REAL TIME BUS TRACKING AND LOCATION UPDATION SYSTEM

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***Abstract*—Public transportation system plays a major role in every aspect of life. It has a greater impact on economic development of the country. Tracking, monitoring, scheduling, alert services are the major challenges faced by this system. Currently, major services of this system are manually operated which are approximate and ease of access is denied to the people. This project aims in automating the services of the system that can provide the real time tracking experience of the public transport buses. The buses will be having RFID tags within them and RFID readers will be placed in every bus stops. Arduino serves as the central controller for this system. GSM module will be used to send the tracking messages to the authorized persons for continuous monitoring. GPS is used for getting the location of the buses. Users will be getting the bus tracking details as notifications in their mobiles through IoT. The inputs from RFID readers are continuously updated to Arduino for processing the data. The processed data is sent to the cloud which serves as the interface between the user and the system.**

Keywords—Public transportation system, Radio Frequency Identification (RFID), Global System for Mobile Communication (GSM), Internet of Things (IoT), Global Positioning System (GPS).

I. INTRODUCTION

Public Transportation is the major means of transport among the people. Growing density of population increases the vehicle density leading to heavy traffic and greater percentage of pollution. Optimal solution to this problem is preferring common modes of transport. Since common people are the greater ratio in making use of public transport, the necessity to provide them with ease of access stands at higher priority. This project mainly focuses on bus transport system. A recent survey by National Sample Survey Organization says that about 62-66% of people uses bus as their mode of transport. Public transport tracking system aims at providing the instant status of the bus to the users via an automated system.

This project deals with Arduino which serves as the central controller acting like brain of the system. People on a long run wait for the buses at the bus stop. Since they are unable to get the location of the bus they get to take some other modes of transport to reach their destination. To destroy the manual log entry and to automate the process this project plays a vital role. Mobiles phones are chosen as the medium to communicate with the passengers that provides an easy access to them. In this paper the project focuses on tracking the buses, sending SMS to the authorized persons, updating the passengers through notifications and improving the accessibility to the system. The highlighted features of this project increases the interest of the passengers in taking public mode of transportation.

II. LITERATURE REVIEW

A system in [1], is deployed using GPS, Web Application, Google Map and tracking device. It uses location tracking mechanism and it is updated for every 1 second to the cloud. Web application is used to monitor the exact location of the bus along with bus route and bus arrival time. Google Map will help in visualizing the location of the bus. The system in [2], was developed using GPS, GSM, RFID and BTS (Bus Tracking System for location estimation). The proposed approach called Bus Tracking System is evaluated using java simulation tool by considering both simulation and real time analysis. Both analysis results in improved accuracy and performance than the existing bus tracking system. This project mainly focuses on accuracy of location and calculation of time, coordinates and simple user interface which saves time and increase the efficiency of work. The project can be done only if the bus is registered. There is a system as in [3], which is a web based application. It uses GPS, GSM and Google map. GPS along with a SIM is used for tracking the bus. The location updation from GPS is send to the Web app through the central server. The web app has a timer which will be updated and refreshed for every 40s. A system was developed in [4], using GPS, Google Map, SMS services, web server and Database server. By this application, the students can get live location updation when internet connection either available or not available. The time could not be predicted which is the main drawback in this project. The paper [5] uses GPS, LoRa WAN and IOT. LoRa WAN means Long Range WAN and it is country specific. LoRa WAN is a long range communication by using lower RF frequency which operates in unlicensed radio spectrum. This consumes low power than GPS. In this project an RF transmitter is equipped inside the bus which transmits set of earlier decided data continuously. An RF receiver is placed at appropriate number of bus stops. When the bus is in range the information like bus identity will be sent from the RF transmitter to RF receiver. Then the information will be passed to the base station through LoRa WAN communication. The project in [6], comprised of GPS, GSM, location based services, clustering and artificial neural network. Neutral network is used for time estimation of buses. System architecture in [7] is used for college bus tracking system. Architecture is built using GPS, Google Map and JVM (Java Virtual Machine). Android Application is developed which gives exact location of the bus along with bus details, driver details, contact number, routes, stops etc,. It also provides time estimation for bus arrival. A system was designed in [8], with RFID which

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uses the ultrahigh frequency ranging from 30MHz to 3GHz and cover up a distance of 5 to 12m range. An RFID system consists of tag which will send the location information to server through the reader by using radio frequency which is then processed as per the requirement of the user. The RFID tag will be placed in the bus and the reader in the bus stops. The server after receiving the location information will alert the upcoming bus stops along the bus route with bus number and expected arrival time of the bus will be displayed in bus stop. The paper in [9], uses embedded ARM (Acron RISC Machine), API (Application Programming Interface), moving object tracking and real time human traffic statistics. It is used in high density traffic areas. The system in [10], uses Area Trace Algorithm and Haversine distance. User will send an SMS in a specified format to a toll-free number and will receive a reply SMS with bus location, seat vacancy and estimated time of arrival.

III. Problem Statement

To design a system that can automate the process of tracking, monitoring and location updation services of Public transport system. Existing system has majority of functions that are manually operated which is error-prone. This project also aims in developing an optimal solution by instant updation system to decrease the chances of errors.

IV. Proposed System

The proposed system consists of two modules. The first module is the sensing module and the second is the IoT application. Sensing module comprises of RFID unit which is used for sensing the bus when it reaches the bus stop. It also has a GPS module to get the live location of the bus with the assistance of RFID reader.

Second module is an IoT application which provides user interface and gives location updates to the passenger.

The block diagram for the proposed system is shown in Fig .1. The modules is further divided into three sections namely,

- Bus unit
- Central processing unit
- IoT application

The bus unit comprises of GPS device, RFID tags within the bus and RFID readers are placed outside the bus unit. RFID tags are of front and rear tags which is placed on respective position within the bus. RFID reader is used to identify the arrival and departure of bus at bus stops. GPS is used to give the location of the bus. Central processing unit comprises of Arduino UNO that process the data received from various modules of the system. IoT application is built using Blynk platform which provides better user interface and facilitates ease of access to the system. GSM module is used explicitly to send SMS or alerts to the authorized members that can help the system in following the respective schedule.

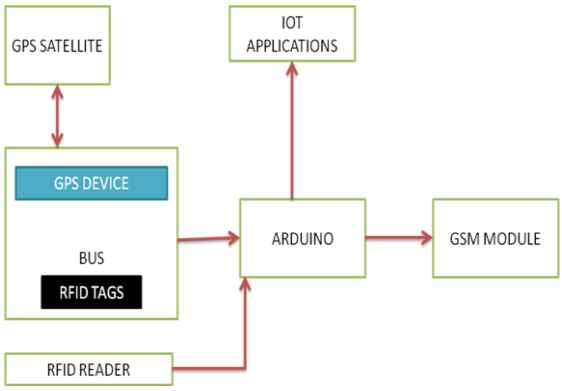

FIG 1: Block diagram of proposed system

The primary function of the system is to sense the arrival of bus at bus stop. Once it is sensed by the RFID reader the current location will be updated by GPS to Arduino. After the departure of the bus is also sensed by the reader and information is updated to Arduino. IoT application is built to provide better user interface and it is controlled by Arduino. GSM module is used for sending messages.

A. Schematic representation:

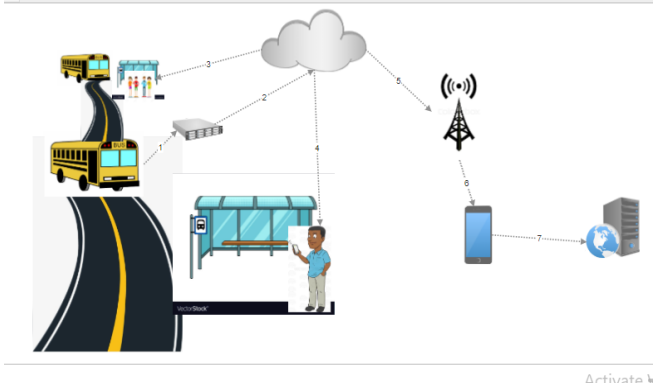

FIG 2: Schematic diagram of proposed system

Consider a scenario of two buses, one at specific bus stop and other bus close to its next stop. The first bus at the bus stop provides its location from the GPS module to the cloud via the central processor. Now the cloud has the present location of the bus.

The person in the second bus stop will request the cloud to know the present location of the particular bus he wants to travel. Cloud will process the client's request and will provide the updated location of the requested bus. Passenger can interact with the cloud by having an IoT application developed using blynk platform in their mobiles. Blynk platform provides mobility to the user because it doesn't need a laptop or PC for controlling its operation. The location of the second bus can also be tracked based on passenger's request. Notification provided to the user can help them in choosing a convenient bus based on its updated location. This feature helps the users in saving their waiting time at the bus stop.

The next stage is providing SMS alerts to the authorized person. This is done by GSM module which is programmed in such a way to send an SMS alert to the registered mobile number. SMS will contain the current location, time of

arrival, time of departure, latitude, longitude and next location that is to be reached.

SMS service can also be extended by designing a database which contains the data, ensuring timely arrival of the buses.

The proposed system provides flexibility to the user and it is scalable supporting multiple user accessibility. User can also synchronize the latitude longitude location to get the exact location of the bus.

Cloud storage reduces the memory requirement of the system. Connectivity to the internet increases the accuracy of the proposed system. All these features attracts people in taking up public buses than any other means of transportation.

B. *Calculation of distance:*

The distance between two points on the earth is calculated using Haversine formula. It uses two pairs of latitude and longitude locations.

Using Haversine formula:

$$D = R*s$$

R is radius of the earth (6371 km)

$$s = 2*k \tan^{-1}(\sqrt{k}, \sqrt{(1-k)})$$

$$k = \sin^2(L/2)+\cos(L1)*\cos(L2)*\sin^2(l/2)$$

L = difference in latitude = L2-L1
l = difference in longitude = l2-l1

C. *Working:*

The activities of the system are designed to perform automatically without any human assistance and are error-prone. The major operating blocks are bus module, processing unit and end user interface.

User interface is designed using IoT application with Blynk platform. Initially the system remains idle until target is identified. Once the target is identified an intimation is sent to the processing unit comprising of output from RFID unit containing unique RFID tags that are placed in front and rear position of the buses and responses from RFID reader. Each bus has its own unique ID comprising of 12 bits. Secondly the location of the bus is tracked by GPS and gives it to the processing unit. GPS information consists of latitude and longitude points that provides accurate positioning of the bus. Additionally there will also be a timestamp which conveys the arrival and departure time of the bus at the bus stop. It will also give the next location of the bus that is to be reached. This feature can give the passengers a clear idea about the next location of the bus and also provides flexibility to choose alternative buses for timely access. To avoid errors and to facilitate timely arrival of the buses, the location of the bus along with its ID or route number is continuously updated to the authorized persons or websites through SMS services sent by GSM module.

Application interface will be the best solution to serve all age groups of passengers with best experience. IoT is the mode of communication in this system. Blynk platform which facilitates IoT feature controls the processing unit over the internet. Users can interact with the system at any point of time supporting mobility. People need not require any specific registration to access the system and this supports the feature of transparency. All the integrated processes are carried out simultaneously increasing the efficiency of the project.

The flow of the system resumes for every new targets that is being identified. Communication of information through cloud is the major facility to provide a portable access. The process of the system takes place with a specific delay to avoid overlapping of information that is to be communicated.

V. FLOWCHART

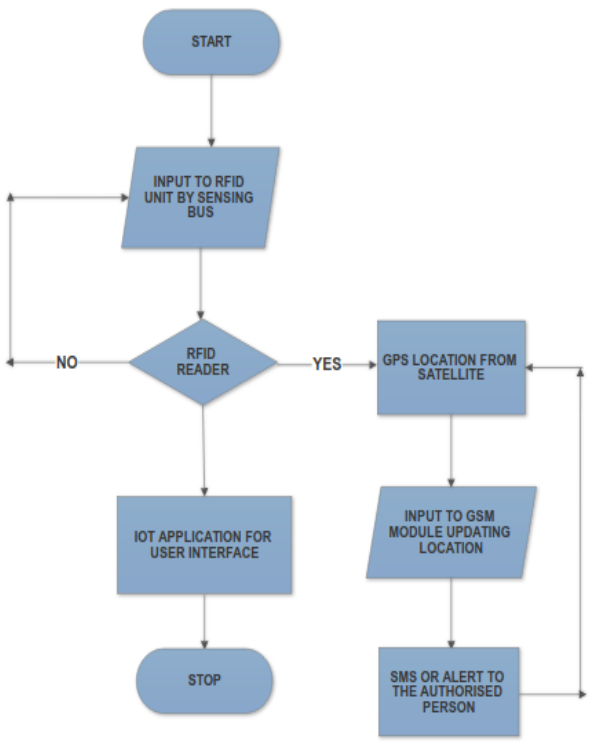

FIG 3: Flowchart of Proposed system

The system starts when the bus is sensed by the RFID reader. If the RFID reader output is true then the GPS loaction is requested from the satellite and the input is given to the GSM module for updating the system via the processing unit. SMS will be sent for every bus being tracked. If the RFID reader output is false then the reader waits until its output becomes true. The next stage is providing the information to the user via IoT. The information to the user is shown as notifiactions. This flow continues for every bus being tracked.

VI. Experimental Results

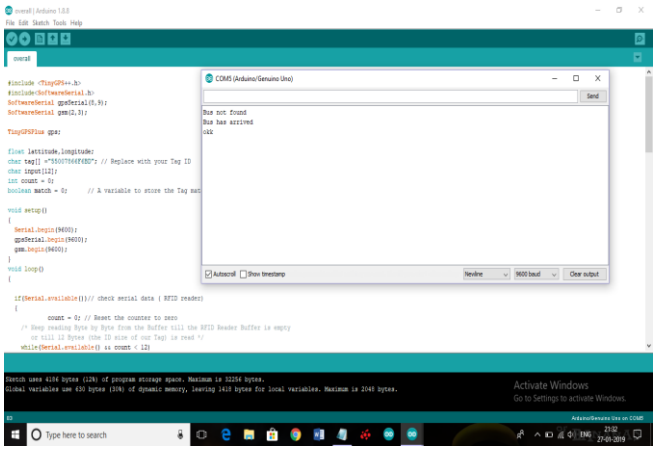

FIG 4: Simulation in Arduino IDE

From Fig 4 it is inferred that, when the bus is identified by the reader, an acknowledgement is sent to the arduino. Arduino updates the acknowledgement to the cloud.

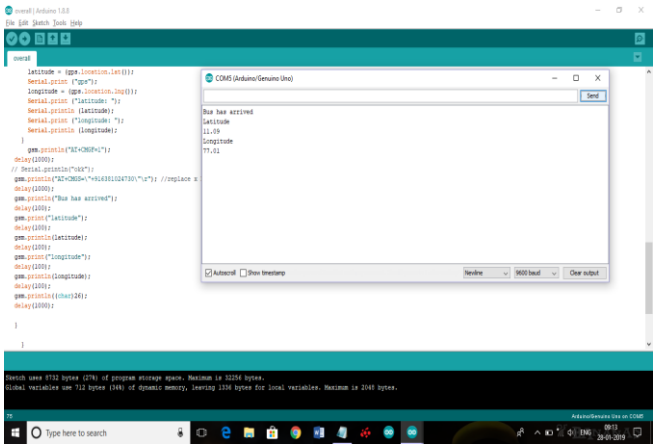

FIG 5: Output message obtained

Fig 5 displays the exact latitude longitude location of the bus that is sensed. Location is updated in the cloud and it is sent to the user.

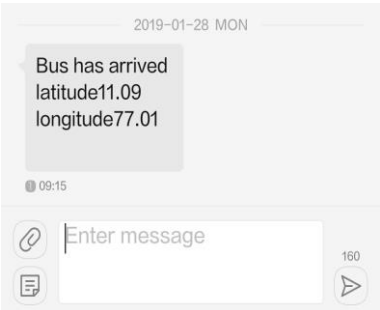

FIG 6: SMS output

Fig 6 ensures successful simulation by providing SMS services to the registered mobile number of authorised person. Tracking details are updated when the bus reaches a new location.

VII. Conclusion

IoT based Public bus transport tracking system is an advanced method that can locate and tarck the buses. The succes of the tracking system lies in providing easy interface to the user via Android application to the user. This system serves as a prototype that can visualize the status of Public transport buses wirelessly. The designed system can be deployed in every rural and urban areas which provides an user friendly environment to the passengers.

VIII. Future Work

This system can be extended in estimating the approximate arrival time of the bus with an accepted delay. Security for this system can be developed by creating a video surveillance environment. Additionally sensors can be deployed in the reader's location to monitor the traffic conditions in the respective bus routes.

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