A CONTEXT-BASED SMART METROPOLITAN TRANSPORT MONITORING SYSTEM

[1]A S Salma Banu
[1]Assistant professor, Department of Electronics and Communication Engineering, Aalim Muhammed Salegh College of Engineering, AVADI, IAF Chennai

Abstract

A metropolitan area's Public Transportation System (PTS) may be nonlinear, dynamic, and complicated. It managing and providing appropriate public transportation services are troublesome. This paper proposes an Internet of Things (IoT) based public transportation in a metropolitan area. The IoT provides seamless property between completely different networking technologies whenever commuters or vehicles move from one location to another. Hence, IoT provides good seamless public transportation services within the metropolitan area. In addition, we have used context data information of transportation entities, such as time, location of the bus, preference, interest and history (history means that like time and location of the bus, passenger count within the bus) are held on within the cloud. Then, a cloud can offer access to themobile application. This system can monitor context-based smart urban transport facilities cost-effectively and smartly.

Keywords: Metropolitan transport monitoring system - Context and IoT based - Sensors - GPS - GSM –Mobile web application

Introduction

Metropolitan areas are very populated,representing the supply of congestion, pollution, and overcrowding. This puts additional pressure on public transportation, which results in problems liketraffic jams, underutilization of resources, waiting time, etc. The migration of public to private transportation results in a rise in holdups and jams. To avoid or cut back on the preceding issues, there's a necessity for quick and intelligent publictransportation. At identical, time prediction of trafficand their abnormalities are necessary. To manage demands and assist commuters and transportation authorities, there's necessary to style associated deploy an intelligent decision-making andcontrol system. Hence, there is a demand for advanced Information and Communication Technologies (ICTs) that are consummated by introducing associate IoT-based Smart Metropolitan Transport Systems (IoT-SMTS)[1]. The main aim of IoT-SMTS is to reinforce the facility's comfortability, efficiency,and effectiveness. Despite the expansion of ICTs, commuters and transportation authorities aren't ready to get correct data from transportation entities, which causes several issues. To avoid or scale back these issues, an Associatein IoT is employed to interconnect all the transportation entities and collect their context data.It analyses numerous circumstances like Time, Location, Preference, Interest and History. In IoT- an based Passenger Transport System (IPTS), Associatein Nursing IoT-based context data utilization might give wealthy services, like relevant routes,alternative modes, etc. Hence, Associate in Nursing IoT-based context-aware IPTS makes the general public installation. In addition to being reliable, it provides seamless property to any or all transportation entitiesto create a sensible town. It provides correct andadditional relevant seamless services to commutersand transportation authority's hands. Bus operators have an interest in the occupancy levels (i.e., number of passengers on a bus) of their bus servicesto be able to manage a service higher, increase or decrease the number of busses or modify [2] the scale of a vehicle to avoid catering, that will increase the price, and under catering, which affectsclient satisfaction. Considering the rise in the publictransport situation and the lack of IoT primarilybased solutions for this problem, this paper presents an Associate in IoT crowd management system. Wetend to use a two-way IR(InfraRed) sensing elementat the entry and exit of the bus to show the passengeroccupancy over a mobile application. The passengeroccupancy status displayed in real-time wouldpermit the passengers to grasp beforehand the situation and state of affairs in an inbound bus. This mayinform them to appear for an alternate route or transport mode before arriving at their destination ontime. The system's accuracy enables passengers to create equally distributed queues todistribute the gang across buses better [3].

LITERATURE REVIEW

The public transportation system is an important part of urban transportation, which is useful to meet the basic needs of citizens' trips; the basic travel needs of citizens can be met if the mode of public transportation isdesigned and possible to answer the highmobility of the community. With thedevelopment of technology, the publictransportation system refers to an intelligent system, which is proven to have significantly increased the level of public transportation services and the level of user satisfaction, namely by increasing the utilization of transportation resources and reducing passenger travel time. The smart public transportation system utilizing Internet support, IoT, can be applied in various research fields. IoT is concerned with building a network of devices that supportthe internet to develop an intelligent environment, [4] As with the use of mobile devices, which can provide the concept of busmovement in real-time so that it can overcomethe problem of tracking and monitoring buses manually. Bus tracking and monitoring are oneof the main problems in the public transportation sector. Bus tracking andmobile device monitoring can also be designed using IR sensors for passenger count,GPS modules for location tracking and a GSM module for passenger communication. So, the bus arrival time is usually estimated from the passenger ride time at the bus stop, so the lack of data can create difficulties in estimating the bus arrival time. Traffic density, as one of the factors inhibiting bus movement through tracking and monitoring, has also been discussed. With IoT, the bus transportation system can utilize the mobile platform as a sensor to increase network coverageof bus movement information from each bus stop. In addition, a combination of technologies, such as Global Positioning Systems (GPS) and mobile devices, as part of IoT, can help passengers travel on public transportation. A bus transportation tracking system using GPS technology is needed to overcome bus tracking manuallybecause manual bus tracking is prone to errors.Several studies have

discussed the problem of using IoT in bus transportation mode in the form of optimization problems using RFID as well as other technologies related to IoT, system performance analysis, use of cable, andsensor networks [5].

METHODOLOGY

In this system, we can see the Transport monitoring system functions such aspassenger count and GPS location of the bus. A passenger count can be detected using two IR sensors in the bus. So one IR sensor is for entryand another IR sensor is for bus exit. Then, GPS location can be detected by using a GPS module for the current location of the bus. AnArduino UNO microcontroller can control an IR sensor and GPS module. Then, input from two IR sensors can be taken from the number of passengers boarding or onboarding the bus and GPS module input can be taken from the bus. Then an inputs can be fed into the Arduino UNO microcontroller. So an Arduino UNO can fetch two inputs and then produce the outputs, such as passenger count and GPS location, to the transport authority(Bus depot). In the previously existing system, we can seethe Transport monitoring system functions such as passenger count and GPS location of the bus. Now, in the proposed system, we can add some extra features such as SMS information about passenger count and the current location of the bus using the GSM module and display the passenger count in the bus using a 16x2 LCD. So this information can be uploaded to the Arduino IoT cloud. Then, transport authorities and users can access the data or information from the cloud. The block diagram of existing and proposed system is shown in figure 1 and 2 respectively.

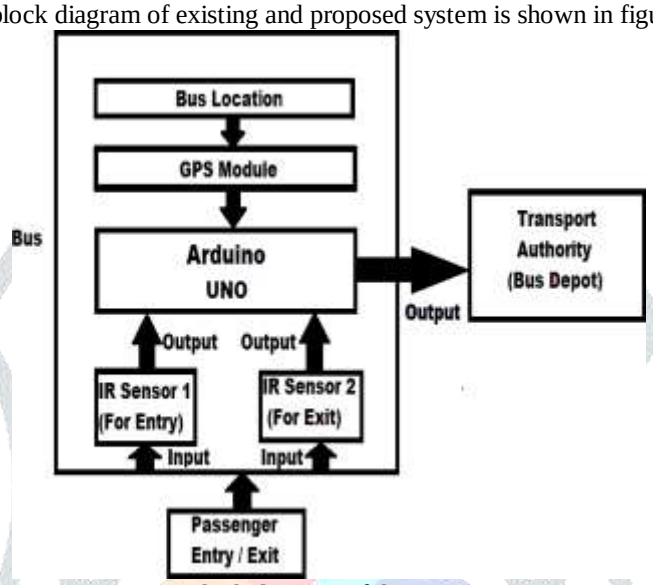

Figure 1: Block diagram of the existing system

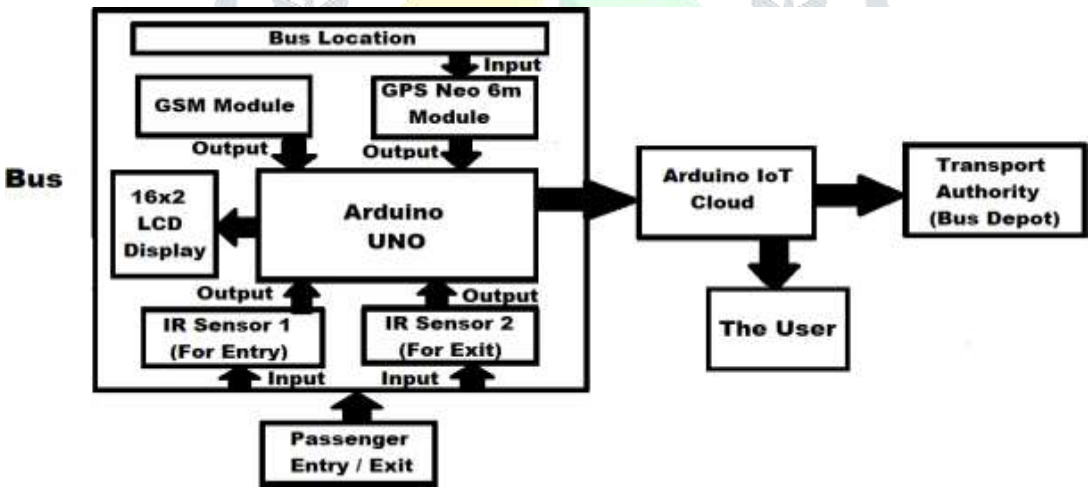

Figure 2: Block diagram of the Proposed system

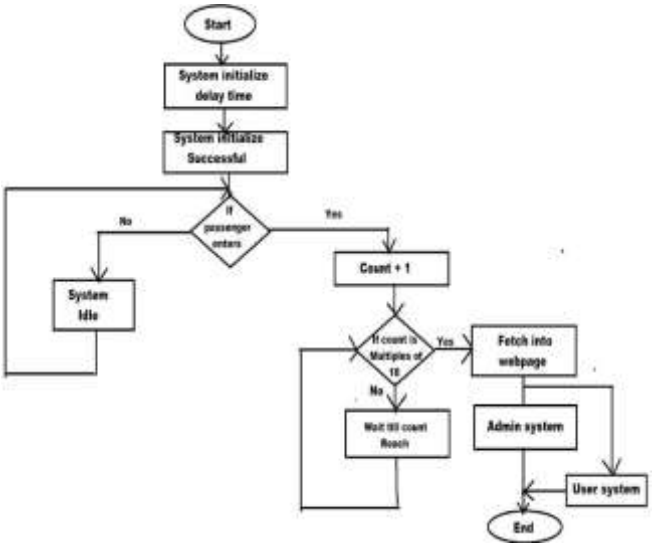

Figure 3: Flow chart for the proposed system

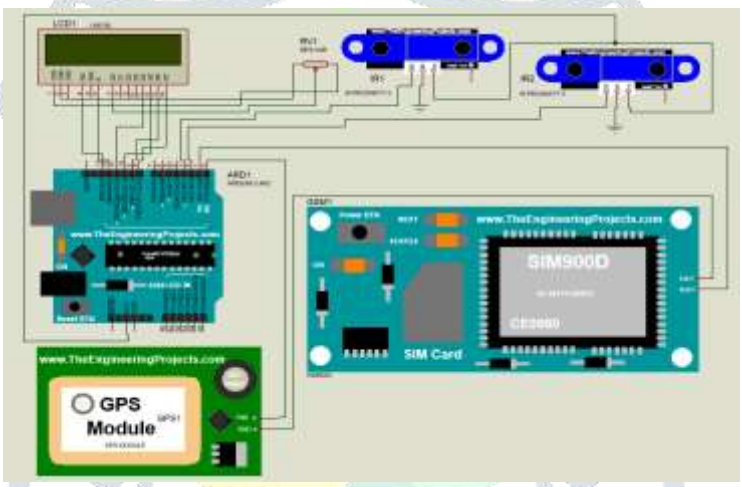

Figure 4: Circuit Diagram of our system

Figure 3 and 4 shows flowchart and circuit diagram of proposed system. we have various factors to get context-based information, such as,The mechanism for passenger count (IR sensor)The mechanism for detecting location (GPS)Mechanism for communication (GSM)

THE MECHANISM FOR PASSENGER COUNT (IR SENSOR)

IR sensor

An infrared detector is an associate degree device that emits to sense some aspects of the environment.Associate degree IR detector will live the warmth of associate degree object further as it detects the motion.These sorts of sensors live solely infrared, instead ofemitting it's known as a passive IR detector. Usually, within the spectrum, all the objects radiate some thermal radiation. These sorts of radiations are units invisible to our eyes, which maybe detected by an associate degree infrared detector. The electrode is an associate degree IR junction rectifier (Light Emitting Diode). Therefore, the detector is just an associate degree IR photodiode sensitive to IR lightweight of a wavelength similar that emitted by the IR junction rectifier. Once IR light falls on the photodiode, the resistances and, therefore, the output voltages can cause modification inproportion to the magnitude of the IR lightweight received. The regulation of the associate degree infrareddetector is comparable to the item detection detector.This detector includes an associate degree IR junction rectifier & associate degree IR Photodiode; therefore, combining these 2 will be fashioned as a photo-coupler, otherwise optocoupler. The physics lawsutilized in this detector area unit planks radiation, Stephan Ludwig Boltzmann & Weins displacement.IR junction rectifier is one quiet transmitter thatemits IR radiations. This junction rectifier appears the same as a conventionalrectifier; therefore, the radiation generatedcannot be visible to the human eye. Infraredreceivers primarily find the radiation victimization associated with degree infrared transmitter. This infraredreceivers area unit is out there in photodiodes kind. IRPhotodiodes' area unit is dissimilar to standard photodiodes because they find merely IR radiation. Completely different types of infrared receivers primarily exist, looking at the voltage, wavelength, package, etc. Once it's used because of thecombination of associate degree IR transmitter & receiver, then the receiver's wavelength should equalthe transmitter. The transmitter is an IR junction rectifier, whereas the receiver is an IR photodiode.

Mechanism for detecting location (GPS)GPS (Global Positioning System)

GPS stands for "Global Positioning System". It's a satellite navigation system that confirms the bottom position of an associate degree object. GPS technology was 1st employed by our militaryin the Nineteen Sixties and enlarged into civilianuse over the consequent few decades. Today, GPS receivers square measure enclosed in several business products, like vehicles, smartphones, exercise watches, and GIS devices. The GPS includes twenty-four satellites deployed in the houseregarding twelve 000 miles (19,300 kilometres) higher than the layer. They orbit the world once everytwelve hours at an especially quick pace of roughly seven 000 miles per hour (11,200 kilometres perhour). The satellites square measure equally openedup, so four satellites are accessible via direct line-of-sight from any place in the world. Every GPS satellite broadcasts a message that has thesatellite's current position, orbit, and actual time. A GPS receiver combines the broadcasts from multiplesatellites to calculate its actual position using triangulation. Three satellites square measure needed to see a receiver's location; an association with four satellites is right since it provides bigger accuracy. So for a GPS device to figure properly, it should 1st establish an association with the desired range of satellites. This method will take anywhere from several seconds to several minutes, betting on the receiver's strength. For example, a car's GPS unit can establish a GPS association quicker than the receiver in an exceeding watch or smartphone. Most GPS devices conjointly use some variety of location caching to hurry up GPS detection. By memorizing its previous location, a GPS device will quicklyconfirm what satellites will be offered when it scans for a GPS signal.

Mechanism for communication (GSM)GSM (Global System for Mobile Communication)

The Global System for Mobile Communications (GSM) may be a second-generation (2G) customary for mobile networks. Within the early Nineteen Eighties, agaggle was fashioned by the European Telecommunications Standards Institute (ETSI) to develop a digital mobile communication system. Competently named Groupe Speciale Mobile (GSM), its main taskwas to develop one consistent network for all of Europe that is available with a much better robusta improved} and more economical technical answer for wirelesscommunication. The GSM customary operateson 3 different carrier frequencies: the 900 megacycle band, which was utilized by the first GSM system; the 1800 megacycle band, which was another to support the swelling rangeof subscribers and therefore, the 1900megacycle frequency, that is employed chieflywithin the U.S. though GSM relies on the timedivision multiple access (TDMA) systems, its technology uses digital signalling and speech channels and is taken into account a second generation (2G) portable system. Being a cellular network, GSM uses cells to produce wireless communication to subscribers United Nations agency area unit within the neighbourhood of those cells. GSMphones could also be known by the presence ofa Subscriber Identity Module (SIM). This smallobject, concerning as wide as a finger, maybe a removable open-end credit containing a user's subscription info, further as some contact entries. This SIM card allows users to modify from one GSM phone to another. In some countries, particularly Asia, GSM phones are units barred to a particular carrier. The experimental setup of system is shown in figure 5.

Experimental Setup and Implementation

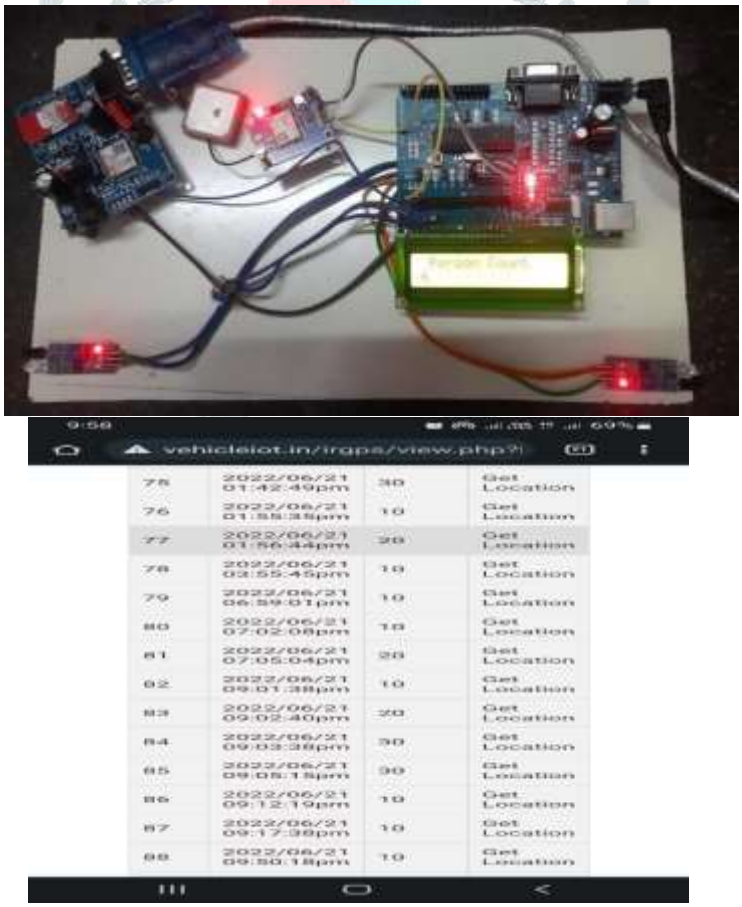

Figure 5: Implementation of our system

At first, the system needs a delay time of 10 secondsto initialize thez GPS module neo 6m and GSMmodule 800C to get connected to the system. The passenger crosses the 1st IR sensor will detect the movement and update the counter. The IoT system will have GSM to transfer the GPS locationand IR sensor counter. Arduino pin 3 and 4 are connected as IR sensor out of data 1 and 2. The transmitter (Tx) pin in Arduino is connected to the receiver (Rx) of the GPS module, and the receiver (Rx) pin in Arduino is connected to the transmitter (Tx) of the GSM module to transmitthe required data to the IoT cloud feature. Figure 6 shows comparative analysis.

RESULT AND ANALYSIS

Table 1: The table shows the result of the system

Context Parameters	Passenger Count	Commuter Location Sharing	Internet of Things (IoT)	Web and Mobile Application	Estimation of bus arrival	Collective Intelligence, Analysis and Sharing
Existing System	✓	×	×	×	×	×
Proposed System	✓	✓	✓	✓	×	×
Future Works	✓	✓	✓	✓	✓	✓

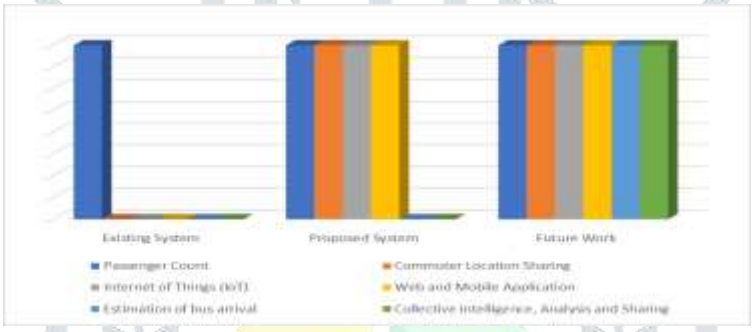

Figure 6: A chart showing the analysis of our system

CONCLUSION

The increasing need for crowd management systems in today's public transport and the scarcityof IoT implementation in public transport. This project has demonstrated a robust, cheap and scalable system to manage crowds in public transport. The website was conducted to check the feasibility of such a system working in a real-time environment. In the future, we will implement Bi-Directional entry and exit on a single gate using momentdetection, autonomous scheduling based on regularscheduling built with Deep Learning, and push notification about the bus's arrival at the stop.

References

[1] Sachin Vidyasagaran, Aditya Varma, Hari Charan, S. Renuga Devi and Rajesh A "A low cost IoT based crowd management system for Public Transport" Proceedings of the International Conference on Inventive Computing and Informatics (ICICI 2017) IEEE Xplore Compliant – Part Number: CFP17L34-ART, ISBN: 978-1-5386- 4031-9.

[2] S. Wang, Y. Hou, F. Gao and X. Ji, "A novel IoT access architecture for vehicle monitoring system," 2016 IEEE 3rd World Forum on Internet of Things (WF-IoT), Reston, VA, USA, 2016, pp. 639-642, doi: 10.1109/WF-IoT.2016.7845396.

[3] E. P. Yadav, E. A. Mittal and H. Yadav, "IoT: Challenges and Issues in Indian Perspective," 2018 3rd International Conference On Internet of Things: Smart Innovation and Usages (IoT-SIU), Bhimtal, India, 2018, pp. 1-5, doi: 10.1109/IoT-SIU.2018.8519869.

[4] V. S. A. A. A. Don, S. W. Loke and A. Zaslavsky, "IoT-Aided Charity: An Excess Food Redistribution Framework," 2018 3rd International Conference On Internet of Things: Smart Innovation and Usages (IoT-SIU), Bhimtal, India, 2018, pp. 1-6, doi: 10.1109/IoT-SIU.2018.8519856.

[5] Y. Jing, B. Guo, Z. Wang, V. Li, J. LAM and Z. Yu, "Crowd Tracker: Optimized Urban Moving Object Tracking Using Mobile Crowd Sensing", IEEE Internet of Things Journal, pp. 1-1, 2017

.