Automatic Accident Detection and Alerting System Using GPS Module and Raspberry Pi

[1]D.Siva Sandeep, [2]K.Bharath Babu, [3]T.Shashank, [4]R.V.Prudhvi Charan, [5]D.Vijendra Kumar

[1, 2, 3,4]U G Scholar, [5]Assistant Professor

[1]Electronics and Communication Engineering

1Godavari Institute of Engineering and Technology, Rajahmundry, Andhra Pradesh

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 Vehicle to ensure the safety of public on IOT platform. The system is about providing information of emergencies case such as accidents, break down, fire accidents, defilement by immediately sharing the location and images of the inside environment of the Vehicle to the concern authorities by Email alert. The system provided with user keys. In case of vehicle breakdown, siren is on through provided key. In case of accidents & defilement an email alert will be sent to the authorities with the images of the inside environment of the Vehicle along with GPS location of the Vehicle. The complete system uses Raspberry Pi build around using ARMII76JZF-S Microprocessor. This project has interface devices such as camera, GPS, Speakers to microprocessor. This basic goal of the project is to provide information about location and images of the inside environment of the Vehicle to the concern authorities by Email alert. Location details obtained by GPS module.

Index Terms **– IOT, GPS Module, LCD, Raspberry Pi.**

I. INTRODUCTION

Day by day traffic is increasing rapidly in India. Most of the people travel by Vehicle, as it is the safest mode of transportation. The development of transport system is unbalanced. There is heavy pressure on road transport in certain cities and regions.

For balanced development of region, alternative routes should be developed e.g. Metro in Delhi has decreased the pressure on road transport. Modernization and use of latest technology in transport system is the need of hour. In road transport system, we are using age old technology so our progress is slow. 80% and above of Vehicles plied by State Road Transport Corporations are out-dated and out modeled.

The main problems of existing Vehicle transport system is irresponsible behavior of the driver, uncertain traffic conditions, Vehicle equipment defects, and lack of passenger protection. Safety is essential when it comes to children and students. School Vehicle's transport millions of kids to and from school each year, incidents are bound to happen. Security camera surveillance provides a great tool in school Vehicles. The control and monitoring system in the Vehicles 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 Vehicle depends upon the driver and the physical conditions of that Vehicle. A Vehicle monitoring system combines the use of automatic Vehicle location using GPS, speed control and live video streaming in the Vehicle with specialized software helps to enhance the safety measurements in the school Vehicles. GPS is a device which is more used in mobile phones to track the road maps. The whole processing of this system relays on ARM cortex board.ARM cortex board is interfaced to GPS.

II. LITERATURE SURVEY

Public vehicle remains the primary mode of transport for most Indian citizens, and India's public transport systems are among the most heavily used in the world. Motor vehicle population in India is low as per international standards, with only 24.85 million cars on the nation's roads as of 2013.[1] In total, about 21 percent of households have two wheelers whereas only 4.7 percent of households in India have cars/jeeps/vans as per the 2011 Census.[2] Despite this, the number of deaths caused by traffic is amongst the highest in the world and increasing.

So Vehicle transportation is the basic mode of transportation in India which is safe and convenient. But the Vehicle transportation in India lacks proper maintenance which leads to fatal Vehicle accidents. A major school Vehicle accident in Nurpur, Himachal Pradesh in April 2018. At least 23 children and two teachers were killed when a school Vehicle plunged 328 feet into a gorge in Himachal Pradesh's Malkwal, on the Punjab border. The driver is unaware of the location of the destination that he has to go. So he drives the Vehicle in a route that which has gorge. If he had the GPS location of the destination the accident may not be happened. This leads to the idea of implementing a GPS in our project, in order to trace out the exact location of the Vehicle. In addition to this, a surveillance camera also implemented in our project which provides a live video stream to the owner at remote pl Nimisha Chaturvedi and Pallika Srivastava says that "The always advancing technology has made our day to day lives easier. Since every coin has 2 sides similarly technology has its benefits as well as its disadvantages. The rise in technology has increased the rate of road accidents which causes huge loss of life. The poor emergency facilities available in our country just add to this problem. Our project is going to provide a solution to this problem. According to our project when a vehicle meets with an accident, a sensor situated on the vehicle will detect it immediately and send a message to the microcontroller. The microcontroller then sends the alert message with the help of GSM modem to a police control room or rescue team which will include the location with the help of GPS. Also the alert message containing the location of accident will be send to the relatives of the victim. In case there is no casualty the driver can terminate the alert message by a switch provided in the vehicle. This will save the valuable time of rescue team. Our

project is useful for detecting the accident precisely with the help of sensor and microcontroller. Keeping in mind the scope for improvement, we can add a wireless webcam which will capture the images at the time of accident which will help in providing accurate help to the victim as quick as possible. It can be interfaced with vehicle airbag system and a bomb detector."

Lih-Jen Kauand Chih-Sheng Chen proposed that "this paper a novel algorithm as well as architecture for the fall accident detection and corresponding wide are are scue system based on a smart phone and the third generation (3G) networks. To realize the fall detection algorithm, the angles acquired by the electronic compass (ecompass) and the waveform sequence of the triaxial accelerometer on the smart phone are used as the system inputs. The acquired signals are then used to generate an ordered feature sequence and then examined in a sequential manner by the proposed cascade classifier for recognition purpose. Once the corresponding features verified by the classifier at current state, it can proceed to next state; otherwise, the system will reset to the initial state and wait for the appearance of another feature sequence. Once a fall accident event is detected, the user's position can be acquired by the global positioning system (GPS) or the assisted GPS (A-GPS), and sent to the rescue center via the3G communication network so that the user can get medical help immediately. With the proposed cascaded classification architecture, the computational burden and power consumption issue on the smart phone system can be alleviated. Moreover, as we will see in the experiment that a distinguished fall accident detection accuracy up to 92% on the sensitivity and 99.75% on the specificity can be obtained when a set of 450 test actions in nine different kinds of activities are estimated by using the proposed cascaded classifier, which justifies the superiority of the proposed algorithm."

Pham Hoang Oat, MichealDrieberg and Nguyen Chi Cuong says that "The ability to track vehicles is useful in many applications including security of personal vehicles, public transportation systems, fleet management and others .Furthermore, the number of vehicles on the road globally is also expected to increase rapidly. Therefore, the development of vehicle tracking system using the Global Positioning System (GPS) and Global System for Mobile Communications (GSM) modem is undertaken with the aim of enabling users to locate their vehicles with ease and in a convenient manner. The system will provide users with the capability to track vehicle remotely through the mobile network. This paper presents the development of the vehicle tracking system's hardware prototype. Specifically, the system will utilize GPS to obtain a vehicle's coordinate and transmit it using GSM modem to the user's phone through the mobile network. The main hardware components of the system are u-blox NEO-6Q GPS receiver module, u-blox LEON-GIOO GSM module and Arduino Uno microcontroller. The developed vehicle tracking system demonstrates the feasibility of near real-time tracking of vehicles and improved customizability, global operability and cost when compared to existing solutions."

Giovanni Acampora, Diane J. Cook, Parisa Rashidiand Athanasios V. Vasilakos together proposed that "Ambient Intelligence (AmI) is a new paradigm in information technology aimed at empowering people's capabilities by means of digital environments that are sensitive, adaptive, and responsive to human needs, habits, gestures, and emotions. This futuristic vision of daily environment wills enable innovative human–machine interactions characterized by pervasive, unobtrusive, and anticipatory communications. Such innovative interaction paradigms make Am I technology suitable candidate for developing various real life solutions, including in the healthcare domain. This survey will discuss the emergence of AmI techniques in the healthcare domain, in order to provide the research community with the necessary background. We will examine the infrastructure and technology required for achieving the vision of AmI, such as smart environments and wearable medical devices. We will summarize the state-of-the-art artificial intelligence (AI) methodologies used for developing AmI system in the healthcare domain, including various learning techniques (for learning from user interaction), reasoning techniques (for reasoning about users goals and intensions), and planning techniques (for planning activities and interactions). We will also discuss how Am technology might support people affected by various physical or mental disabilities or chronic disease. Finally, we will point to some of the successful case studies in the area and we will look at the current and future challenges to draw upon the possible future research paths."

Vikram Singh Kushwaha , Deepa Yadav,AbuyeedTopinkatti, Amrita Kumari says that "India witnessed one road accident every minute in 2011 which claimed one life every 3.7 minutes, one of the highest in the world. Mint reported last year: As per the National Crime Records Bureau (NCRB), in the year 2011 there were 440,123 road accidents resulting in the death of 136,834 people. The incidence of accidental deaths increased by 44.2% in 2011 from 2001.This paper proposes a new dimension in order to allow early response and rescue of accident victims; saving lives and properties. Our system uses the capability of GPS and GSM along with the android phone to provide a solution which can be used to precisely detect the accident spot and to send the emergency notification to the nearby hospital s ICU and to the victim s relatives. The proposed system consists of two unit namely, Crash Detector Embedded Unit and Android Control Unit. Crash Detector Embedded Unit is responsible for detecting the accident condition using three-axis accelerometer sensor, position encoder, bumper sensor and one false alarm switch. Bluetooth module (HC-05) is used to send the accident notification to the victim s android phone where an android app will get the GPS location of accident spot and compare it with all the nearby hospital s location in order to calculate the shortest path and send the notification to the nearest hospital s ICU as mentioned earlier in the form of SMS. Keywords: GSM, Crash Detector, Bluetooth, GPS, Android phone, sms notification to hospital.

III. EXISTING METHOD

The usage of auto mobiles has improved linearly over the past decade, which increased in the risk of human life. This is because due to the insufficient emergency facilities .In this paper we are using a alarm system which helps in improving the emergency system of the accident system. This system detects the accident occurrence and the co-ordinate of the accident are messaged to the rescue team .A switching system issued switch off in case there are no causality. The Accident is detected with the help of MEMS Sensor and Vibration Sensor. The Angle in which the car has rolled off is indicated through a message. This Application helps in providing feasible solution to the poor emergency facilitates.

3.1 WORKING PRINCIPLE

The Prototype of this Accident Detection and information passing technique uses the following steps:

1. The complete setup is depicted in the form of Block Diagram.
2. A Piezoelectric sensor detects the first occurrence of the accident and it is intimated to the MCU.
3. The Latitude and Longitude are detected using GPS and it is sent as message to the rescue team through GSM.
4. The message receiver number is pre stored in the EEPROM.
5. A OFF Switch is also provided at times of need to avoid false message.

In this paper GSM helps in controlling the DC motor, stepper motor, Temperature sensor and solid state relay by messaging schemes. This scheme helps in reducing the need of manual systems which are time consuming and not efficiency for usage. But the proposed system is fully automatic and can function without any manual interruption. Hence this automatic system is more efficient and less expensive and more convenient to use from wherever possible. Hence can be preferred mode of communication for controlling purpose.

GPS helps in both tracking and navigation purpose.Tracking systems are used to keep track of the vehicle without the intervention of the driver. But a navigation system guides the driver to reach the destination without any disruptions. Both tracking and navigation uses the same architecture. As a accident occurs the tracking stem detects the accident prone vehicle and a message assent to the rescue team through a call or SMS.

3.2 Block Diagram

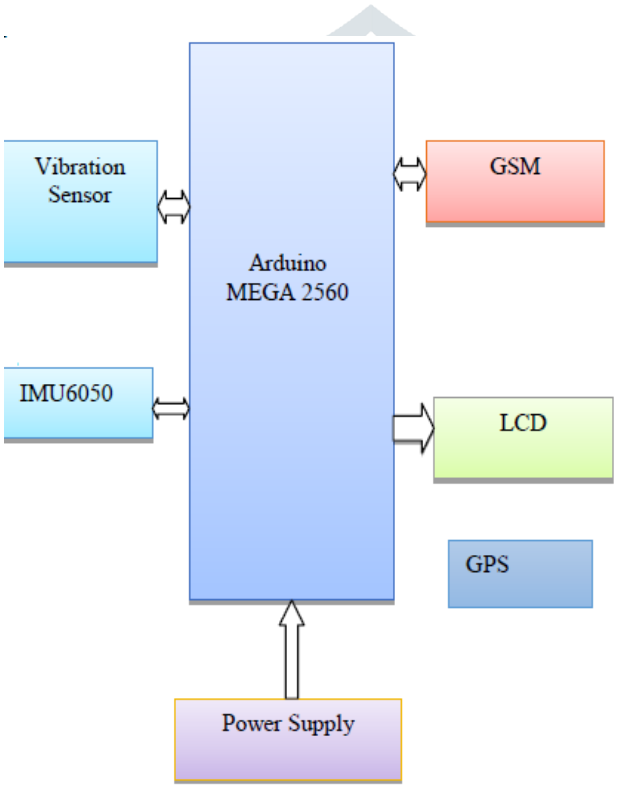


Fig 1 Automatic accident detection and alerting using GPS and GSM

3.**3 Hardware Description**

The ARDUINO MEGA BOARD 2560 is an open source electronic platform which supports both ADC and DAC conversions. Its software Arduino IDE version 1.6.5 is used for programming the board. We can be infer that GSM accident detector , the IMU6050accelerometer and gyroscope are used to detect the posture of motion. In the proposed scheme, the gyroscope is to acquire the tilt angle, i.e., pitch, of the vehicle. This is because when the elderly is suffering an accident event, the vehicles tend to lie down, and the pitch angle is usually small. Actually, the work of acquiring the pitch angle of the vehicle can also be accomplished by using a gyroscope which provides the angular acceleration information of the GSM .Furthermore, the tilt angle pitch angle of the Vehicle is estimated by using the IMU6050 in conjunction with the accelerate meter. The gyroscope helps in calculating pitch angle which helps in applying the proposed algorithm.

3.3.1AT MEGA 2560 MICRO CONTROLLER

The Arduino Mega ATmega2560 is a development board developed for projects by an Italian company named „Arduino", providing an open-source hardware and software ecosystem. The main purpose of the Arduino is to communicate with the electronic devices and achieve many procedures in the real world.

3.3.2 UBLOX NEO 6M GPS RECEIVER MODULE

Ublox NEO 6M is a standalone GPS receiver designed for low power consumption and low cost. This module can withstand environmental conditions and electrical testing when performed for road vehicles. The receiver is of the dimension 12.2 x 16.0 x 2.4 mm, which is a 24 pin LCC (Leadless Chip Carrier) package. The module has the ability to interface serially in various forms as mentioned below.

3.3.3 SIM800A GSM

SIM800A is most used GSM module in Arduino community. SIM800A is easily interacts with Arduino which is more easy for beginners. The below table shows interaction of GSM and Arduino.

3.3.4 LCD

The LCD display is a display device which that isused to print text, make custom characters, bink text, and position text. The display is 20X4 matrixes which mean that the LCD has 4 rows and 20 columns. Thus, it can display 80 characters at once.LCD is a flat-panel display that uses the light modulating properties of liquid crystals. Liquid crystals use backlight or reflector to produce images in colour or monochrome. LCDs display arbitrary.

3.4 DISADVANTAGES

At present, existing method employs GSM module. Main drawback of this method is that GSM modules works on only 2G sim and they are not available for 3G/4G sim networks. Thus we can over this drawback by employing cloud server for email alert.

IV. PROPOSED METHOD

Vehicle monitoring system consists of two components, Embedded Control Unit (ECU) is part of Vehicle monitoring where security system implemented and Remote Control Unit (RCU) is a framework implemented on Users smart phone.

4.1. EMBEDDED CONTROL UNIT (ECU)

ECU is an efficient, low power consumption and low cost embedded access control system for Smart home security and allows user to remote monitoring and alerting. ECU consists of Raspberry Pi set up with Raspbi an Operating System on installed SD card. User keys, amplifier circuit, GPS and Pi Camera are interfaced with Raspberry Pi to track the exact location of the Vehicle respectively. Captured images with time and date are saved on SD card. Raspberry Pi configured for enabled camera. ECU also consists of a Wifi module in order to transmit the captured image or video to the remote control unit through e-mail alert.

4.2 REMOTE CONTROL UNIT (RCU)

RCU is a software tool implemented on Users Smart Phone. Provide GUI (Graphical User Interface) to send predefined Linux Terminal Commands via SSH to ECU. SSH is a secure protocol and the most commonly used to administrate and communicate with Linux servers. RCU is implemented on android platform using Java Script on JDK (Java Development Kit) and Eclipse IDE.

4.2 BLOCKDIAGRAM

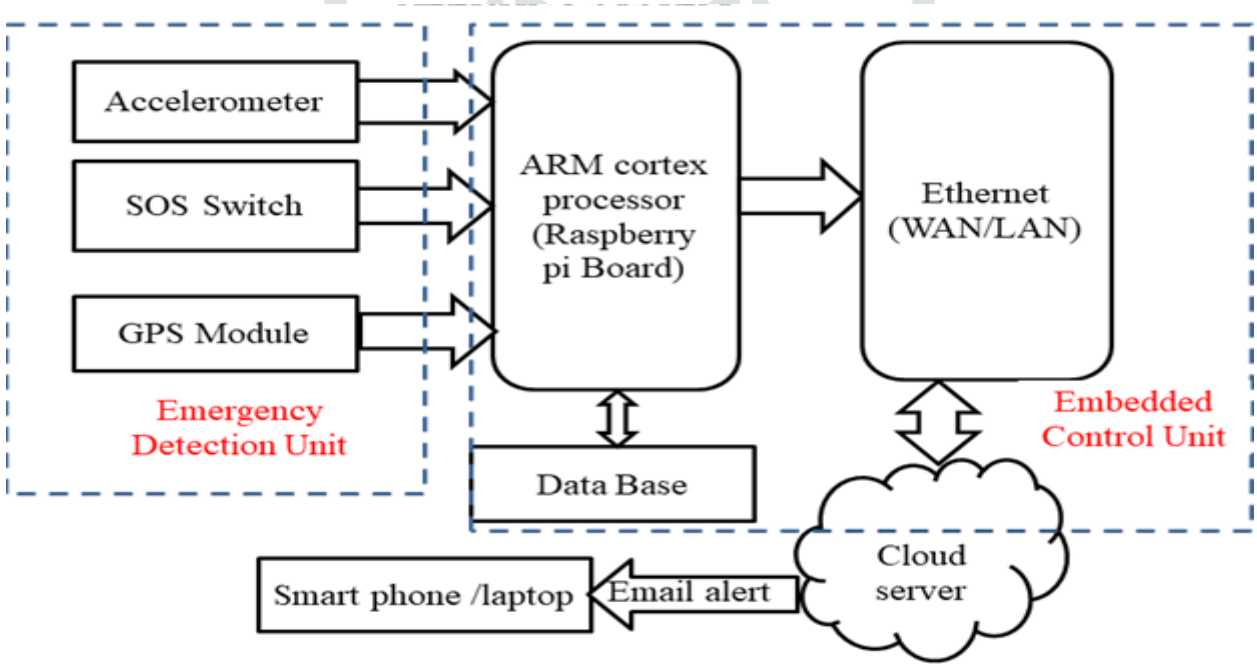


Fig. 2 Automatic accident detection and alerting using Raspberry pi and GPS

4.3 RASPBERRYPI

Raspberry Pi board [6] is a miniature marvel, packing considerable computing power into a footprint no larger than a credit card. The processor at the heart of the Raspberry Pi system is a Broadcom BCM2835 system-on-chip (SoC) multimedia processor. This means that the vast majority of the system's components, including its central and graphics processing units along with the audio and communications hardware, are built onto that single component hidden beneath the 512MBmemorychipatthecentreoftheboard.It'snotjustthisSoCdesignthatmakes the BCM2835 different to the processor found in your desktop or laptop, however. It also uses a different instruction set architecture (ISA), known as ARM. The Raspberry Pi, by contrast, is designed to run an operating system calledGNU/Linux Raspbian. Hereafter referred to simply as Linux. Unlike Windows or OS X, Linux is open source: it's possible to download the source code for the entire operating system and make whatever changes you desire.

4.3.1 HISTORY OF RASPBERRYPI

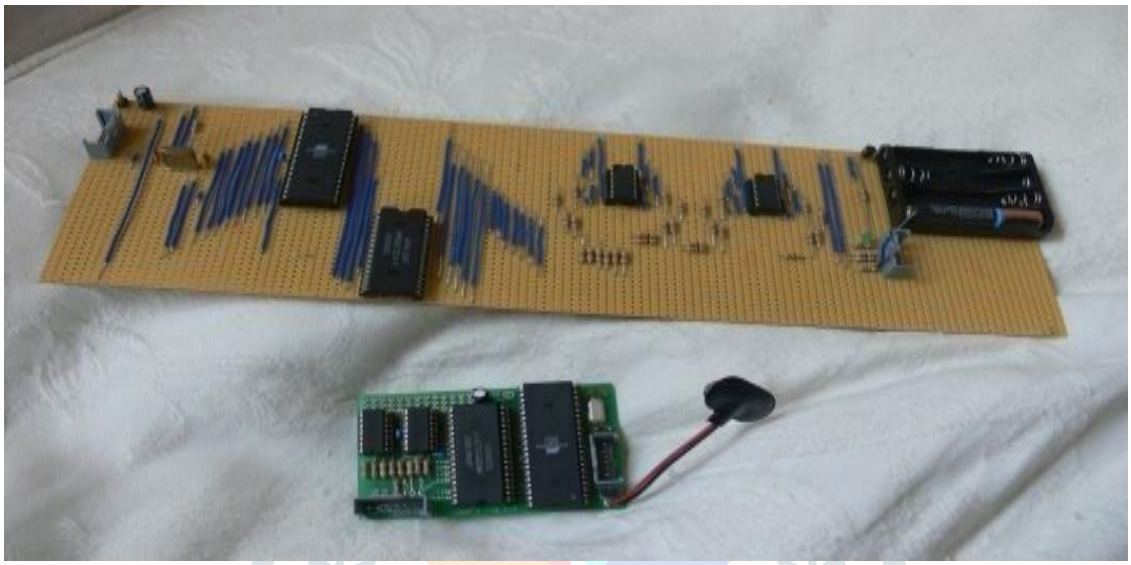
The idea behind a tiny and affordable computer for kids came in 2006, when Eben Upton, Rob Mullins, Jack Lang and Alan Mycroft, based at the University of Cambridge's Computer Laboratory, became concerned about the year-on-year decline in the numbers and skills levels of the A level students applying to read Computer Science. From a situation in the 1990s where most of the kids applying were coming to interview as experienced hobbyist programmers, the landscape in the 2000s was very different; a typical applicant might only have done a little web design.

Something had changed the way kids were interacting with computers. A number of problems were identified: majority of curriculums with lessons on using Word and Excel, or writing web-pages; the end of the dot-com boom; and the rise of the home PC and games console to replace the Amigas, BBC Micros, Spectrum ZX and Commodore 64 machines that people of an earlier generation learned to program on

- *Initial Design Considerations*

From 2006 to 2008 they created many designs and prototypes of what we now know as the Raspberry Pi. One of the earliest prototypes is shown below:

Fig. 3 One of the earliest prototype of the Pi



These boards use an Atmel ATmega644 microcontroller clocked at 22.1MHz, and a 512K SRAM for data and frame buffer storage.

By 2008, processors designed for mobile devices were becoming more affordable, and powerful enough to provide excellent multimedia, a feature which would make the board desirable to kids who wouldn't initially be interested in a purely programming-oriented device. The project started to look very realizable and feasible. Eben (now a chip architect at Broadcom), Rob, Jack and Alan, teamed up with Pete Lomas, MD of hardware design and manufacture company Norcott Technologies, and David Braben, co-author of the BBC Micro game Elite, to form the Raspberry Pi Foundation to make it a reality. Three years later, the Raspberry Pi Model B entered mass production through licensed manufacture deals with Element 14/Premier Farnell and RS Electronics, and within two years it had sold over two million units.

4.3.2 FEATURES OF THE RASPBERRYPI

- Model B+ Raspberry Pi with Mounting Points
- 512MBRAM.
- Broadcom BCM2835 ARM11 700MHz
- Integrated Video core 4 Graphics GPU capable of playing
- Full 1080p HD Video.
- 4 x USB Ports (Max Output 1.2A).
- Board Power Draw:600mA.
- HDMI Video Output.
- 10/100Mb Ethernet Port for Internet Access.
- Micro SD Flash Memory Card Slot.
- 40-pin 2.54mm Header Expansion Slot (Which allow for peripherals and expansion boards)
- Dimensions 85 x 56 x 17mm.
- The Raspberry Pi is boot by external memory card with Raspbian Jessie images

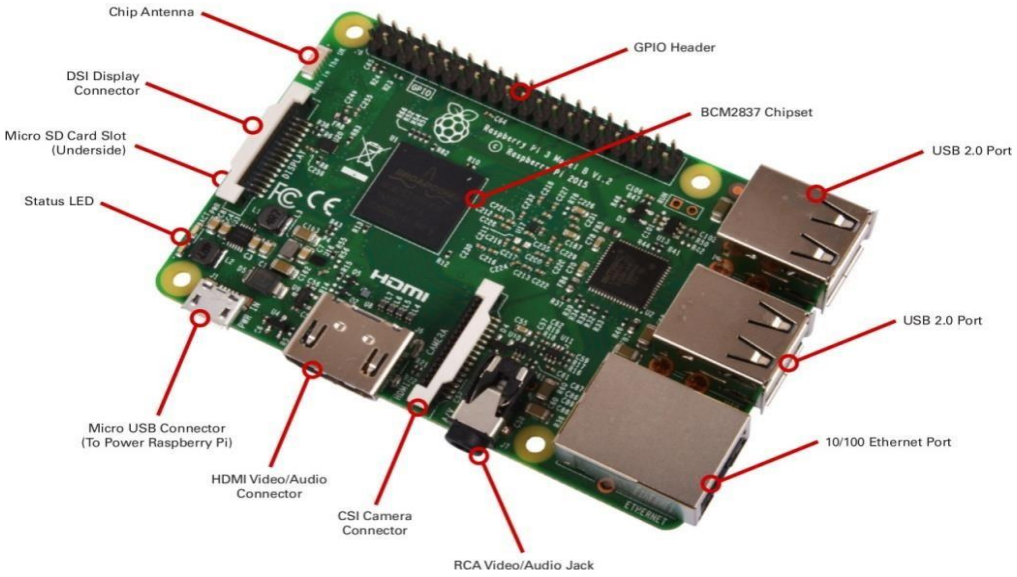


Fig. 4 Raspberry Pi3

V. RESULTS

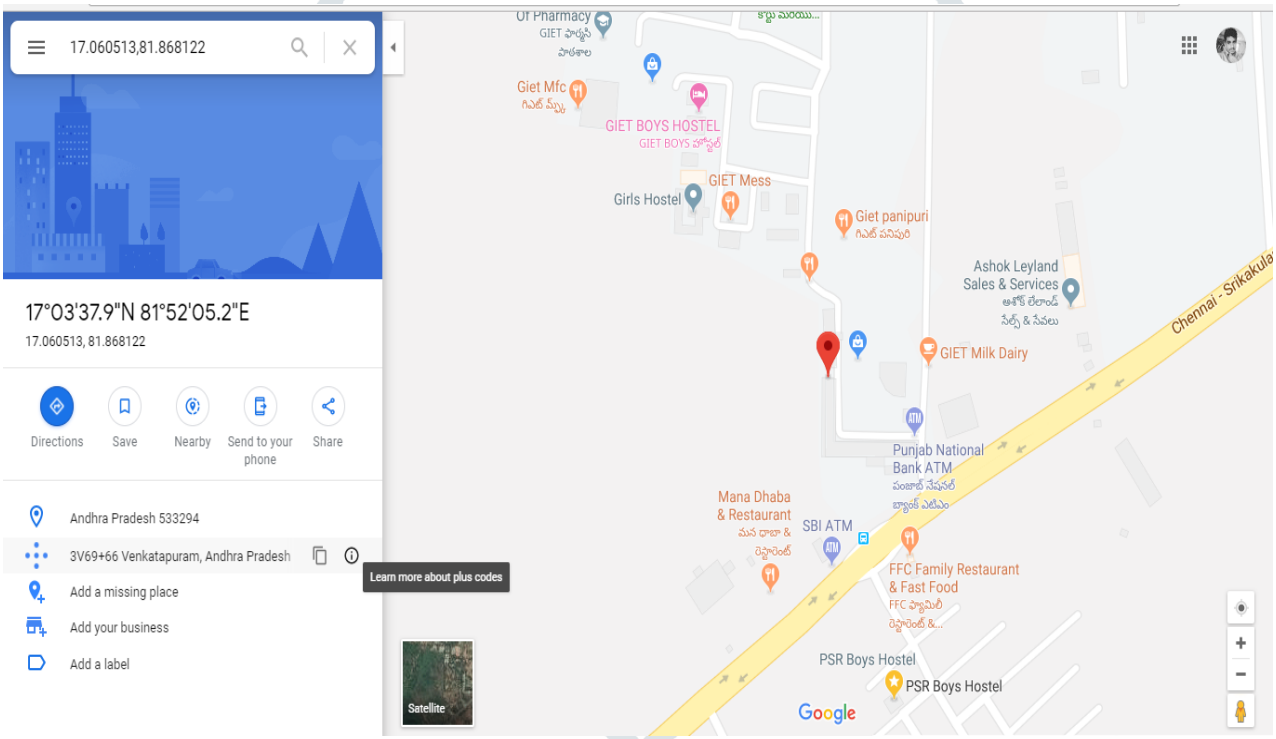


Fig 5 GPS location of the Vehicle

This is the image of the location of the Vehicle. The Vehicle location can be easily tracked and monitored by using GPS in this project.

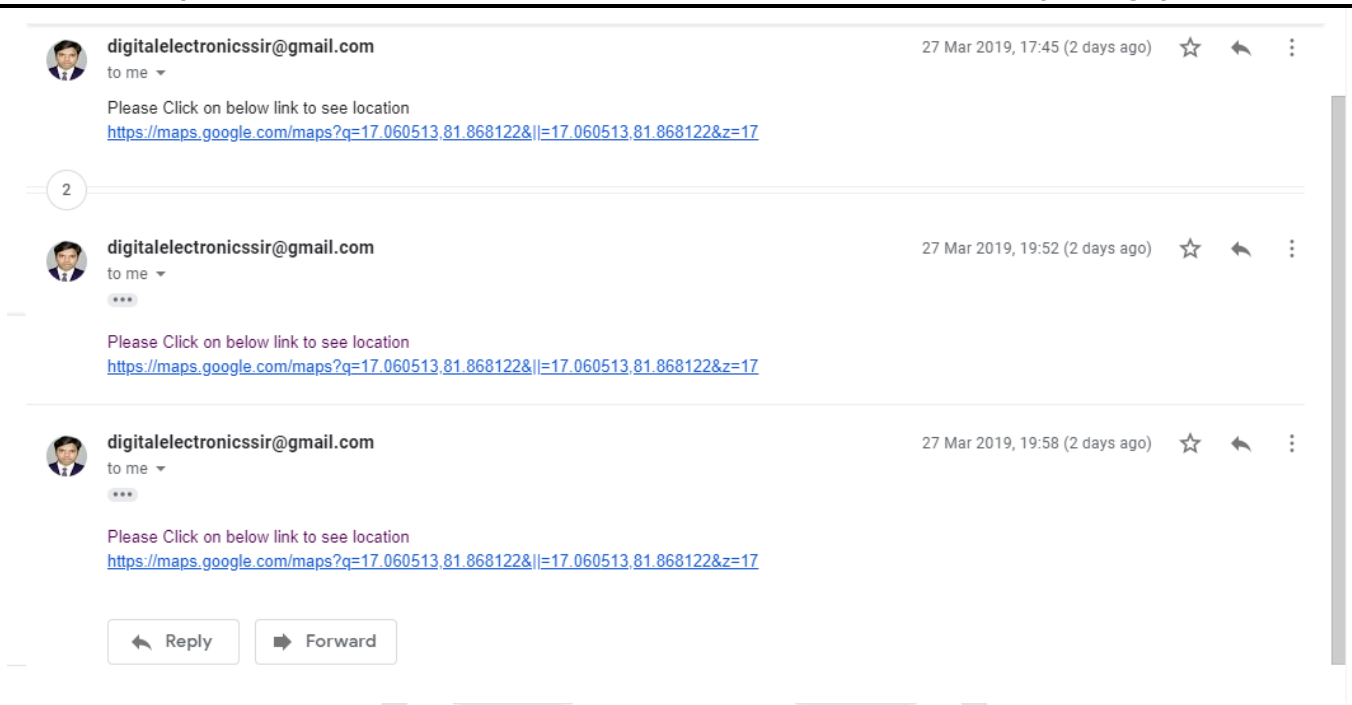


Fig 6 E-mail alert of Vehicle location

After locating the Vehicle, the location details are sent to the owner through an E-mail alert. This is the image of the E-mail alert of the Vehicle location.

VI. CONCLUSION

This paper presents the design and the implementation of a smart Vehicle monitoring system which is advancement in commercial Vehicle transportation system. On board video surveillance system in Vehicle transportation eliminates even minor glitches. The software is equipped with components that make the Vehicle journey safer, convenient and accountable. Live video in the Vehicle 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 Vehicle. Today, the use of GPS enabled Vehicle tracking system reduces the crime rates. By using GPS, improves the efficiency, profitability and safety of most commercial Vehicle transportation systems.

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