PUBLIC TRANSPORT OPTIMIZATION USEING IOT

PROJECT PHASE - 03

BUILDING A SMART PUBLIC TRANSPORT SYSTEM USING IOT SENSORS WITH PYTHON SCRIPTS

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INTRODUCTION

The Internet of Things is a network of physical objects that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. IoT has the potential to revolutionize many industries, including public transportation.

Real-time tracking of vehicles and passengers:

GPS sensors can be used to track the location of buses, trains, and other public transportation vehicles in real time. This information can then be used to provide passengers with accurate arrival times and to help dispatchers reroute vehicles around traffic congestion or other disruptions.

Passenger counting and demand forecasting:

Sensors can be used to count the number of passengers on buses, trains, and at bus stops and train stations. This data can then be used to forecast demand for public transportation services and to optimize vehicle scheduling and routing.

Traffic monitoring and management:

IoT sensors can be used to monitor traffic conditions and to identify congestion hotspots. This information can then be used to adjust traffic signals and to reroute vehicles around congestion. This can help to improve the flow of traffic and to reduce travel times for public transportation users.

Predictive maintenance and safety:

IoT sensors can be used to monitor the condition of public transportation vehicles and infrastructure. This data can then be used to predict when maintenance is needed and to identify potential safety hazards. This can help to reduce the risk of breakdowns and accidents, and to improve the overall safety and reliability of public transportation systems.

SENSORS USED IN PUBLIC TRANSPORT

A wide variety of sensors can be used in public transportation to improve efficiency, safety, and passenger experience.

GPS sensors:

GPS sensors are used to track the location of vehicles in real time. This information can be used to provide passengers with accurate arrival times and to help dispatchers reroute vehicles around traffic congestion or other disruptions.

Passenger counting sensors:

Passenger counting sensors are used to track the number of passengers on vehicles and at stations. This data can be used to forecast demand for services and to optimize vehicle scheduling and routing.

Environmental sensors:

Environmental sensors are used to monitor temperature, humidity, air quality, and other environmental conditions on vehicles and at stations. This data can be used to improve passenger comfort and safety.

Door sensors:

Door sensors are used to detect whether doors are open or closed. This information can be used to prevent accidents and to ensure that vehicles are secure.

Safety sensors:

Safety sensors are used to detect objects and people in the path of vehicles. This information can be used to prevent collisions and to protect passengers and pedestrians.

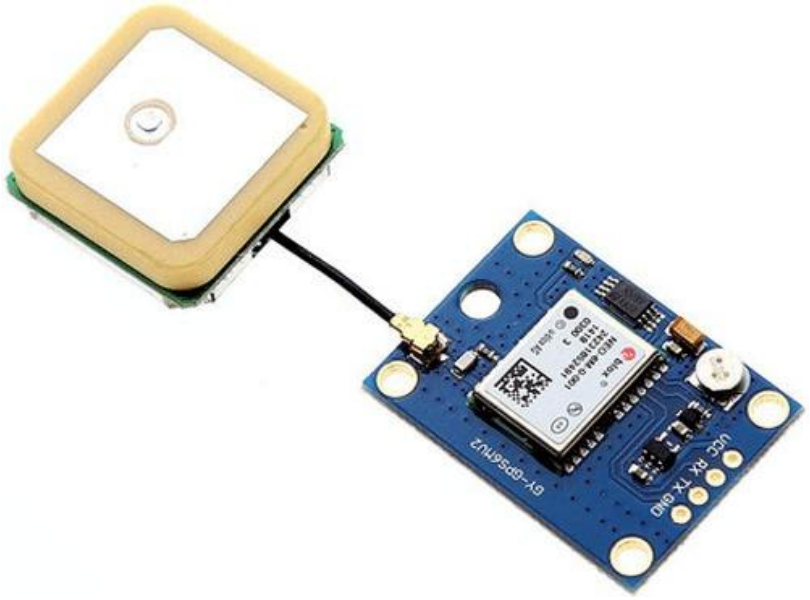
GPS SENSOR

GPS sensors play a vital role in public transport optimization. They can be used to track the location of vehicles in real time, which can be used to:

- Provide passengers with accurate arrival times and route information.
- Help dispatchers reroute vehicles around traffic congestion or other disruptions
- Optimize vehicle scheduling and routing to improve efficiency and reduce costs.
- Improve passenger safety by identifying and responding to potential hazards.

GPS sensors are also being used to develop new and innovative ways to improve public transport. For example, some cities are using GPS sensors to develop real-time bus tracking apps that allow passengers to track the location of their bus and see its estimated arrival time. Other cities are using GPS sensors to develop systems that can predict demand for public transportation services and adjust bus and train schedules accordingly.

As GPS technology continues to develop, we can expect to see even more innovative and effective ways to use GPS sensors to optimize public transport.



GPS SENSOR

Algorithms used in GPS

GPS sensors in IoT use a variety of algorithms to determine a device's location. These algorithms typically work by using the signals from multiple GPS satellites to calculate the device's position in three-dimensional space (latitude, longitude, and altitude).

Trilateration algorithm:

Trilateration works by using the distances between the device and at least three GPS satellites to calculate its location. To do this, the device measures the time it takes to receive a signal from each satellite. This information is then used to calculate the distance between the device and each satellite. Once the distances are known, the device can use trilateration to calculate its location.

Multipathing algorithm:

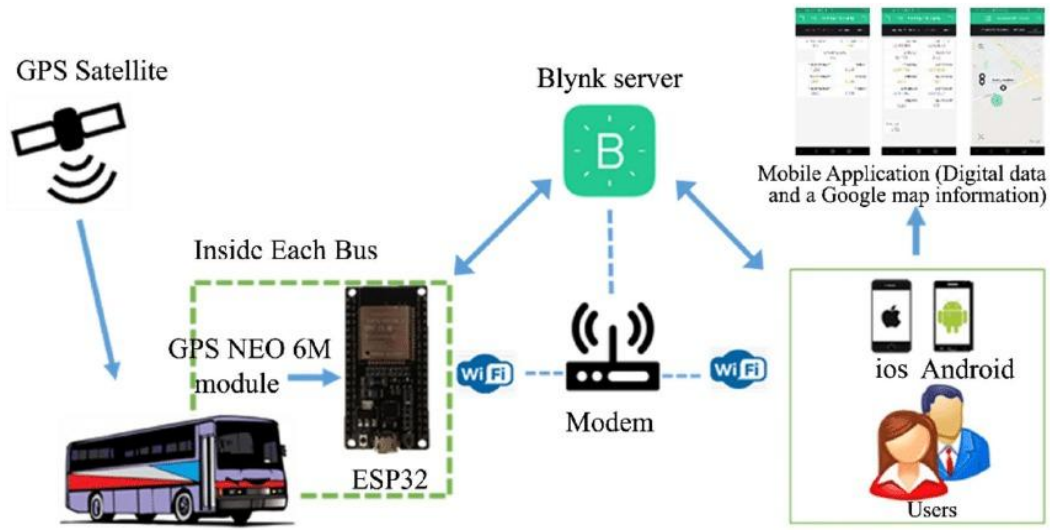
Multipathing occurs when a GPS signal is reflected off of objects in the environment, such as buildings or trees. This can cause the device to receive multiple signals from the same satellite, which can make it difficult to accurately calculate the device's location. The multipathing algorithm helps to address this problem by identifying and filtering out reflected signals.

In addition to trilateration and multipathing, GPS sensors also use a variety of other algorithms to improve the accuracy and reliability of their location estimates.

The specific algorithms that are used in a GPS sensor will vary depending on the type of sensor and its intended application. However, all GPS sensors use some form of algorithm to calculate the device's location based on the signals from multiple GPS satellites.

Python script to find arrival time of public vehicles

```
import time
import requests

def get_bus_location(bus_id):
    url =
"https://api.example.org/get_bus_location?bus_id={}".format(bus_id)
    response = requests.get(url)
    return response.json()

def calculate_arrival_time(bus_location, destination):
    def main():
        bus_location = get_bus_location(bus_id=1234)
        arrival_time = calculate_arrival_time(bus_location=bus_location,
destination="Aravil")

        print("The bus will arrive at Aravil at {}.".format(arrival_time))

    if __name__ == "__main__":
        main()
```

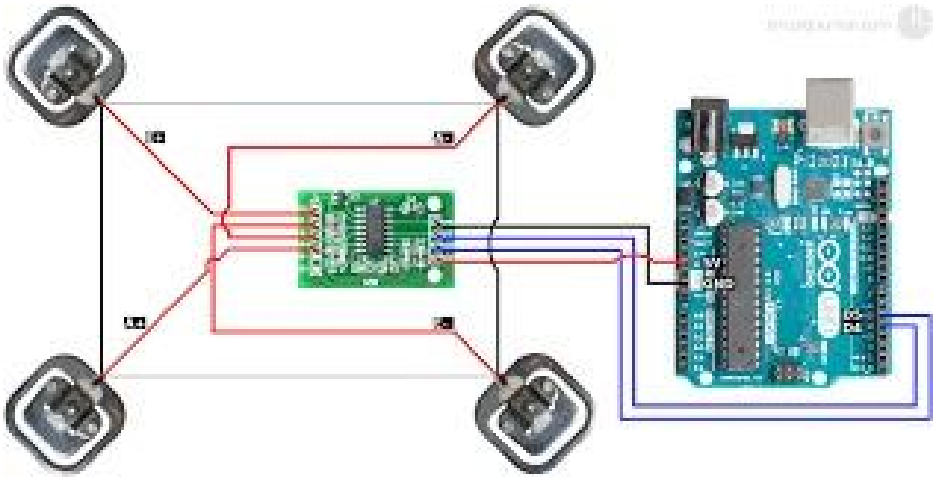


PASSENGER COUNTING SENSORS

Sensors can be used to count the number of people in public transport in IoT in a variety of ways. Some of the most common methods include:

Weight sensors:

Weight sensors can be placed on the floor of public transport vehicles to measure the total weight of the passengers on board. This information can then be used to estimate the number of passengers on the vehicle, based on the average weight of a person.

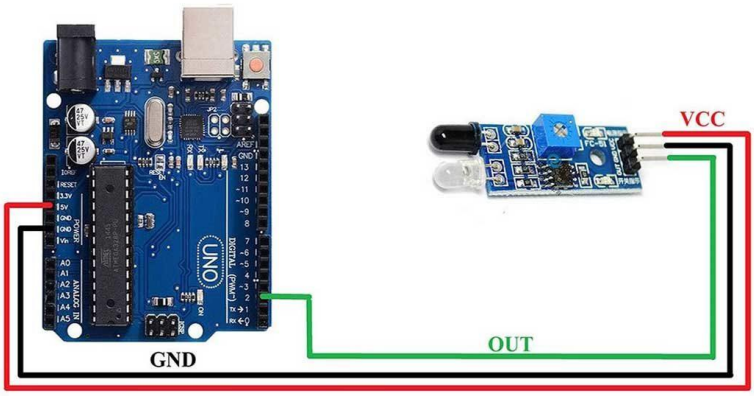


Passenger counting gates:

Passenger counting gates can be installed at the entrance and exit of public transport vehicles to count the number of passengers entering and exiting the vehicle. This information can then be used to estimate the total number of passengers on the vehicle.

Infrared sensors:

Infrared sensors can be used to detect the presence of people in a given area. By placing infrared sensors at the entrance and exit of public transport vehicles, it is possible to count the number of passengers entering and exiting the vehicle.



Video cameras:

Video cameras can be used to count the number of people in a given area by using image processing techniques to identify and track individuals. Video cameras are often used in conjunction with other sensors, such as infrared sensors or weight sensors, to improve the accuracy of the count.

The specific method used to count the number of people in public transport using IoT will depend on a variety of factors, such as the type of public transport vehicle, the budget available, and the desired accuracy of the count.

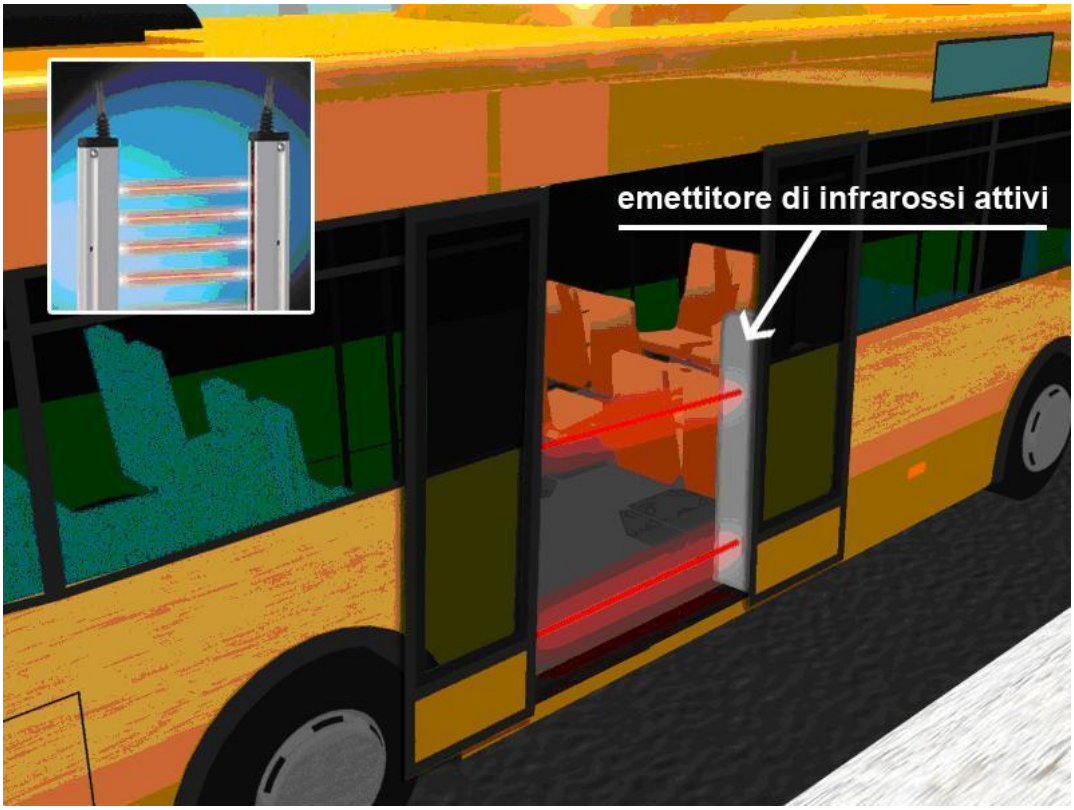
Python script to counting passengers in public vehicles

Script 1 (weight sensor**)**

```
import time
import requests

def get_weight_reading(sensor_id):
    url =
"https://api.example.org/get_weight_reading?sensor_id={}".format(sen
sor_id)
  response = requests.get(url)
  return response.json()

def count_passengers(weight_reading, average_weight_per_person):
    return weight_reading / average_weight_per_person

def main():
    weight_reading = get_weight_reading(sensor_id=1234)
    average_weight_per_person = 70
    number_of_passengers =
count_passengers(weight_reading=weight_reading,
average_weight_per_person=average_weight_per_person)

print("The number of passengers is:", number_of_passengers)

if __name__ == "__main__":
  main()
```

Script 2 (infrared sensor**)**

```
import time
import requests

def get_infrared_sensor_reading(sensor_id):
    url =
"https://api.example.org/get_infrared_sensor_reading?sensor_id={}".fo
rmat(sensor_id)
  response = requests.get(url)
  return response.json()

def count_people(infrared_sensor_reading, threshold):
    if infrared_sensor_reading > threshold:
    return 1
  else:
    return 0

def main():
    infrared_sensor_reading =
get_infrared_sensor_reading(sensor_id=1234)

    threshold = 100
    number_of_people =
count_people(infrared_sensor_reading=infrared_sensor_reading,
threshold=threshold)

    print("The number of people is:", number_of_people)

if __name__ == "__main__":
  main()
```



INFRARED SENSORS IN BUSES

DOOR SENSOR

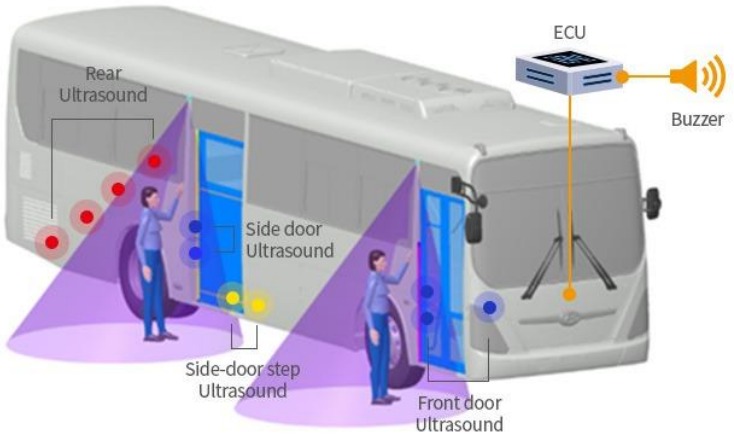
Door sensors in public transport are used to detect the opening and closing of vehicle doors. This information can be used to improve safety, security, and passenger comfort.

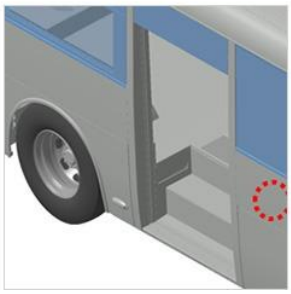
Safety: Door sensors can be used to prevent doors from closing on passengers. This is especially important for buses and trains, which can have a large number of passengers boarding and exiting at once.

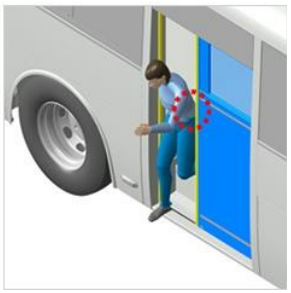
Security: Door sensors can be used to detect unauthorized entry and exit to vehicles. This can help to prevent theft and vandalism.

Passenger comfort: Door sensors can be used to automatically open and close doors at bus stops and train stations. This can make it easier for passengers to board and exit vehicles, especially those with disabilities or mobility issues.

Door sensors are typically installed on the doors of buses, trains, and other public transport vehicles. They can be either passive or active. Passive door sensors detect the presence of an object by measuring changes in the environment, such as temperature or magnetic field. Active door sensors emit a signal and detect the presence of an object by measuring the reflection of the signal.







Python script for door sensor

```
import time
import requests

def get_door_sensor_reading(sensor_id):
   Url=
"https://api.example.org/get_door_sensor_reading?sensor_id={}".form
at(sensor_id)
  response = requests.get(url)
  return response.json()

def take_action(door_sensor_reading):
    if door_sensor_reading == "open":
        pass
  else:
        pass

def main():
    door_sensor_reading = get_door_sensor_reading(sensor_id=1234)
    take_action(door_sensor_reading=door_sensor_reading)

if __name__ == "__main__":
  main()
```