Report of Recommended Counting Systems

Existing Technology

Infrared Beams: Active

Active infrared beams are sold and work in pairs. There is one device that is the transmitter, and one that is the receiver (also called target reflector). Both parts must be set up vertically and directly across from each other in order to work properly. Active beams have a narrower zone/cone of detection than passive beams and work best when set up in narrow trail passages. The active infrared sensor works by sending a series of infrared pulses from the transmitter to the receiver, and when the beam is broken a count is registered. Typically, different models of active infrared beams will allow the owner to predetermine the time the beam is broken for or size of the object breaking the beam required to register a count. This prevents falling sticks, leaves, or larger animals from being falsely added to the count.

Infrared Beams: Passive

Passive infrared beams use only a transmitter and operate by identifying changes of heat in the detection area. Human body temperature (~37°C) is used to register a count since animals tend to have higher internal body temperatures and will not register as a count. Passive beams are mounted on one side of the trail and work best when the sensor is pointed toward a wall, building face, dense vegetation, or similar background.

Radar Sensor

Radar sensors use mmWave technology to identify and count pedestrians. The device is mounted at least 2-2.5 m above ground level and can detect people in a wide area. The radar sensor supports up to five counting lines and zones, so it can be used to track the number of people at multiple entrances at the same time as well as pedestrians' direction of travel and time spent in each zone. Additionally, the owner can set the sensor to record and classify pedestrians moving at different speeds to help distinguish between walkers, joggers, and bikers.

Technology	Applications	Strengths	Weaknesses
Infrared Beams: Active	Short term or permanent; counts hikers and bikers combined	Relatively portable; low profile, unobtrusive appearance	Cannot distinguish hikers and bikers unless combined with a bike counter; difficult to use for lanes; may have a higher error for groups
Infrared Beams: Passive	Short term or permanent; counts hikers and bikers combined	Very portable with easy setup; low profile, unobtrusive appearance	Cannot distinguish hikers and bikers unless combined with a bike counter; difficult to use for lanes; may have a higher error for groups or if the temperature reaches close to body temperature; direct sunlight may cause false counts
Radar Sensors	Short term; counts hikers and bikers separately	Very portable; most accurate; tracks duration of time spent in the zone; supports live data analysis	Less camouflaged appearance; must be connected to the internet and a power bank; less accurate with dense crowds of people

Companies and Products

Eco-Counter

Eco-Counter is based in Lannion, France and has subsidiaries in Montreal, Canada, and Köln, Germany. Eco-Counter specializes in pedestrian and cyclist counters for both urban and rural environments. The solutions they provide are infrared beams, pressure slabs, inductance loops, tubes, patented cameras, real time analysis, and data analysis platforms. With clients in more than 50 countries including France, Chile, Canada, Germany, Australia, the United States, Eco-Counter is focused on international expertise. Their core values are innovation, quality and reliability, sustainability, expertise, peopleology, and international.

- Website: https://www.eco-counter.com
- Contact Form: https://www.eco-counter.com/#
- Phone number: France/World +33 2 96 48 48 81
- Additionally, sample worldwide bike count display data is shown here: https://www.eco-public.com/ParcPublic/?id=4586
  - Note that there is a sensor in Bucharest!

PYRO Sensor

Eco-Counter's PYRO Sensor is a passive infrared counter that is designed for outdoor and natural environments. The PYRO Sensor has the ability to count pedestrians, cyclists, horseback riders, kayakers, and skiers, as well as the direction of travel. It is also able to detect two people walking in a slight stagger, making it most appropriate for trails. The PYRO Sensor

is designed to be installed inside a tree, stone wall, or footbridge and the logger is installed in housing that is buried underground. This makes the system well-hidden and decreases the risk of vandalism. This sensor does not require electricity or internet to operate but does use a cellular connection to transmit count data to the data analysis platform (Eco-Visio). The PYRO Sensor is currently used in the following national parks: Santiago Metropolitan Park (Chile), Yosemite National Park (USA), the National Park of Les Ecrins (France), the National Park of Bieszczady (Poland), the National Park of Alpi Marittime (Italy), the Bohemian Switzerland National Park.

Other characteristics include:
- IP68 waterproof material
- Functions in temperatures from -40°C to +40°C
- 1.8 x 4.0 x 9.0 cm
- Range up to 15 m
- Made of high-density polyethylene and polyvinyl chloride
- Battery life of 10 years
- For more information: https://www.eco-counter.com/produits/pyro-range/pyro-sensor/

PYRO Box Evo-Nature

The PYRO Box Evo-Nature uses passive infrared technology to count hikers, bikers, kayakers, and more as well as track direction. It is designed for a natural environment without electricity. The system relies on new cellular 4G IOT technology (Cat-M1/NB IoT) that is emerging worldwide and may not yet be available in some countries*. This system combines a physical counter with software to analyze trends in the data collected. It is a box that can be temporarily attached outside of a post (the post can also be temporary) or permanently placed inside the post.

*According to https://www.gsma.com/iot/deployment-map/ this technology is available in Romania

Other characteristics include:
- IP68 waterproof material

- Functions in temperatures from -25°C to +70°C
- Accuracy of -/+ 5%
- 12.6 x 12.6 x 5.35 cm
- Range up to 10 m
- Weighs 820 kg
- Two-year battery life
- Material is POM-C
- Box is green, but other colors are available upon request
- For more information: https://www.eco-counter.com/produits/pyro-evo-range-en/pyro-boxevo-nature-2/

Eco-Visio

     Eco-Visio, the data analysis platform provided by Eco-Counter, is included with every counter. Through Eco-Visio, the user can manage counting sites and data, analyze data, share data between multiple users, and export graphics for external information. This platform is a

website in HTML format that the user can log into with their username and password and is accessible with internet connection on a computer, smart phone, or tablet. The count data is automatically uploaded from the counter to the platform via daily GSM transmission, or the user has the option to upload the count data manually. The data is presented on a personal dashboard with interactive "widgets" (such as graphs, key figures, and maps) to help the user discover trends in count data. Some trends include but are not limited to daily average, seasonality, direction of travel, hourly and weekly usage, heatmaps, and weather data. The dashboard can be uploaded as a PDF, image, Excel spreadsheet, or direct link to be shared with others. No prior data analysis knowledge as needed as a training video is provided.

- For more information: https://www.eco-counter.com/en/produits/eco-visio-range/eco-visio-5/
- You can email sales@eco-counter.com to request a demo.

SensMax

SensMax is a European developer and manufacturer of high-quality counting and monitoring systems for businesses. SensMax was founded in 2010, and since then has continued to progress in technology and innovation. SensMax products can be bought from two distributors in Romania: 4Retail Romania and GO DIGITAL LTD.

- SensMax
  - Website: https://sensmax.eu
  - Email: ag@sensmax.eu
  - Phone Number: +371 2875744

- o   Contact Form (under free consultancy): https://sensmax.eu/where-to-buy/
- 4Retail Romania
  - o   Website: www.4retail.ro
  - o   Email: info@4retail.ro
  - o   Phone Number: 031 424 57 37
- GO DIGITAL LTD
  - o   Website: www.go-digital.ro
  - o   Email: contact@go-digital.ro
  - o   Phone Number: 0040 736 409 739

SensMax SE Unidirectional Sensor

The SensMax SE Unidirectional Sensor is an active infrared counting technology that can be used in outdoor, non-electricity areas. The SE Sensor is set up in narrow passages like bridges, nearby trees, or can be installed on wooden or metal posts if narrow passages are not available. The two sensor devices are set up across from each other and perform optimally when placed 1 to 5 meters apart but can be placed up to 9m apart. The sensor has one infrared beam at an angle of 6° that only counts pedestrians in one direction. The SensMax SE Sensor requires AA batteries that need to be changed every two years and has an internal memory of 250 days of count data. The count data is transferred manually to the SensMax SE/DE Data Collector, which is detailed later in the report.

Other characteristics include:
- IP68 waterproof material
- Case is made of black ABS plastic
- Uses double sided mounting tape or screws to install
- Counting accuracy is 95% for pedestrians 2 m away from the sensor, and decreases by 1% for every 1 m further
- For more information: https://sensmax.eu/devices/outdoor-people-counting-wireless-sensor-sensmax-se/

SensMax DE Bidirectional Sensor

The SensMax DE Bidirectional Sensor is the next step above the SE Sensor. The only differences are that the DE Sensor has three infrared beams that can keep track of direction, only has an internal memory of 150 days of hourly data, and the AA batteries need to be changed every year instead of two years.
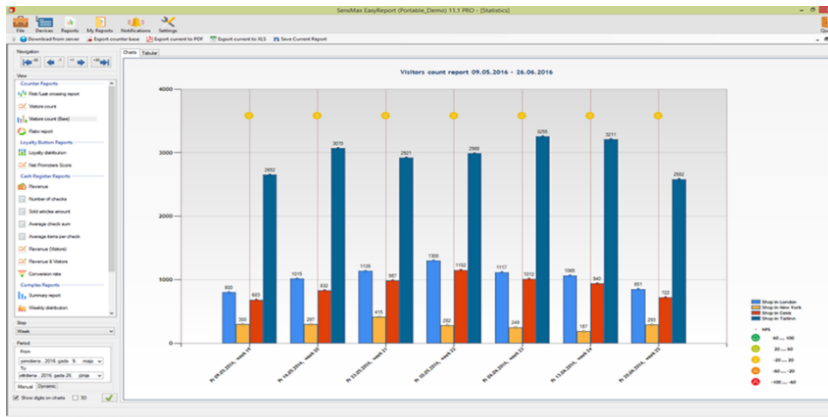
- For more information: https://sensmax.eu/devices/outdoor-wireless-people-counting-bidirectional-sensor-sensmax-de/

SE/DE Data Collector and EasyReport

To obtain count data from the SE/DE Sensors, the user can use the SensMax SE/DE Data Collector (price is 137 EUR) to manually transfer the data to a computer. The data collector reads the counting statistics from the SE or DE Sensor through infrared technology. The user can point the data collector at the counting device and press the "Read" button to obtain the counting data. The SE/DE Data Collector can store up to 2000 days of counting data and has a rechargeable battery. To view statistics of the data collected, the SE/DE Data Collector can be connected to a PC that has the SensMax EasyReport software installed. With EasyReport, the user can generate graphs and detect trends in the count data. Data analysis time intervals include every 5 minutes, hour, day, week, month, quarter, and year. EasyReport contains over 20 statistical, analytical, administrative, and financial reports.

- For more information on the SE/DE Data Collector: https://sensmax.eu/devices/data-collector-for-outdoor-people-counters-sensmax-sede/
- For more information or a demo request of EasyReport: https://sensmax.eu/software/people-counting-and-customer-survey-system-software/

SensMax TAC-B Real Time Bidirectional Sensor

The SensMax TAC-B is a radar sensor that uses mmWave radar technology to count and classify pedestrians in both indoor and outdoor conditions. Outdoors, the sensor works through kinds of weather including rain, fog, and snow. There is a setting to classify each pedestrian by speed, and through this it is possible to distinguish walkers, joggers, and bikers in the overall count. The SensMax TAC-B is able to detect and track the direction of travel as well as time spent in a specified zone (such as how long someone is sitting on a bench for). The sensor can record pedestrians in a 6m range at a 120° viewing angle in high resolution, and up to 14m at a lower resolution. This device is installed at least 2-2.5 meters above ground level on a sidewall or pillar and requires internet connection and a power supply. For temporary installation, a WiFi hot-spot from a mobile phone can be used and the sensor can be connected to the SensMax MiniUPS Powerbank which will last for about seven hours. The sensor operator can view the count data and graphics live (or later) through the SensMax cloud reporting portal. Since the radar requires an internet connection, the count data is transferred automatically. The operator can choose to schedule and receive automated reports through email or receive live real-time text updates via Telegram messenger. To share the counting information with a third party, the SensMax TAC-B supports MQTT protocol for direct data reading from the sensor or API data export from the SensMax cloud platform.

Other characteristics include:
- ABS plastic case or IP65 discreet outdoor case
- Has user-defined counting lines and zones

- Counting accuracy is up to 99% in areas with one person per m², and >93% for more crowded areas with three people per m²
- 8 x 8 x 3.5 cm
- Data transfer through WiFi 2.4 GHz/WPA2-PSK via WiFi Router or WiFi-GSM modem
- Power supply is AC 220V to DC 12V/0.5A
- For more information: https://sensmax.eu/solutions/outdoor-people-counting-in-parks/
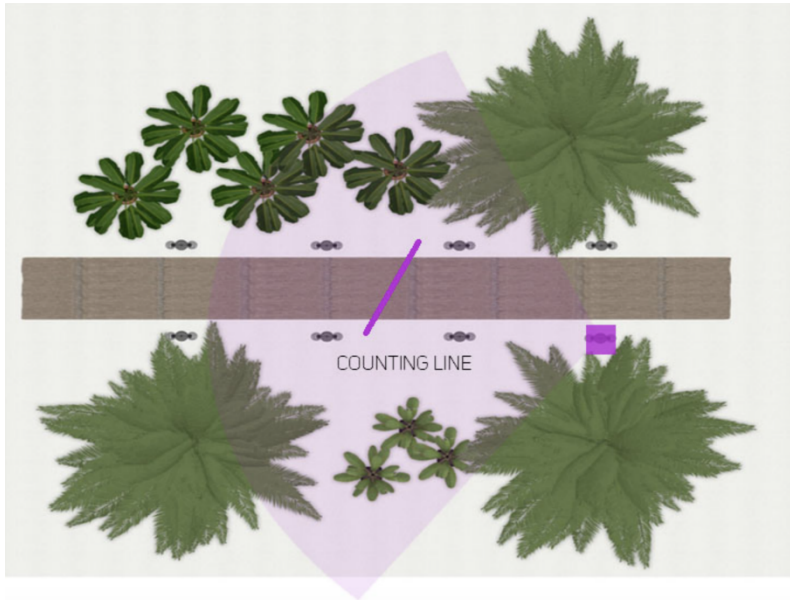
Summary of Products

Company and Product Name	Technology	Tracks Direction	Range	Accuracy	Report Cycles	Size	Power and Maintenance	Cost	URL
Eco-Counter; PYRO Sensor	Passive Infrared	Yes	Up to 15m	Not available	Every 15 min or 1 hour	1.8 x 4.0 x 9.0 cm	LS batteries; change every 10 years	Quote Request	https://www.eco-counter.com/produits/pyro-range/pyro-sensor/
Eco-Counter; PYRO Box Evo-Nature	Passive Infrared	Yes	Up to 10m	95%	Every 6 hours	2.6 x 12.6 x 5.35 cm	LS batteries; change every 2 years	Quote Request	https://www.eco-counter.com/produits/pyro-evo-range-en/pyro-boxevo-nature-2/
SensMax; SE Unidirectional Sensor	Active Infrared	No	Up to 9m	95% within 2m, >2m -1% per m	Hour, day, week, month, or year	6.7 x 6.7 x 2.5 cm	AA batteries; change every 2 years	241 EUR	https://sensmax.eu/devices/outdoor-people-counting-wireless-sensor-sensmax-se/
SensMax; DE Bidirectional Sensor	Active Infrared	Yes	Up to 9m	95% within 2m, >2m -1% per m	Hour, day, week, month, or year	6.7 x 6.7 x 2.5 cm	AA batteries; change every 1 year	255 EUR	https://sensmax.eu/devices/outdoor-wireless-people-counting-bidirectional-sensor-sensmax-de/
SensMax; TAC-B Real Time Bidirectional Sensor	Radar Sensor	Yes	Up to 14m	99% per person per m^2; 93% for crowded areas	Shares live and stores data as collected	8.0 x 8.0 x 3.5 cm	Internet and power source connection	590 EUR	https://sensmax.eu/solutions/outdoor-people-counting-in-parks/