

# An Internet of Thing Based GPS Bus Tracking with Automated Passenger Counting System

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**ABSTRACT:** This paper presents the design of an Internet of Things (IoT) based Global Positioning System (GPS) bus tracking with automated passenger counting system to help campus' students to know current location, the next stop and bus crowd level, respectively. In this project, two infrared (IR) sensors, Neo-6M GPS module and ESP8266 Wireless Fidelity (Wi-Fi) module are used. The location of the bus is tracked using a GPS in a real time. Moreover, IR sensors act to count number of bus passengers. All data are sent through Blynk application for monitoring purpose and the students can estimate bus time arrival and number of its passengers.

**Keywords:** *Internet of things; Bus tracking; GPS*

## 1. INTRODUCTION

The Many students are frequently late for class due to an unpredictable bus schedule and unable to enter bus when it gets too crowded although they reach bus station on time. Besides, it would be a waste of time waiting for a fully loaded bus as if passenger knew that bus will arrive in an hour is fully loaded, they can decide to either use their personal transportation or calling for grab service as an alternative [1]. Most importantly, with loaded bus, the maximum weight limits are compromised, and bus passengers are put at risk.

According to [2], the lack of real-time information on public transportation can be improved by indicating available seats, current location, and arrival time of the bus using IoT. Therefore, [3] and [4] proposed an IoT-based system that capable of indicating the bus current location, next stop, and crowd level. Different from [4], the project in [4] does not indicate the location of bus but only shows bus crowd level by counting the number of seats be taken. The purpose of the project is to obtain accurate bus fares without manual helpers. Hence, no receipt or ticket is needed to ride a bus. Other than using IoT to display the information, the paper in [5] presents a realistic model based on the Global Positioning System (GPS) and Global System for Mobile Communication

(GSM) for the routing and tracking of mobile vehicles in a broad outdoor environment [6]. The GPS supporting unit constantly travels with the vehicle and measures the coordinates of each location and can be communicated with the aid of GSM modem.

## 2. DESIGN AND IMPLEMENTATION

This project implements GPS tracking system that allows passenger to keep track exact location of the bus. Therefore, user can constantly check on crowd level to avoid overloading of bus. All data can be checked through mobile phones to ease user to plan their schedule. Fig. 1 shows the hardware connection of GPS bus tracker with automated passenger counting. The IR sensors are connected to the Arduino Mega that will send data to cloud server and display data in Blynk application via mobile phone. Next, the NEO-6M GPS module is used to track the location of the bus. The ESP8266 Wi-Fi module (NodeMCU) is connected to the Arduino Mega board and is used to transmit the real-time data collected from Arduino board to mobile application.

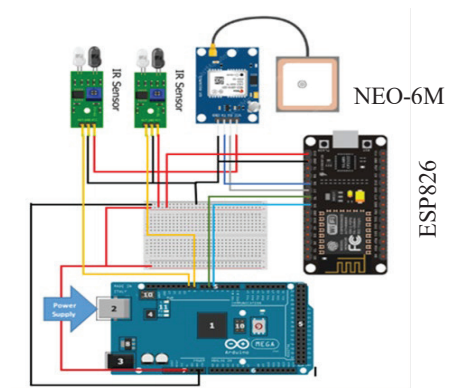


Figure 1 Hardware connection of GPS bus tracker with automated passenger counting

### 3. RESULTS AND DISCUSSION

Fig. 2 shows the prototype of passenger counting consists of two IR sensors act as counter device to count the number of bus passengers. The GPS module is placed on bus as it can detect the location of the bus.

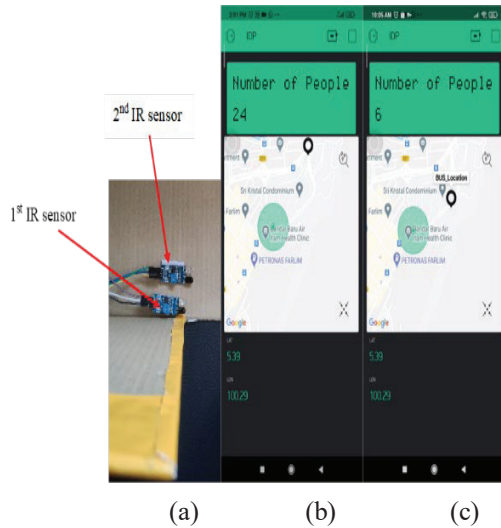


Figure 2 Prototype of passenger counting: (a) IR sensors, (b) Incremental number of passenger, (c) Decremental number of passenger

Fig. 3 shows the prototype of IoT based GPS bus tracker to track location of the bus and to count the number of bus passengers.

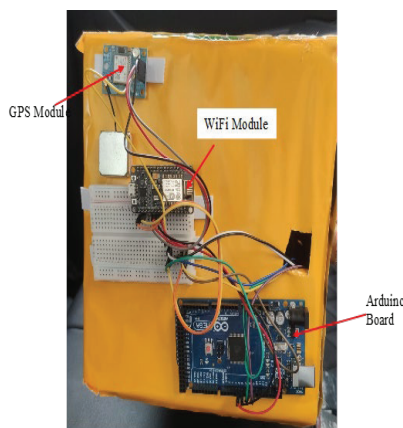


Figure 3 Prototype of IoT based GPS bus tracker

Fig. 4 (a) shows the Blynk application that indicates location of the bus, and Fig. 4 (b) shows the location of user.



Figure 4 Mobile phone application: (a) Location of the bus, (b) Location of the user

### 4. CONCLUSION

The IoT based GPS bus tracker with automated passenger-counting system is successfully designed and tested. The bus location is tracked using Neo-6M GPS, ESP8266 Wi-Fi and Arduino board. Meanwhile, the number of passengers on the bus is counted by IR sensors. The Blynk is employed to monitor bus location and the number of passengers through mobile app. The bus tracker system is constantly tracking and updating exact location of the bus continuously. The proposed system helps the students to know the current location of the bus, the next bus stop and the crowd level of the bus.

### REFERENCES

- [1] E. LeMaster, "GPS on the Web: applications of GPS pseudolites", pp. 6, pp. 268-270, 2003.
- [2] J.I. Sojol, N.F. Piya, S. Sadman and T. Motahar "Smart bus: an automated passenger counting system", in *International Journal of Pure and Apply Mathematic*, vol 18, pp. 3169-3177, 2018.
- [4] S. Pooja, "Vehicle Tracking System Using Gps", *Journal Critical Review*, vol. 05, pp. 128-130, 2020.
- [5] G.K. Kumar, C.B. Aishwarya, and A. Sai Mounika. "College Bus Tracking Android Application using GPS", in *International Journal of New Innovations in Engineering and Technology*, vol. 4, no. 4, pp. 40-44, 2016.
- [6] A. Ibraeva and J.F. de Sousa, "Marketing of public transport and public transport information provision", in *Procedia-Social and Behavioral Sciences*, vol. 162, pp.121-128, 2014.