Monitoring & Managing Public Transport Service using IoT Technology

[1]S. S. Pansare, [2]Abhijeet Ankush, [3]Abhishek Baviskar, [4]Kunal Patil

Email: [1]sspansare@mescoepune.org, [2]ajankush1@gmail.com, [3]abhi.3353@gmail.com, [4]kucpatil@gmail.com

Abstract—The concept of a network of smart devices was discussed as early as 1982, with a modified Coke machine at Carnegie Mellon University becoming the first internet-connected appliance able to report its inventory and whether newly loaded drinks were cold. The Internet of Things (IoT), also called Internet of Everything, is the network of physical objects or "things" embedded with electronics, software, sensors, and connectivity to enable objects to exchange data with the production, operator and/or other connected devices based on the infrastructure of International Telecommunication Union's Global Standards Initiative. Managing public transport service is a very complex and challenging task. It is also difficult for passengers to know the schedule and the current location of the bus. This problem can be resolved using IoT based real-time tracking system. It will help transport management system to manage all schedules of the buses. This can be implemented using a Gateway device such as Arduino, Intel-Galileo, Raspberry pi, etc. This gateway is interfaced with GPS and GPRS modules. GPS module works as sensor to locate the current position of the vehicle. The GPS module creates coordinates, which are sent to the Centralized server through GPRS module using internet. The centralized server keeps all record of these coordinates and process it in real-time.

I. INTRODUCTION

The Internet of Things allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration between the physical world and computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. The IoT technology is going to make our life much easier, comfortable and more efficient. IoT is going to be our future; it's going to connect every object, every device, everything around us to each other through internet.

- **Bodies**: Many people will wear devices that let them connect to the Internet and will give them feedback on their activities, health and fitness. They will also monitor others (their children or employees, for instance) who are also wearing sensors, or moving in and out of places that have sensors.
- **Homes**: People will be able to control nearly everything remotely, from how their residences are heated and cooled to how often their gardens are watered. Homes will also have sensors that warn about everything from prowlers to broken water pipes.
- **Communities**: Embedded devices and smartphone apps. will enable more efficient transportation and give readouts on pollution levels. "Smart systems" might deliver electricity and water more efficiently and warn about infrastructure problems.
- **Goods and services**: Factories and supply chains will have sensors and readers that more precisely track materials to speed up and smooth out the manufacture and distribution of goods.

India is a developing country which is now emerging as great power. In order to achieve this dream our cities should become smart. Smart city needs smart objects. Public transport system is the heart of any smart city. Currently public transport system management is very difficult because it does not have any centralized operating system for transportation. Managing the public transport service is a very complex and challenging task. It is difficult for PTS Management to maintain the schedule and to know the current location of the bus. This problem can be resolved using IoT based real-time tracking system. This will help management to know the proper location of required bus and its condition. It will also help passengers if we also develop an app which will provide the current status of the bus they are looking for.

II. BLOCK DIAGRAM

Fig. 1. Shows the block diagram of IoT based tracking system. It includes a tracking device in the vehicle which continuously tracks the vehicle location. Here GPS is a tracking device. In order to monitor the vehicle from a remote location the coordinates of the vehicle location must be send to the remote server.

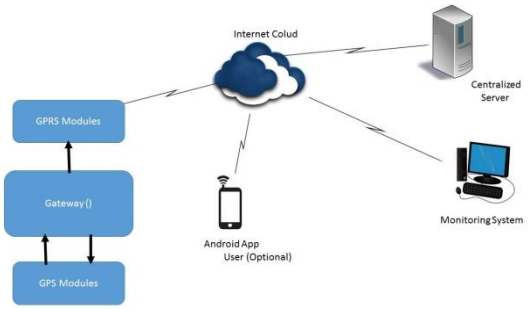

Fig. 1. Block digram of IoT based Public Transport System

This is done by sending the vehicle location coordinate to theserver by using a gateway and GPRS module. The gateway could be any microcontroller which supports IoT technology. Microcontroller processes the coordinate and sends it to the server in the form of data packets via internet cloud. The server has a storage facility to store the received data. This data is used to track the vehicle location. This database is very useful to know the path traveled by the vehicle in that time slot.

III. UNDERSTANDING OF HARDWARE

This IoT design consist of a GPS module, a GPRS module, a microcontroller and a centralized server located at a remote place.

A. GPS Module

- A GPS module is used to sense the location of the vehicle.A GPS device calculates accurate geographical location (longitude, latitudes and height coordinates) which is received using GPS satellites.
- These coordinates of any location are accurate within a range of 20m to approximately 1mm.

Fig. 2. GPS Receiver Module

- The precise time (Universal Time Coordinated, UTC) accurate to within a range of 60 ns to approximately 5 ns.
- Speed and direction of travel can be derived from these coordinates as well as time. These coordinates and time values are obtained using by 28 satellites revolving around the earth.
- Soon India is going to get its own indigenous GPS system under IRNSS (Indian Regional Navigation Satellite System) which is developed by ISRO.

B. GPRS Module

- GPRS module is first introduced bySIMCom Wireless Solutions which is part of SIM Technology Group Ltd. Their last module is SIM900 which supports GPRS.
- GPRS supports various frequency bands such as 800 MHz, 900 MHz, 1800 MHz and 1900 MHz.
- GPRS (General Packet Radio Service) module is a Full Type Approved Quad Band Embedded with R323interface on CMOS level and AT command set.

Fig. 3. GPRS Module (SIM 900)

- It is suitable for SMS as well as data transfer application in M2M interface (Machine to Machine).
- The modem requires only 3 wires ie. Tx, Rx, GND except power supply for the module.
- As it has a built-in Low Dropout Liner voltage regulator allows to connect to an unregulated power supply (4.2 V -13 V).
- It works on built-in powerful TCP/IP protocol stack for data transfer through internet.

C. Microcontroller

- A microcontroller is the brain of any IoT system which actually processes the data and decide what to be transferred.
- There are many microcontrollers available but as per requirement and cost effective solution, Arduino Uno ATmega 328 is a suitable option.

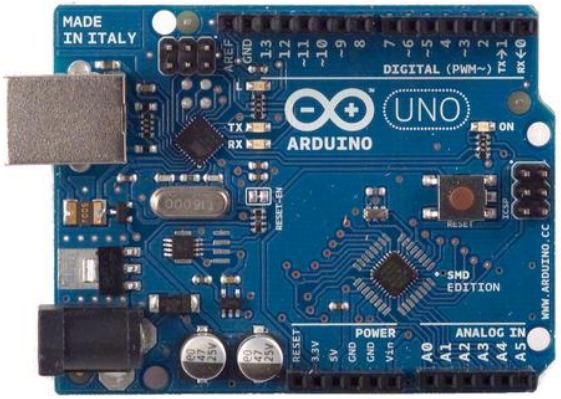

Fig. 4. Arduino UNO Bord

- It has clock speed of 16 MHz, 32 Kb flash memory, 1KB EEPROM, 2KB RAM.
- Most important any other external OS cannot be installed on the microcontroller.

D. Centralized Server

- A centralized server is a system which contains a storage system and a monitoring system.
- This server consist of field such as ID, vehicle ID, Time, Latitude, Longitude etc.

IV. WORKING OF THE SYSTEM

The system consist of GPS module, GPRS module, and arduino microcontroller. These together are mounted on the bus. Fig. 4. Shows basic block diagram of the system. First interface GPS module serially with the arrduino microcontroller. Then GPRS module is also serially with the arduino microcontroller. Both the modules are interface through the digital I/O pins. The system works in following sequence:

1. As soon as bus is started the GPS module is initialized.
2. GPS module gathers the current coordinates of the bus.
3. These coordinates are sent to the microcontroller through the serial port.
4. These coordinate gives the information about latitude, longitude and time to the controller.
5. After collecting this information by microcontroller, the microcontroller processes that info.
6. Then it prepares the GPRS module to send this info. To the centralized server.
7. GPRS module uses TCP/IP protocol to send this info as data through port number 80.
8. This data packet reaches the centralized server via internet cloud.
9. The centralized server is built using SQL (Structured Query Language).
10. The server consist of at least 3 parameters: Longitude, Latitude and Time.
11. When these parameters are inserted in the Google maps API (Application Program Interface).

V. FUTURESCOPE

1. This system will can be upgraded and some more parameters can be measured and monitored continuously, such as crowd in the bus, temperature and humidity in the bus, air pressure of tire, fuel level etc.
2. An android App. can be developed for public to get real-time location of the bus. Every ones time will save.
3. Online ticket service can be provided to the public so that crowd in the bus is maintained by increasing or decreasing the frequency of the buses.

REFERENCES

[1] SeokJu, et al. "Design and implementation of vehicle tracking system using GPS/GSM/GPRS technology and smartphone application." IEEE, World Forum on Internet of Things, 2014.

[2] ThiyagarajanManihattyBojan "An Internet of Things based Intelligent transportation system." IEEE, ICVES2014

[3] http://www.google.com/

[4] http://www.pmpml.org/

[5] http://playground.arduino.cc/Tutorials/GPS

[6] https://www.arduino.cc/en/Tutorial/ GSMToolsTestGPRS

[7] https://en.wikipedia.org/wiki/Global_ Positioning_System