IOT BASED BUS TRACKING AND MONITORING SYSTEM USING GPS AND RASPBERRY PI

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Abstract : The Internet of Things(IoT) is the network of physical objects or things embedded with electronics, software, sensors, and connectivity to enable objects to exchange data using Internet. IoT is present up going and future technology, it is estimated that 25 billion things are interconnected by the end of 2020. This project aims at implementing an advanced and real time system for monitoring and tracking the bus to ensure the safety of public on IoT platform. The system is about providing information of emergencies such as accidents, break down, fire accidents, defilement by immediately sharing the location and images of the inside environment of the bus to the concerned authorities by Email alert. This system provided with user keys. In case of vehicle break down, siren is on through provided key. In case of accidents and defilement an email alert will be sent to the authorities with the images of the inside environment of the bus along with the GPS location of the bus. The complete system uses Raspberry Pi build around using ARMI76JZF-S Micro processor. This project has interface devices such as camera, GPS, speakers to Micro processor. The basic goal of this project is to provide information about location and images of the inside environment of the bus to the concerned authorities by Email alert. The images are captured by using Pi camera and location by GPS module.

IndexTerms **- IoT, Defilement, Microprocessor, ARMI76JZF-S, electronics, software.**

I. INTRODUCTION

Safety is essential when it comes to children and students. School buses transport millions of kids to and from school each year, incidents are bound to happen. Security camera surveillance provides a great tool in school buses. The control and monitoring system in the buses are becoming more and more complex. This is leading to increased use of cluttered wiring difficulty which are difficult to install, service, high cost and hazardous. New technologies using in-vehicle networking methods cannot solve these problems. Safety of the students in the bus depends upon the driver and the physical conditions of that bus. A bus monitoring system combines the use of automatic bus location using GPS, speed control and live video streaming in the bus with specialized software helps to enhance the safety measurements in the school buses.

Emerged Systems

J.Pelegri, *et.al.* proposed a vehicle speed monitoring system by using GMR magnetic sensors. Here a Microcontroller process the signal of sensors to obtain the speed and length of the car in real time[1]. A PC stores the data permanently, and after present it with a software. The signal transfer is based on the FSK modulation.

Rajesh Kannan *et.al.* proposed a wireless sensor network for vehicle speed monitoring and traffic routing[2]. This system is monitored with wireless sensors in order to identify the speed of vehicles and also to regulate the traffic.

Ravi Kishore *et.al.* proposed a over speed monitoring system[3]. This system calculates the speed and GPS coordinates which are able to find out the vehicle maximum speed in the respective area. If the speed of the vehicle exceeds the speed limit, the driver is alerted through a buzzer. If the driver still does not drive within the speed limit, a SMS will be sent to the concerned authorities.

G.Kirankumar *et.al.* proposed a vehicle speed monitoring system using Rubee protocol[4]. This approach involves a fixing device called Rubee in all vehicles and by installing two receivers at a specific distance. Here receivers receive and store the license plate details.

Ahmed Al-Gindy *et.al.* proposed a RFID speed monitoring system which is able to identify the objects in certain range[5]. A vehicle speed can be approximated by travelling between two RFID readers. These RFID readers are placed at known and predetermined distances from each other.

Proposed System

Many of the papers for vehicle monitoring are based on sensor networks, RFID measurements and GPS routing. RFID speed monitoring systems have a limitation of range which is predominantly fixed. By using sensors information monitoring and exact location of the bus requires a sequence data. If the sequential flow of data is missed at the time of communication between the bus and the base system, the overall data is corrupted. So these papers have a limitation in complexity of monitoring the vehicle data in real time. In addition to that, analyzing the situation in the bus if there is any panic condition also consuming more amount of time. So we are proposing a system that which is a new version of emerged systems.

In this paper we are introducing a new system that is capable of gathering the data of each and every location of the bus. This is the advanced version of emerged systems which are incapable of exact route locations, speed limit and condition of the bus. This system is comprised with three modes of data monitoring and live video streaming.

Level 1: Live Video, Email alert, Siren

- Live Video recorders offer tough and lasting performance in any bus environment. Live video recording deters bullying and vandalism, ensures student ridership, and notifies document chain of events.

- Email alert can be sent in two different forms. One is location details and another is image captured by the surveillance camera in the bus. If location details are sent via email alert then GPS is initiated. If image is sent via email alert then the picture is captured by using the camera in the bus. When the camera is ON then video recording is paused and later on it works normally.
- Siren system is used to alert the driver when there exist any panic situation in the bus. At that time, driver activates the siren system. This siren system is also used to alert the passengers and neighboring vehicles.

Level 2: Remote monitoring at Owner side and Speed alert

- A web page is created by using HTML and Java Script Programming. This helps the owner to look out the condition of the bus. If there are any emergency situations in the bus, then there will be a chance of acting before something happen.
- Speed alert can be sent to the driver and the owner if the speed of the bus exceeds 60kmph.

Level 3: Passenger alert

- Passenger alerts are used for easy navigation of blinds [6]. The passenger alerts are for the safety and security of the passengers.

II. SYSTEM ARCHITECTURE

The architecture of this project consists of two parts.

1. Embedded Control Unit
2. Remote Control Unit

The Embedded control unit must be installed in the bus. This unit has a Raspberry Pi 3 processor, accelerometer, class D amplifier, GPS module, camera module, wifi access, LCD display, user keypad, loud speaker and a memory management system. Raspberry Pi 3 is a tiny credit card size computer. It has a 64 bit ARM11 cortex processor with camera, display and HDMI ports. Accelerometer is used for speed alerts. Class D amplifier is used for boosting up the power. The user keypad is controlled by the driver. It has three buttons. Button 1 is for Email alert, button 2 is for mode select. Mode select has two options, one is default video mode and another one is image mode. Button 3 is for siren alert.

Fig. 1 Web page of Remote unit

The Remote control unit is accessed by a web page using python programming. This unit is viewed by the owner. Each and every student who is entering in to the bus will be captured by the camera installed in the bus. A live video will be sent to the owner by using this camera. If there are any conflicts or any accidents occurred, then an alert will be sent to the owner before something is happened and parallely siren system is also enabled by manually or by mobile alert of the owner or driver. If the speed is increased more than 60 KMPH then also siren is activated. The transfer of data of both image and video cannot be possible at a time, because the camera should be switched between two modes. Thais data can be sent using GPS module. It is also viewed by the driver in the bus by using LCD display and the owner by a web page. The passenger alert also provided to this system using GPS.

III. BLOCK DIAGRAM

The block diagram of this system is,

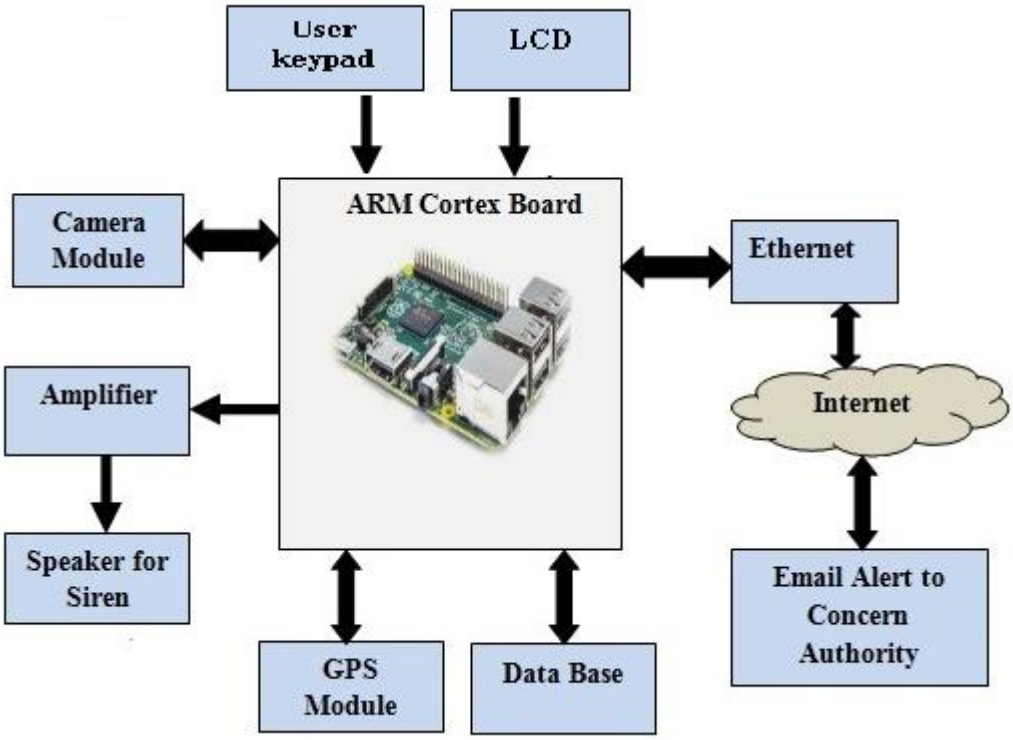

Fig 2 Block diagram

The block diagram consists of an ARM cortex processor. ARM stands for Advanced RISC Machine. ARM 11 is based on ARM v6 instruction set architecture. Since many embedded devices have smaller amounts of memory, So 16-bit instruction set is used in ARM. Thumb instructions are decoded into ARM instructions. CPU is either in ARM state or Thumb state [7]. User keys are available to the left hand side of the driver's seat. User keys sent the data to the ARM processor in order to process the initial data. These keys provide email alerts, mode select and siren alert.

The Mode select has two options, default video mode and image mode. According to mode select option either image or video will be sent to the destination or the owner. The sent data will be amplified by using an amplifier. A speaker is provided for siren system. The amplified data will be sent to the destination through GPS. GPS is used to track the position of the bus. It transmits data and operates independently of any internet reception. So the location of the bus is traced out easily. The data which is transmitted to the owner can be stored in the database for future purpose. An Ethernet connection is provided to the embedded control unit of the bus. The bus location and the functioning of the bus with route alerts are sent to the owner for every 30 mins.

IV. WORKING PRINCIPLE

Each and every student who is entering in to the bus will be captured by the camera installed in the bus. A live video will be sent to the owner by using this camera. If there are any conflicts or any accidents occurred, then an alert will be sent to the owner before something is happened and parallely a siren system is also enabled by manually or by mobile alert of the owner or driver. If the speed is increased more than 60 KMPH then also siren is activated. The transfer of data of both image and video cannot be possible at a time, because the camera should be switched between two modes. Thais data can be sent using GPS module. It is also viewed by the driver in the bus by using LCD display and the owner by a web page. The passenger alert also provided to this system using GPS.

V. FLOWCHARTS

Flowchart for Mode 1

This is the flowchart that represents mode 1 that includes live video inside the bus, email alert with location details and siren system which functions both manually and automatically.

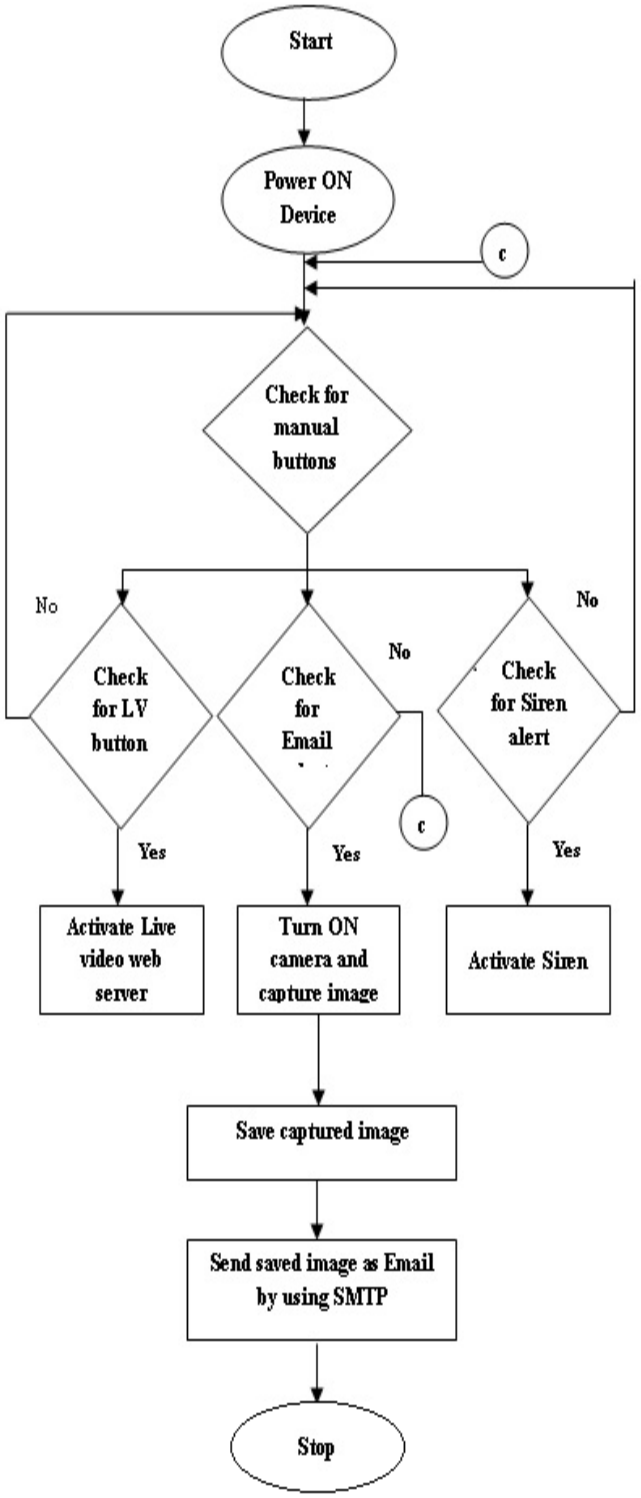

Fig 3 Flowchart for Mode 1

Flowchart for Mode 2 and Mode 3

This flowchart represents speed alert of 60KM and passenger alert of number of passengers those who are entered in the bus. Mode 2 and Mode 3 is in driver control and owner control.

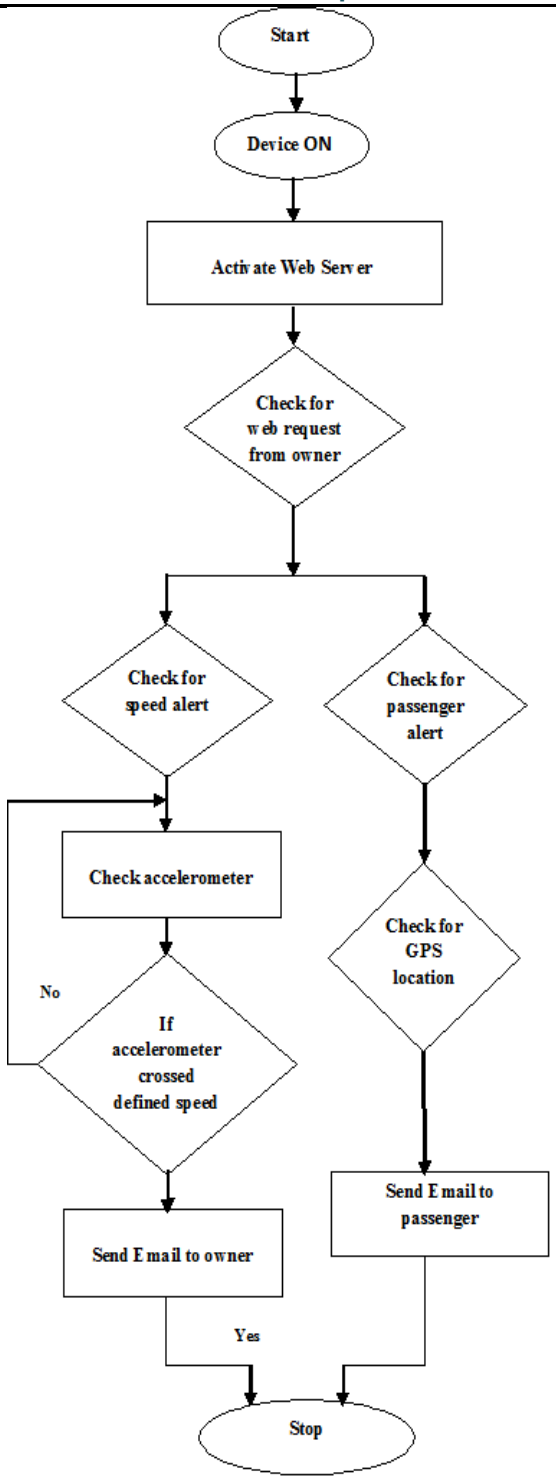

Fig 4 Flowchart for Mode 2 and Mode 3

VI. RESULTS

This is the image of the location of the bus. Now-a-days, due to growing world & importance of the time in day to day life, there is need of effortless transport [8]. Tracking systems are rarely available in the market and available systems are not good and effective systems are costly. This system is much economical than other system are currently available now in the market. This suggested system helps to getting information and location of college bus or school by using mobile or smart phone [9]. GPS is an integral part of this system. There are more advantages by installing a GPS module in this project. The bus location can be easily tracked and monitored by using GPS in this project. The range is not sustained by using GPS. The communication between Embedded control unit and Remote control unit is easily possible with the GPS. Bus location and navigation is continuously tracked. if driver changed the bus route then that will known to the owner by using GPS module in bus system. The real time tracking of the bus ensures the speed control. So the owner will be alerted in case of over speeding by bus driver. It provides the effective management of the bus. It also reduces the time that will be spent at an unuthorized location. It has low operational cost and high productivtity. The continous tracking of the bus even in long range is possible by using GPS that which provides a better result. Everyone ensures about the safe and effective transportation. This system is the safest and effortless transportation system.

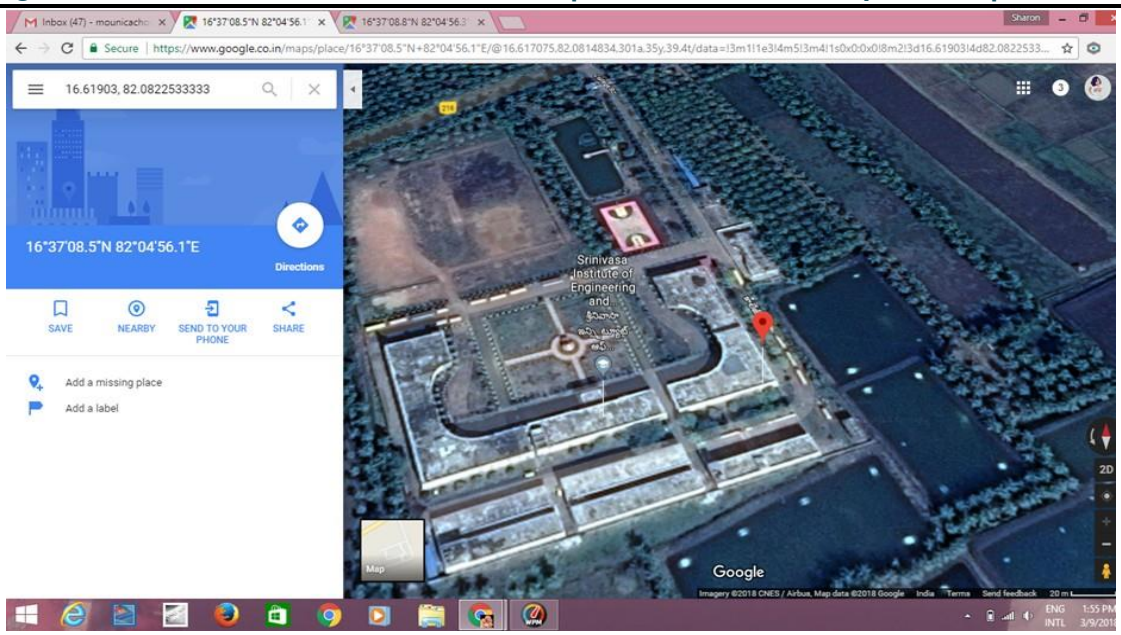

Fig. 5 GPS location of the bus

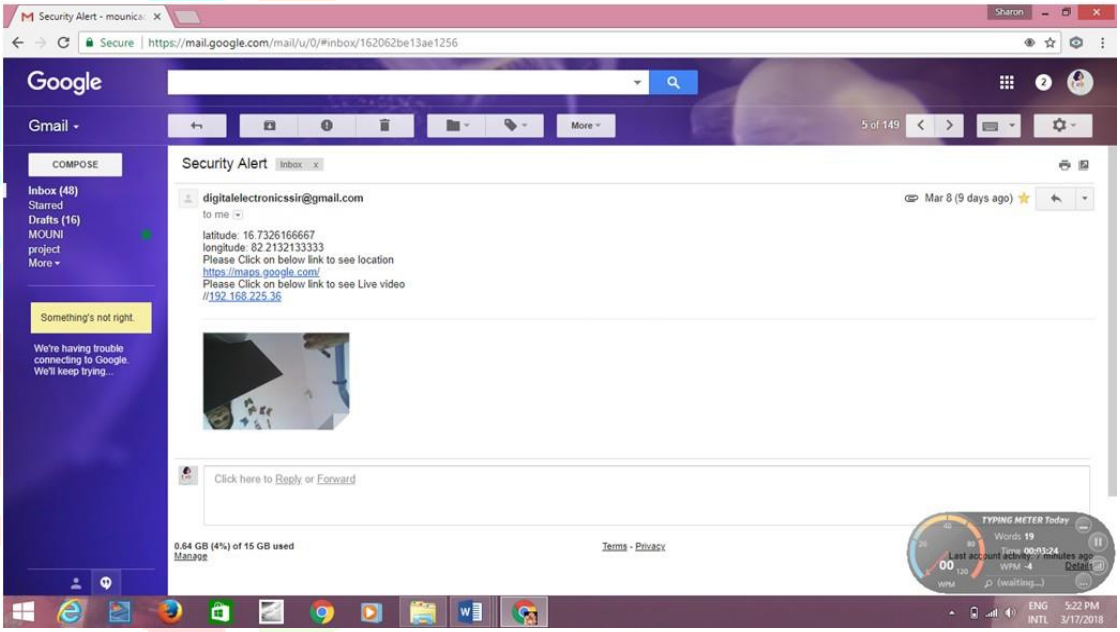

Fig. 6 E-mail alert of bus location

The location of the bus can be observed continuously using GPS system. The GPS satellites transmit signals to a GPS receiver. These receivers statically receive signals. GPS satellite transmits data that indicates the location and current time of the vehicle [10]. After locating the bus, the location details are sent to the owner through an E-mail alert. This is the image of the E-mail alert of the bus location. By using live video streaming in the bus, the situation in the bus is analysed. A live video stream provides an actual information about what is happening inside the bus. If there is any panic condition arises, then an email alert is sent to the owner and siren system is enabled for alerting the passengers and other vehicle users. Either image or video will be sent to the owner based on the mode selection pins. Whenever the bus is failed to leave or return then the email alert will be send to notify the delay. Unauthorize accessing of the bus and excessive speeding also effects the bus transportation. These will be monitored and persists the situation through an email alert within a 30 seconds gap. Then the action will be taken immediately. Authors in the IoT enabled navigation system for urban bus riders named as Urban Bus Navigator (UBN) [11], presented about wireless transmission of the signal of bus location through an email alert. UBN monitors the wireless signals of mobile phones seen on buses to recognize bus passenger crowds and provides enhanced reality aware bus route recommendation to avoid overcrowding on public bus journeys. Route is continuously tracked and monitored by using GPS module.

VII. CONCLUSION

This paper presents the design and the implementation of a smart bus monitoring system which is advancement in commercial bus transportation system. On board video surveillance system in bus transportation eliminates even minor glitches. The software is equipped with components that make the bus journey safer, convenient and accountable. Live video in the bus alerts the owner of

the remote location in case of panic situations through an e-mail alert. By live video, reports can be analyzed like over speed, harsh breaking, vehicle ideal time, halt time, ignition on/off to closely monitor the security compliance and Driver's behavior.

Live Tracking helps to identify the current location of the bus. Today, the use of GPS enabled bus tracking system reduces the crime rates. By using GPS, improves the efficiency, profitability and safety of most commercial bus transportation systems.

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