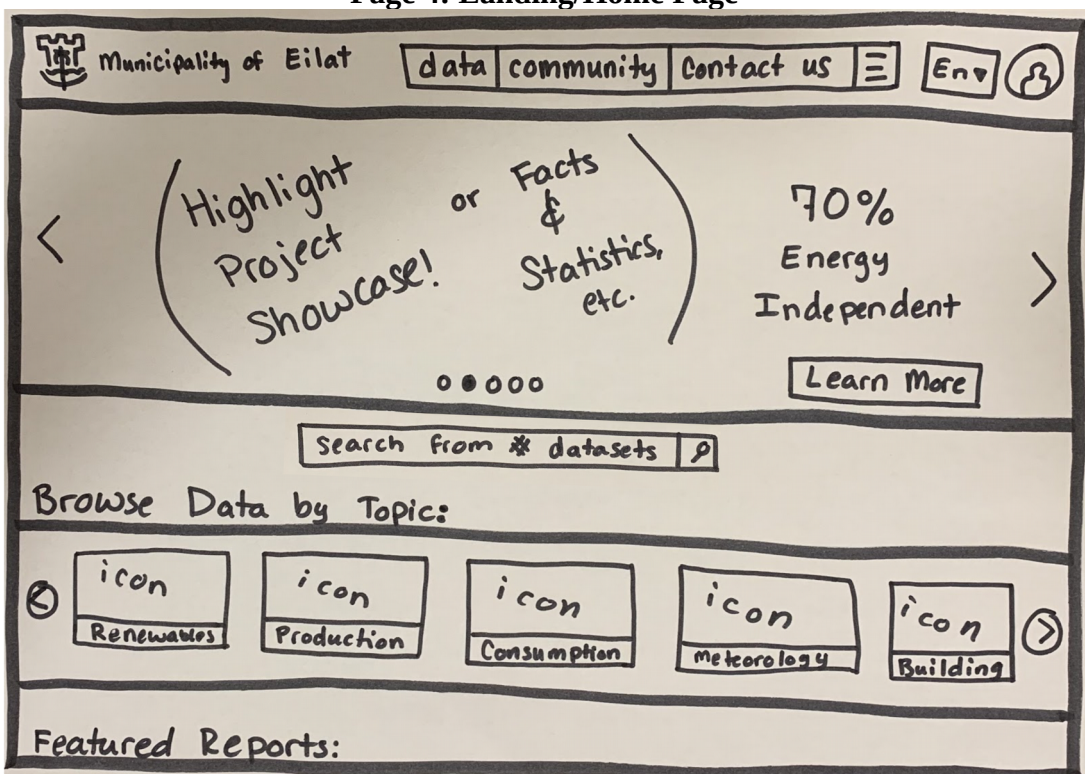
Page 2: Request Access



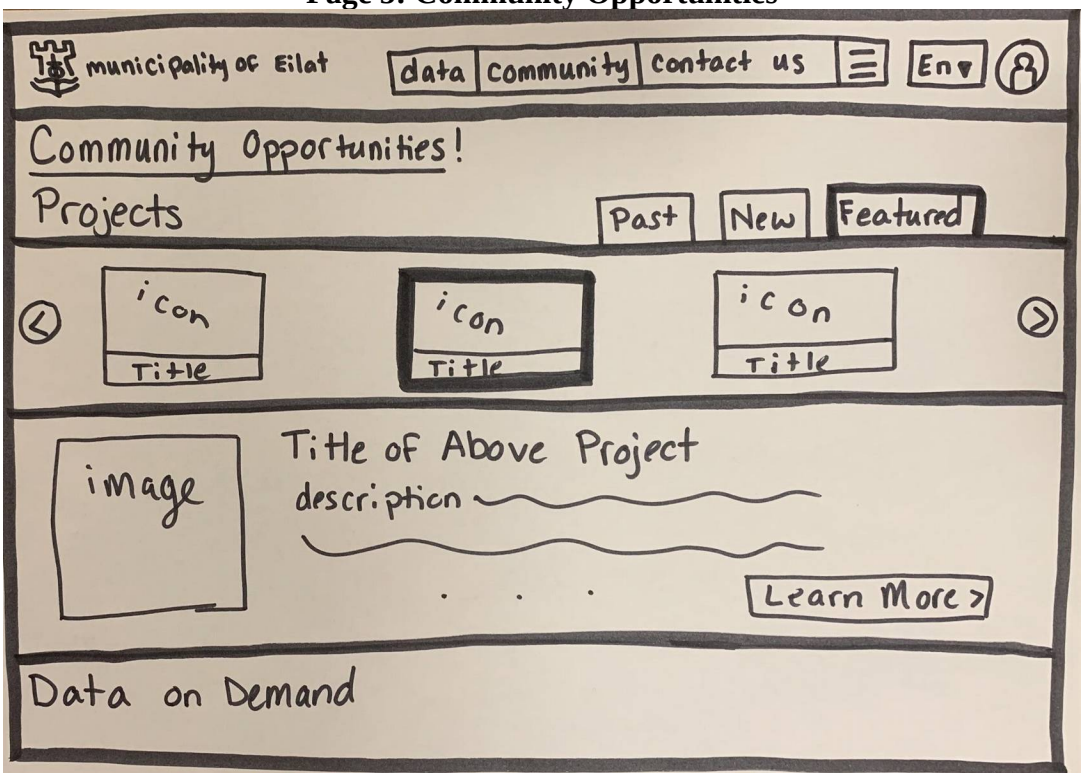
Page 3: Create Account



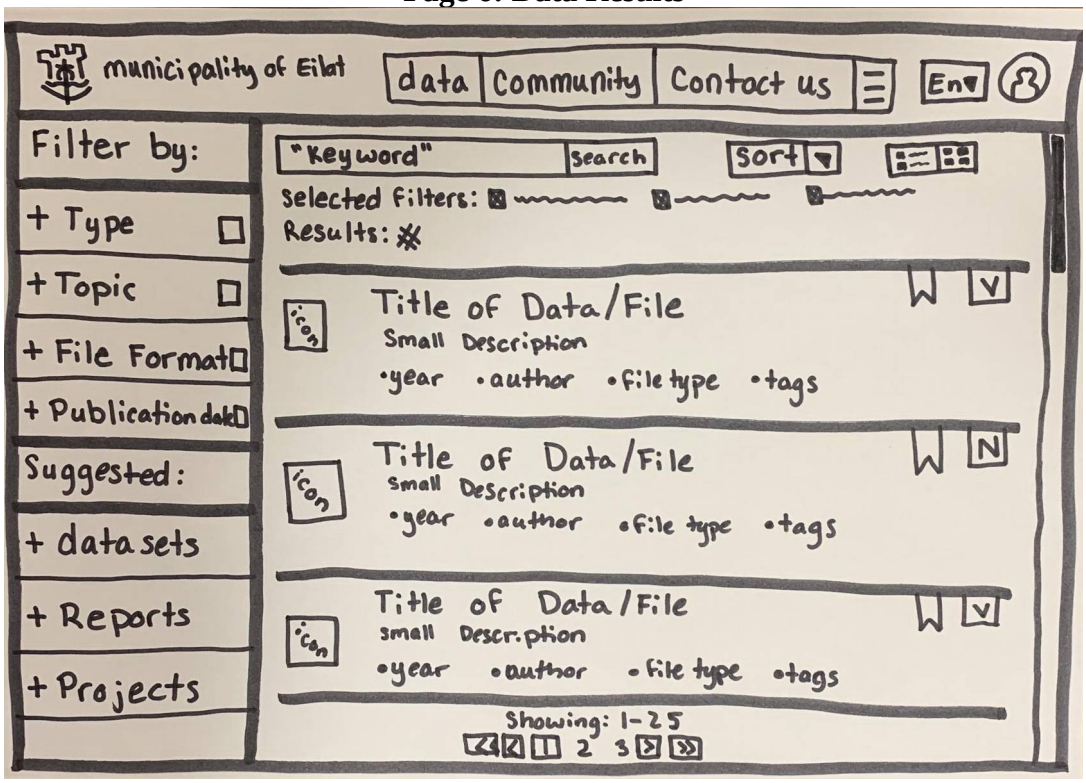
Page 4: Landing/Home Page



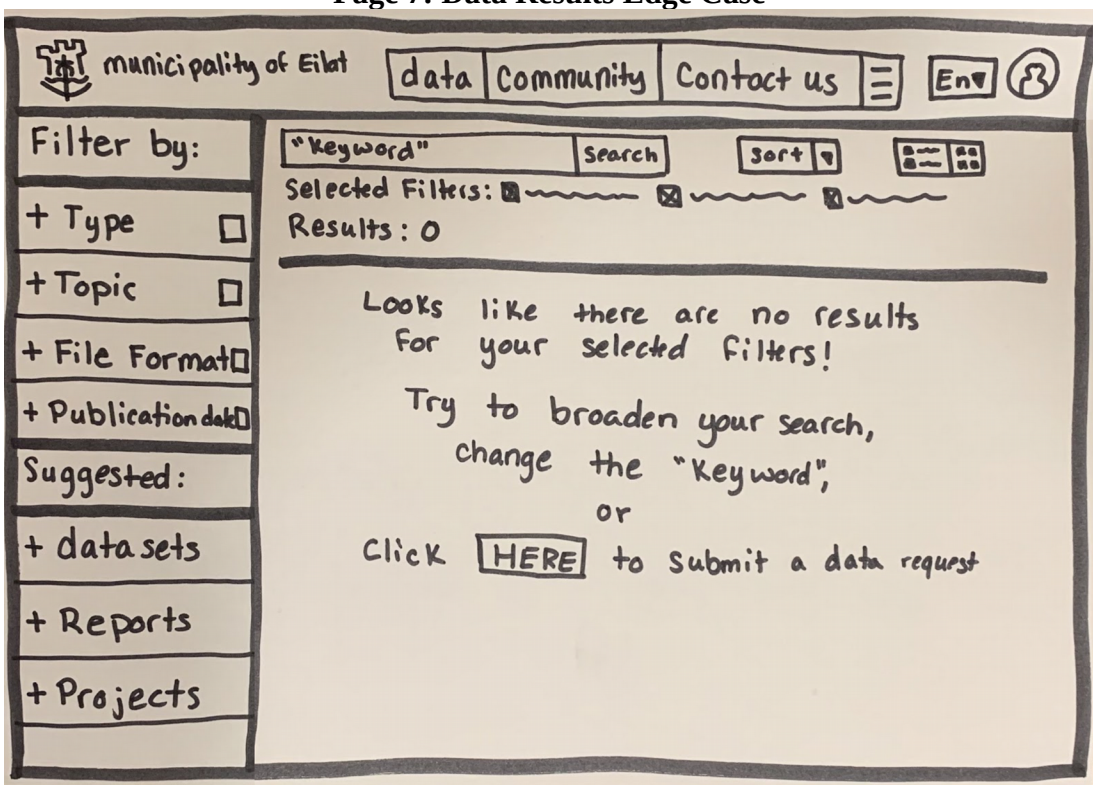
Page 5: Community Opportunities



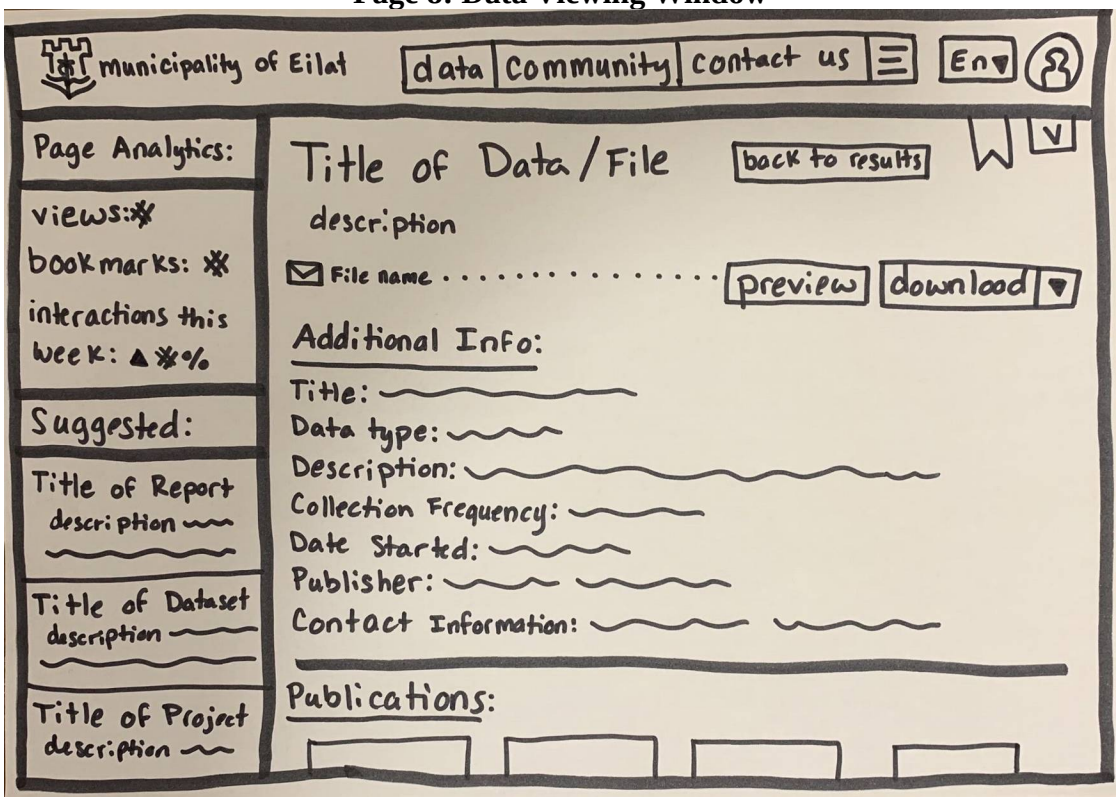
Page 6: Data Results



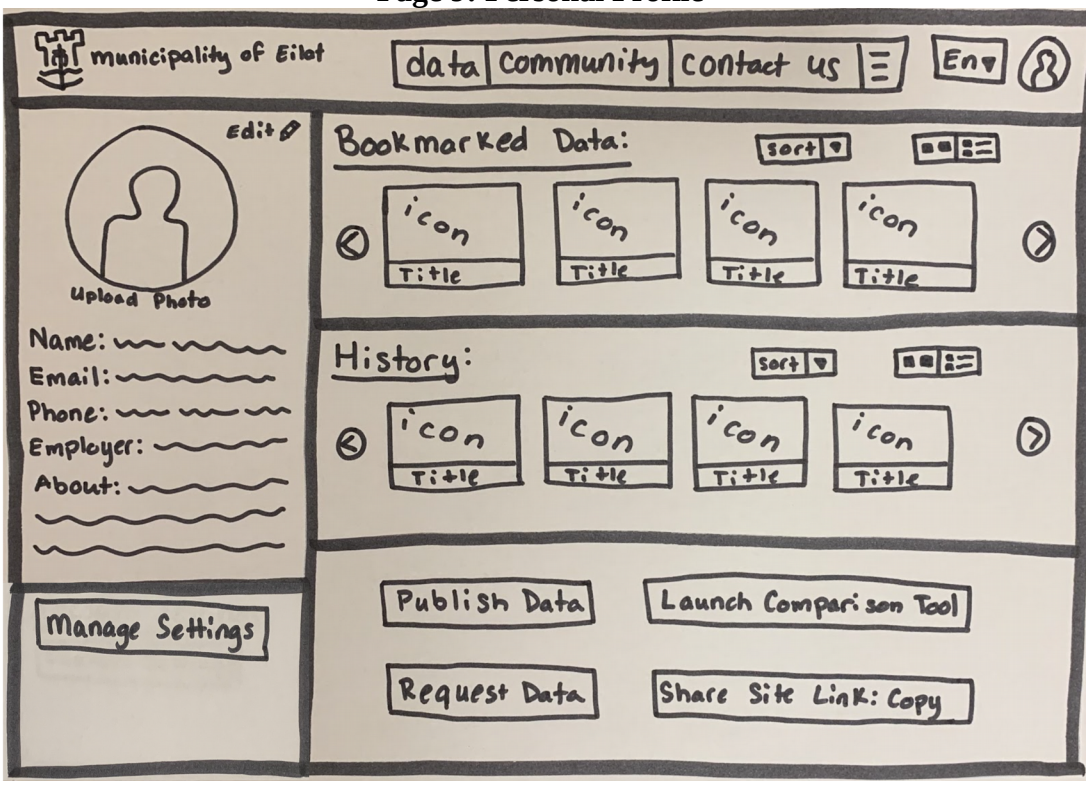
Page 7: Data Results Edge Case



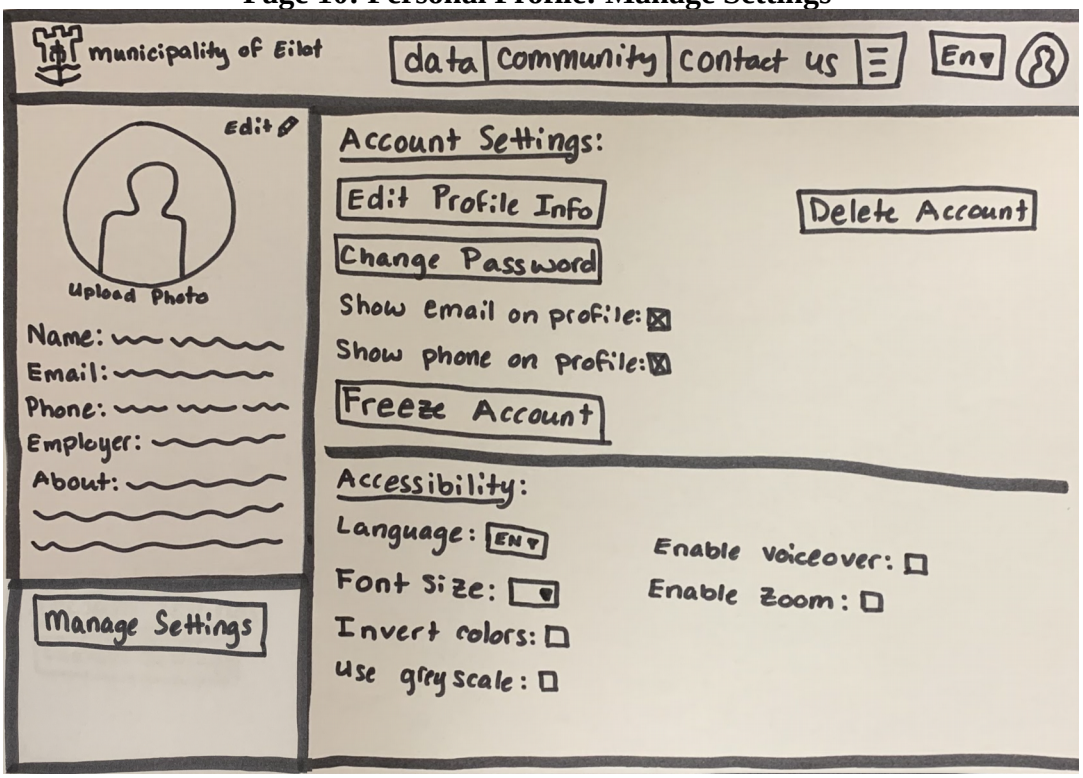
Page 8: Data Viewing Window



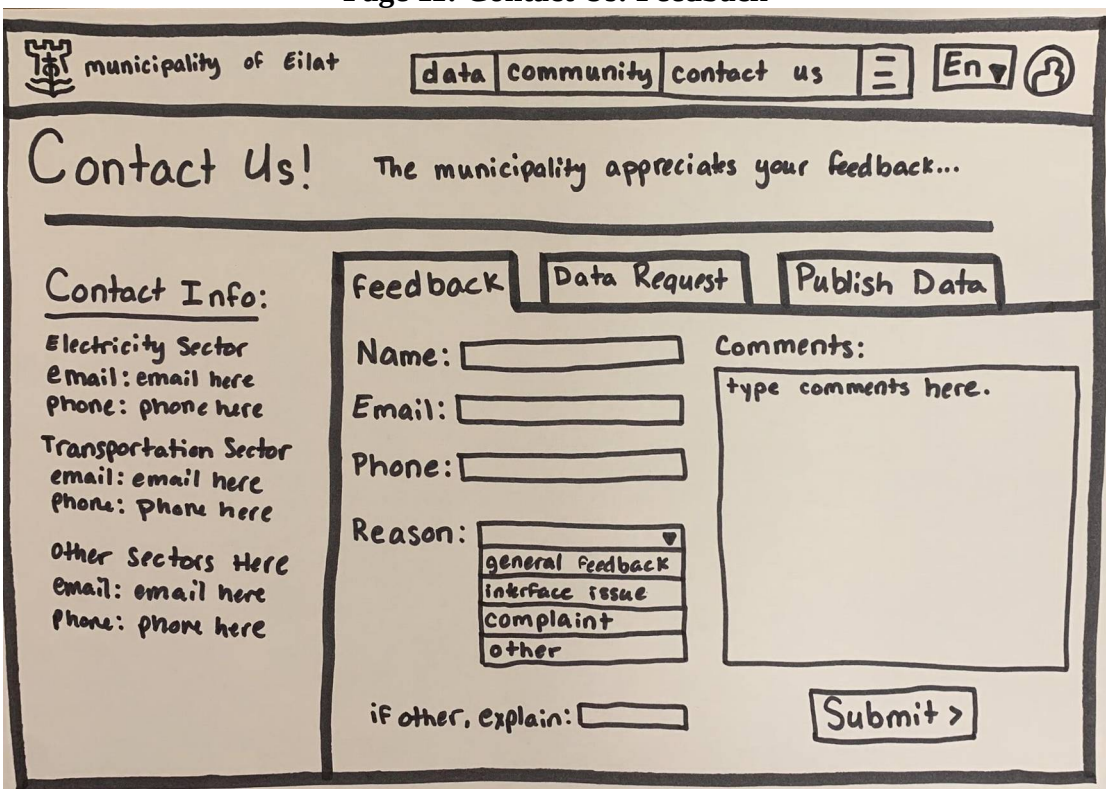
Page 9: Personal Profile



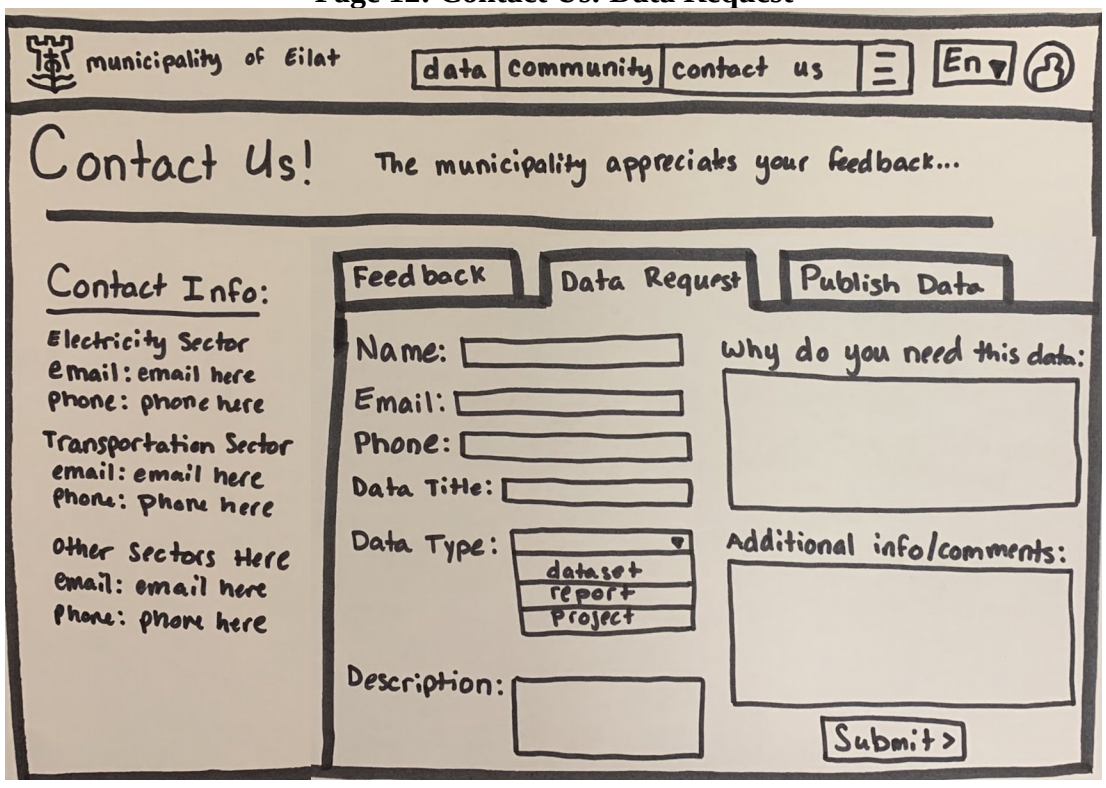
Page 10: Personal Profile: Manage Settings



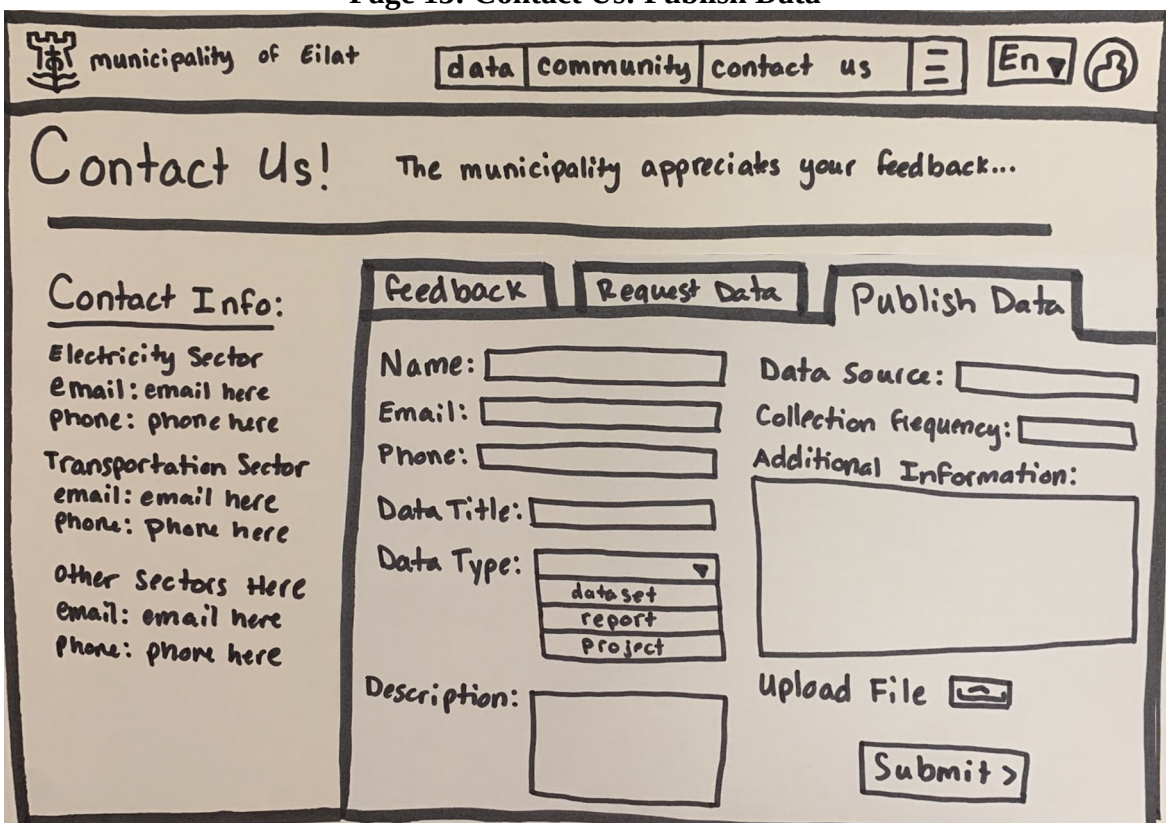
Page 11: Contact Us: Feedback



Page 12: Contact Us: Data Request



Page 13: Contact Us: Publish Data



Appendix B: Wireframe Navigation Tool

The following presentation slideshow visualizes the navigation of the platform by allowing the user to click on components of the webpages. Access the navigation tool here.

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