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Real Time Bus Tracking System using Sim808 and Firebase

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Abstract:
Fleet operators mostly use tracking systems to track a vehicle position, routing, and others. This event is a good way of preventing stolen of our cars. This tracking system gives us the geographic coordinates, and it can track our vehicle location on electronic maps using the internet using these coordinates. By using those tracking systems, we can share transportation information in real time. And information or location of trains and buses can be shared with passengers in real time. Means passengers can see the bus arrive on mobiles in real time. In this project, SIM808 (GPS module) is used to continuously obtain the coordinates (latitude and longitude) as a string. Using the Node MCU ESP8266 (Wi-Fi module), it will then send the vehicle coordinates to the Firebase Cloud database. An android application can pull Firebase data and view the vehicle's positions in the map. So let users see where the vehicle is and can track their movement.

Keywords**:** GPS module, NodeMCU, Sim808 module, Wi-Fi module.

1. Introduction

Embedded system is a system that has software and hardware. Both mixed in an embedded system application. Embedded systems are designed for specific purpose. This means that less memory is used. For embedded system, mostly microcontrollers are used. It controls the devices that are mechanically or electrically attached to this controller. It uses programming at the assembly level and embedded C programming.

1.1 Wi-Fi module

Wi-Fi is wireless networking system. It is a data transfer system with high speed. It can share the data up to 7 devices at a time. Radio, antenna and router are essential elements of the devices on the wireless network. Wireless networking systems are coming to promote automation. Access long distance devices through wireless networking systems. This implements a common data transfer protocols TCP/IP. Microcontrollers are able to easily access Wi-Fi devices. Wi-Fi forms a piconet connection between devices. Figure 1 shows the wifi module.

1. Integrated 32-bit low-power CPU could be used as application processor.
2. This promotes variety of antennas.
3. Wake up and send packets in 2ms.
4. Integrated control systems and PLL regulators

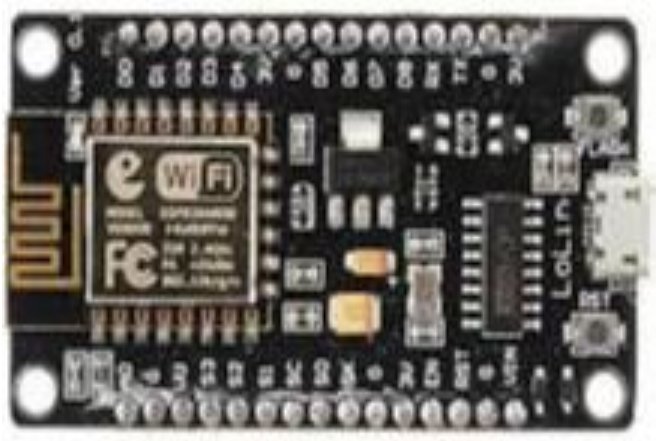

Figure 1: Wi-Fi module

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1.2 Firebase database

Firebase database is a cloud storage device. It is used to store the data whatever send to that server. It stores and synchronizes the data with NoSQL cloud database. It's so realistic. Whenever data needed, even the software goes offline, it gives the data. It stores data as JSON format. It's so portable and scalable. This database is used by Android devices and websites. It provides security. No licenses are required for NoSQL database.

1.3 GPS module

GPS stands for Global positioning system wherever in the world the location information can be accessed by everyone. They are always available. GPS has three components. The components are ground station controlling the GPS system, a group of satellite fixed in the sky at various locations such as consellatation and receivers.

1.4 Sim808 module

Sim808 system is compatible with GSM, GPS devices. We don't need a separate device. GPS and GSM are incorporated into the SMT package. Figure 2 shows the sim808 module.

1. Quad-band 850/900/1800/1900MHZ.
2. Voltage supply range 3.4 ~ 4.4 V.
3. Control checks through AT commands.
4. GPRS class B mobile station.
5. Data transfer speed is high.

Figure 2: SIM808 module

2. Proposed Work

In this project uses SIM808 and NODEMCU ESP8266. SIM808 includes a GPS module that can uses to get latitude and longitude to locate a vehicle's location. The SIM808 GPS is used for continuous string formation of the coordinates. Extract the required data (latitude, longitude) from the string after reading this string using ESP8266. NODEMCU ESP8266 will connect to internet.

Using this, NODEMCU ESP8266 would send the vehicle's latitude and longitude (read from SIM808) to the cloud storage. The real time firebase database of Google here. Now, the firebase will contain the position of buses (latitude and longitude). Now, the Android application that is installed in mobile of end users will pull the latitude and longitude of firebase buses and mark them on the map.

Each time, any bus changes in latitude and longitude, the change will be reflected in the map suddenly. The app also allows users to use the Google Maps app (Google Inc.) to access the bus location. In addition, it'll show the approximate distance and duration of the selected bus to reach user. Figure 3 shows the Block Diagram of bus tracking system.

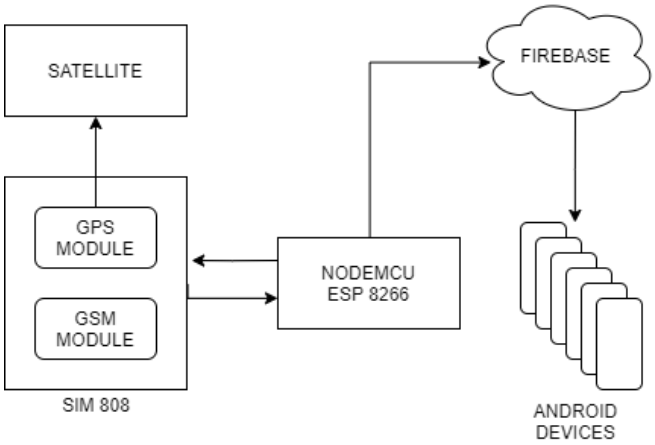

Figure 3: Block Diagram of bus tracking system

3. Result and Discussion

Most of the implementation relies on separate server to interact with database, and in client side they have to check for the location changes periodically. They used separate server for handling the location data in the cited document [9]. From the raspberry pi-3, the location data is sent to the server and the location data is then pushed into the database from the server.

When the locations are shown in a mobile device, the mobile device has to question the server, and the server must ask the database and send the mobile device back as an answer. Compared with our implementation it is a long time-consuming operation. NODEMCU 8266 will communicate directly with database in the proposed work it'll push directly into the database. Mobile devices will also query the mobile devices directly when locations are displayed in mobile devices.

So the communication between the intermediate servers is not necessary. They used JDBC database. In the referenced text, they have to regularly check all the locations from the database when displaying the locations on the phone, and have to view all the locations on the screen. Even if no location is changed until the last fetch, the program will fetch and display the unchanged data in map. This is a high weight, or an intensive resource.

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But in our proposed work it will be automatically signaled in the android app whenever the data changes within the firebase. Mobile app doesn't need to check the position update regularly; it will be reflected in the android app whenever the change occurs. So, it will be less cycle of weight. Figure 4 shows the Hardware setup of the bus tracking system.

Figure 4: Hardware setup of the bus tracking system

4. Simulation and Results

The GPS module transmits the latitude and the bus to the cloud storage every certain interval. The devices latitude and longitude are shown below. Figure 5 and 6 shows the latitude and longitude and google map location of the bus.

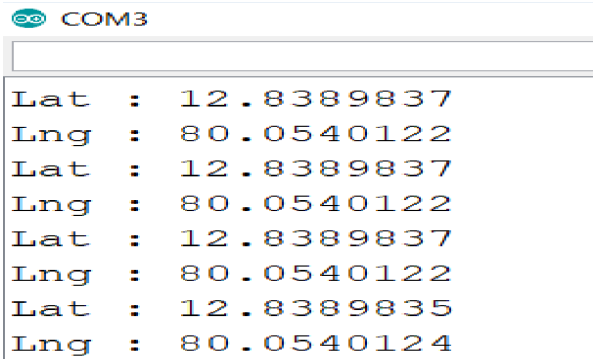

Figure 5: GPS module gets and displays the latitude and longitude

Fetch the data from the cloud storage. Then use of the data it pointing location of devices in the google map. It's shown below.

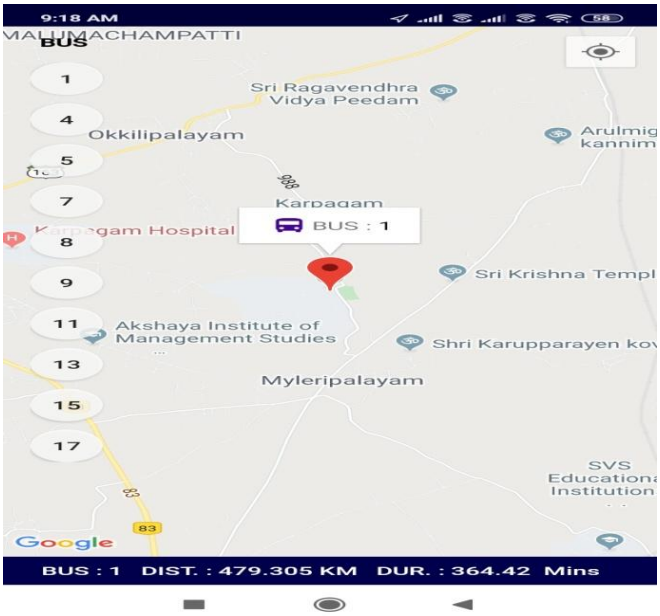

Figure 6: Google map shows bus location

5. Conclusion

A client-side system on the Android platform is the GPS Based Bus Tracking System. System is inexpensive and easy to mount on smart phones. This system's accuracy is based on the GPS coordinates generated using satellites, while system reliability is dependent on the GPRS facility. It provides real-time bus tracking to let the end users know where the bus comes from. Since changing the location, database updates every time. In future, gives alert to the passengers before the bus arrives the bus stop. Gives alert to the passenger before the stop where they have to departure, showing traffic status in map. Creating Webpage administration panel.

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