IOT based Bus Monitoring System using Biometrics and Accident Detection using Accelerometer

R. Mohan Krishna, B. Samyuktha, E. Sanjana, B. Sai Kumar, B. Babitha

Abstract: Every parent is always concerned about their children's safety. Despite the high-quality protection measures, students may also become in a state of affairs that endangers their life. This challenge develops a model to monitor the pickup and drop off of college students every day. To beautify the general protection of the day by day bus transportation to and from college, the project aims at detecting while scholar boards or leaves the bus and sends an alert message to reduce parent's concerns. It has two-step authentication using Biometrics and RFID technology. It also detects when an accident occurs using an accelerometer. An alcohol sensor is also used to enhance security.

Keywords : Arduino, RFID(Radio Frequency Identification), Fingerprint Sensor, GPS(Global Positioning system), GSM(Global System for Mobile Communications), LCD(Liquid Crystal Display).

I. INTRODUCTION

In the present progressing world, the embedded system plays an important role in the real time system. IOT is a connected system which has various smart devices that gives featured experiences to public consumers all over the world by affordable costs. The smart connected IOT solution provides safety, two-way communication between devices. The device targets routinely detecting while student boards or leaves the bus and issues an alert message when he/she enters or departs the bus to reduce parent's concerns. The system developed here uses biometric identification and RFID technology for student detection while boarding or leaving the bus. Every student scans his/her fingerprint using the fingerprint scanner.

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The fingerprint module stores the fingerprint of the concerned person and when the student boards/leaves the bus he places his finger on the reader and if it matches the student is identified. Every bus stop and college premises has a unique tag. When the bus arrives at a stop, the tag corresponding to the bus stop or the college premises is placed on the RFID reader. Every student is given a unique tag through which the reader identifies student when they get on and off of the bus. This is a two-step authentication process. The reader sends the details to microcontroller. GPS detects the latitude and longitude when a student gets on and off of the bus. The coordinates data is sent to the Arduino microcontroller. The Arduino microcontroller sends an alert message through GSM to the corresponding parents about the entry and exit of the student. It sends the google maps location as well as the bus stop name or college premises when a student gets on and off of the bus. To provide more security an additional sensor called accelerometer is added which gives an alert message when the bus has met with an accident and also by installing the alcohol sensor complete security is provided.

II. METHODOLOGY

A. Technology used

1) Arduino Microcontroller

Arduino microcontroller is the most important component of the project. It consists of capacitors, resistors etc. The program written is stored in the microcontroller. Based on the program written, the modules connected to the microcontroller communicate with each other.

Fig. 1.Arduino Microcontroller

The microcontroller used in this project is the Arduino UNO board. It is based on ATmega328. It is shown in the above Fig. 1. It has fourteen digital input/output pins

2) Fingerprint Sensor

This is used in the first authentication process. This fingerprint processing has two parts. They are fingerprint enrolment and fingerprint matching.[5].

Retrieval Number: F9328038620/2020©BEIESP
DOI:10.35940/ijrte.F9328.059120
Journal Website: www.ijrte.org

1051

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

In the first step i.e. fingerprint enrolment; the user has to place his finger twice on the sensor. The system processes these fingerprints and generates a template on the outcome and then stores it. In the second step i.e. fingerprint matching, the user places his finger on the sensor and the system generates a template of the finger. Then the template is compared with the existing templates in the fingerprint library.

Fig. 2.Fingerprint sensor

The above Fig. 2 shows the Fingerprint sensor.

3) RFID Technology

RFID tags are small chips which are utilized in our daily lifestyle to unlock the hotel rooms and to enter inside the vehicles. This tiny chip in conjunction with an RFID reader that forms the RFID machine[4]. It is composed of two elements namely an RFID Reader and a RFID Tag.

a)   RFID reader

It has a radio transmitter enclosed in it. The reader is capable of transmitting the radio frequency indicators.

Fig. 3.RFID Reader

When the RFID tag is placed on the reader, the reader reads the RFID tag and sends the information which in specified in the tag.

b)   RFID Tag

This image given here is of an RFID tag (smart card shaped tag). These RFID tags are available in different types of shapes and sizes[4].Tags contains an IC for storing the information, an antenna for transmitting and receiving, and also a modulator.

Fig. 4.RFID Tags

The tags can store only a few bits of the data[4]. The operation of a reader is much similar to barcode scanning method which uses Universal Product Codes (UPC) codes

4) Alcohol Sensor

We here develop a mechanical system which consists of MQ-2 gas sensor (alcohol sensor) which is suitable for detecting the alcohol strength in our breath and it can be placed near the driver[8]. It's surface is sensitive towards various alcoholic contents and it can detect the content of alcohol from the drivers breath.

Fig. 5.MQ2 Sensor

5) Accelerometer

An accelerometer detects the immediate change of the angle of the vehicle and then the GSM module sends the alert message to the college phone number with the location of the accident. The location where the accident has been occurred is sent in the form of Google Map link, derived from the latitude and longitude form from the GPS module [7].

Fig. 6.MEMS Accelerometer

The MEMS Accelerometer is shown in the above Fig. 6.

6) Global Positioning System (GPS)

GPS is used to locate the position of any object[1]. It gives us the information about the longitude, latitude, and altitude. A person can locate the position of any object easily by using GPS. By using this technology, communication takes place between GPS transceiver and the GPS satellite.


Fig. 7.NEO-6M GPS module

The NEO-6M GPS module is shown above in the Fig. 7. It comes with an outside antenna and does include header pins. So we need to solder it.

7) Global System for Mobile Communications(GSM)

GSM is a mostly used mobile communication modem. Its abbreviated as global system for mobile communications[2]. It is used in mobile communication system in the world.
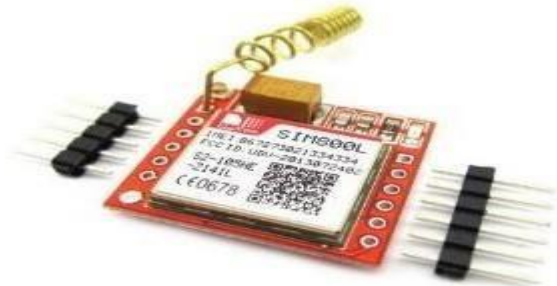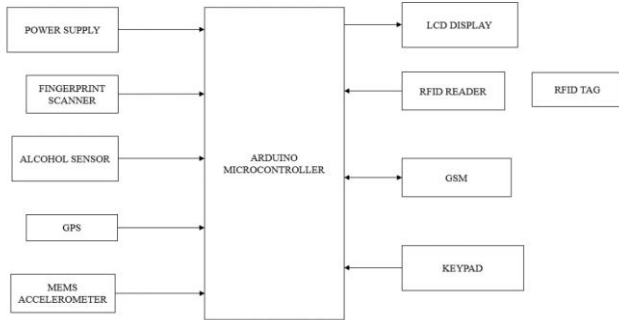

Fig. 8.GSM Module

GSM is an open and digital mobile science used for transmitting cell voice services operate at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands. The GSM module used in this project is shown in above Fig. 8.

B. Software Specification

In this prototype, the development is done using Arduino C in Arduino IDE.

C. Architecture

Fig. 9. System Architecture

The above Fig. 9 is the architecture of the project. The system developed here uses biometric identification technology for student detection while boarding or leaving the bus. Every student scans his/her fingerprint using the fingerprint scanner. The fingerprint module stores the fingerprint of the concerned person and when the student boards/leaves the bus he places his finger on the reader and if it matches the student is identified and he is allowed to board/leave the bus. The fingerprint module sends the details to the microcontroller. RFID technology is used for second step of authentication process. Every student is given a unique tag through which reader identifies student when they get on and off the bus. GPS detects the latitude and longitude when a student gets on and off the bus. The coordinates data is sent to the Arduino microcontroller. The Arduino microcontroller sends an alert message through GSM to corresponding parents about the entry and exit of the student. It sends the google maps location as well as the bus stop name or college premises when a student gets on and off the bus. To provide more security an additional sensor called accelerometer is added which gives an alert message when the bus has met with an accident. Accelerometer detects the immediate change of the angle of vehicle and GSM module sends an alert message on university cellphone with the location/area of the accident. If the axis values are greater than 30 degrees a message is sent about the accident. By installing the alcohol sensor complete security is provided. If driver is drunk then sensor i.e. if it crosses a threshold value of 0.10 mg/l, a message is sent to the College management so that they will take action about that.

III. RESULTS

A. Journey from Bus stop to College

When student enters the he places his finger on the fingerprint sensor. If it matches he goes for second authentication.
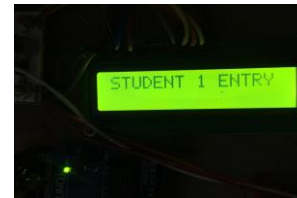

Fig. 10.Fingerprint Verification

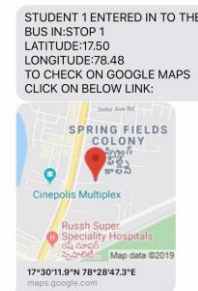Fingerprint verification is shown in above Fig 10. The next authentication is using RFID.

Fig. 11.LCD display when BUS STOP tag is placed on reader

When the bus arrives at BUS STOP 1, the tag corresponding to the bus stop is placed on the RFID reader. The Fig. 11 shows the LCD display.

Fig. 12.LCD display when student enters

Fig. 13.Message sent when student enters the bus at bus stop1.

When a student enters the bus, he/she has to place the RFID tag on the RFID reader .A message is sent to their parents. The Fig. 12 shows the LCD display and Fig. 13 shows message sent when student enters the bus at bus stop1.

Fig. 14. LCD display when COLLEGE PREMISES tag is placed on reader.

When the bus reaches college, the tag corresponding to college premises is placed on the RFID reader. The Fig. 14 shows the LCD display.

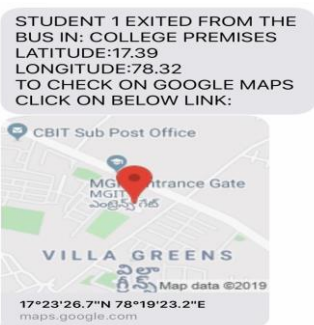**Fig. 15.LCD display when student exits the bus at College premises**

Fig. 16.Message sent when student exits the exits the bus at College premises

When a student exits the bus at college, after biometric verification the student tag is again placed on the RFID reader a message is sent to their parents. The Fig. 15 shows the LCD display and Fig. 16 shows message sent when student exits the bus at College premises.

B. Accident Detection

If the axis coordinates is greater than 30 degrees then a message is sent to College about the accident along with location.
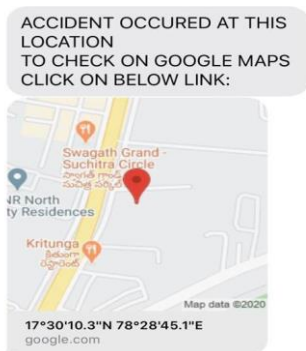

Fig. 17.Message sent when accident occurs

The above Fig.17 shows the message sent to college when accident occurs.

C. Alcohol Detection

If the value is greater than 0.10 mg/l the a notification is sent to the college about it along with the location.
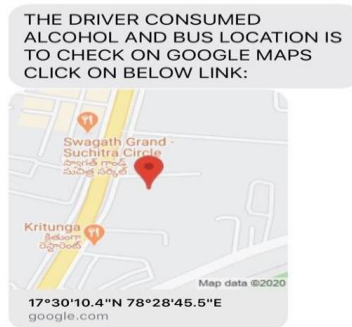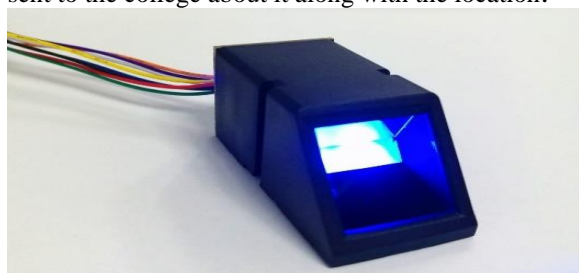

Fig. 18.Message sent when the driver is drunk

The above Fig. 18 shows the message sent to college when the driver is drunk.

IV.   CONCLUSION AND FUTURE SCOPE

This project has been designed and tested successfully. It has been developed by integrating all the components. The presence of each module has been explained. They are positioned accordingly for the successful working of the project.

This project can further be developed so that it can be useful for more purposes by the parents as well as the college. There are various features that can added. An application can be developed which displays the live location of the bus. This helps parents to continuously monitor the location of their child. Wireless communication through mobile GIS can be used for faster communication. A heart beat sensor can be added which continuously monitors the heart rate of the driver. The college can be acknowledged if there is a cardiac arrest. Sensors can be added for the opening and closing of doors. Emergency situations can also be notified to the police.

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