Detection of Road Accidents and Minimizing their impact through MEMS Sensor

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Abstract*—As using cars is growing drastically, the risks be-cause of cars is likewise increased. The essential purpose for injuries is excessive speed, drunk and drive, diverting minds, over stress and due to electronic gadgets. There are situations where most of the accidents could not be reported properly to near ambulances on time. In most of the cases, there is unavailability of emergency services which lack in providing the first aid and timely service which can lead to loss of life by some minutes. Hence, there's a requirement to develop a system that caters to all or any these problems and may effectively function to beat the delay time caused by the medical vehicles. The purpose of this paper is to introduce a framework using IoT, which helps in detecting car accidents and notifying them im-mediately. This can be achieved by integrating MEMS sensor with microcontroller within the car that can trigger at the time of an accident. The other modules like Wi-Fi module are integrated with the system to send the accident alert to registered numbers and nearby ambulance to notify them about the accident to obtain immediate help at the location.

***Keywords*—Road accidents, MEMS Sensor, Notification, IoT**

I. INTRODUCTION

The development of the transportation framework has made conceivable the fast change in the civilization of mankind's set of experiences. Transportation has extraordinary significance in our day-to-day life and its advancement has made our correspondence a lot simpler. In any case, it can be additionally reason for loss of lives and properties. As indicated by Association for Safe International Road Travel [1] approximately 1.25 million people die in road accidents every year while 3,287 passing consistently. Plus, 20-50 million individuals are harmed and debilitated. The clearer explanation of an individual's passing during accidents is the inaccessibility of the medical aid arrangement due to the deferral in getting to the specific data of the accident area. The trivial reasons of inaccessibility of brief nearby clinical help are late reporting of accidents, incorrect geographic location and unreliable mobile application due to malfunctioning of smartphone.

Besides, accidents occur on highways, vehicles passing the accident area generally ignore their responsibility to notify hospital and police. Safety may be a necessary a part of man's life. Due to the accident cases reported daily on the major roads in all parts of the developed and developing countries, more attention is needed for research in designing an efficient road accident detection and notification system. It is expected that if such a device is designed and incorporated into our cars as a road safety device, it will reduce the incidence of accidents on our roads and various premises, with subsequent reduction in loss of life and property.

The paper starts by discussing about the meaning of a lightweight, independent, wise accident detection system in the current situation. A concise description of the related work is introduced in Section II. The methodology of the proposed system along with system architecture is described in Section III. Hardware setup is depicted in Section IV. The working flow diagram is shown in Section V. At long last, Section VI finishes up the paper with future course.

II. RELATED WORK

Car accidents that happen daily are the main social problems towards which serious action must be taken. One of the solutions for this domain is that the Internet of Things which is that the current trend in technology. For this purpose, many authors have worked in this domain by applying this technology.

To protect the vehicle and tracking so many advanced technologies are available in now a day. In olden days the knowledge of accident are often transferred, but the place of accident spot can't be identified. In any vehicle, airbags are designed, airbags are used for security and safety travels [2]. The bag system was introduced within the year of 1968.

Existing system also provides the situation of the accident using Atmega 328 Microcontroller and RF transmitter and receiver. The information is shipped to the saved mobile numbers [3].

Message Queuing Telemetry Transport (MQTT) was used to send an alert through email while a vehicle accident has detected and accident data received by accelerometer and ultrasonic sensors stored in the Losant IoT platform in [4]. However, this technique couldn't detect the precise location of the accident. Hence, rapid rescue and sending help is quite

difficult. Email communication is comparatively slower than a text message on a smartphone. RFID based real-time accident detection algorithm has been employed in [5] which collected in-formation such as speed, vehicle plate number and the number of passengers of the vehicle though it is not necessary to collect the number of passengers in the vehicle. In this system, four crash sensors were mounted in the four corners of the vehicle which made the system less compact.

Akriti et al., [6] found many tradeoffs while working with the accidental management system such as high cost, non-portability, false delivery etc. The system faced many shortcomings due to lack of resources. In their technique, they used severity scale to measure the impact of an accident. This reduced load on the cloud server by 30 percent.

Chatrapathi et al., [7] designed a framework that has two components. First one is accident detection and alerting system. The second one is traffic management for the ambulance. The efficient routing algorithm is used is used to route the ambulance. The technique is feasible for the road junctions with signals. However, it is not applicable to the segments without signals.

III. PROPOSED METHOD

The importance of defining the research problem is to cope with the gaps in the literature. The purpose is to contribute to the existing work to enhance the quality of the overall framework so that it can benefit the end society in future. This can be achieved by adding more functionalities and features that can improve the working of the end system.

The overall model includes the following components:

ARDUINO

The Arduino UNO is a extensively used open-source microcontroller board primarily based on the AT-mega328P microcontroller and evolved through Ar-duino.cc. The Arduino is the major control unit to detect or alert when an accident occurs. It collects the data from MQ3 gas sensor, accelerometer sensor and displays the output either in display system or through a message.

ADXL335

ADXL335 Accelerometer Module is a small, tiny, low power, complete three-axis accelerometer with signal conditioned voltage outputs. X, Y and Z pins are linked to Analog pins of Arduino. The X-axis of the accelerometer offers the measure of positive acceleration, Y-axis offers the measure of negative acceleration (retardation) and Z-axis imply the angle of turnover of the device in which it is installed. When the signals from the three pins starts varying, the Arduino detects the fall of the vehicle.

MQ-3 GAS SENSOR

MQ-3 module is applicable for detecting Alcohol, Benzine, CH, Hexane, LPG, CO. Sensitive material of MQ-3 gas sensor is SnO_2, which with decrease conductivity in easy air. When the target alcohol gas exists, the sensor's conductivity is higher along with the gas concentration rising. It has excessive sensitivity to Alcohol, and has good resistance to disturb of gasoline, smoke and vapor.

H-BRIDGE L293D

The H-Bridge is particular used as a bridge among DC Motor and Microcontroller. Without H-Bridge the DC motor can't be controlled so for the DC motor to control or rotate in particular direction we are going for H-Bridge L293D.

NODE MCU

Node MCU is an open-source firm-ware that open-source prototyping board designs are available. The name Node MCU combines node and MCU (micro con-troller unit). The ESP8266 Node MCU has 16 GPIO pins and one analog input pin shown in the image below. However only 10 of these GPIO pins can be used for digital input and output operations.

RFID READER

A radio frequency identification reader (RFID read-er) is a device used to gather information from an RFID tag, which is used to track individual objects. Radio waves are wont to transfer data from the tag to a reader. RFID is a technology similar in theory to bar codes. However, the RFID tag does not have to be scanned di-rectly, nor does it require line-of-sight to a reader. The RFID tag it must be within the range of an RFID reader, which ranges from 3 to 300 feet, in order to be read. RFID technology allows several items to be quickly scanned and enables fast identification of a specific product, even when it's surrounded by several other items.

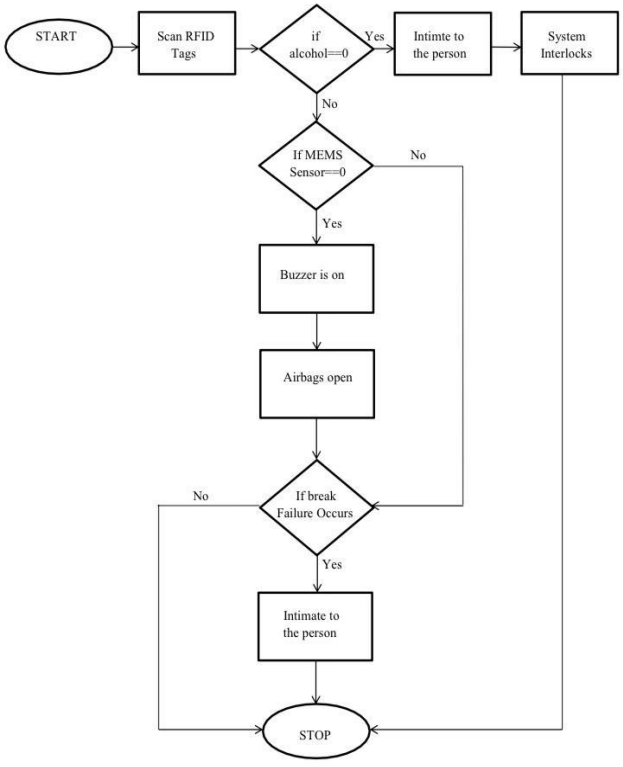


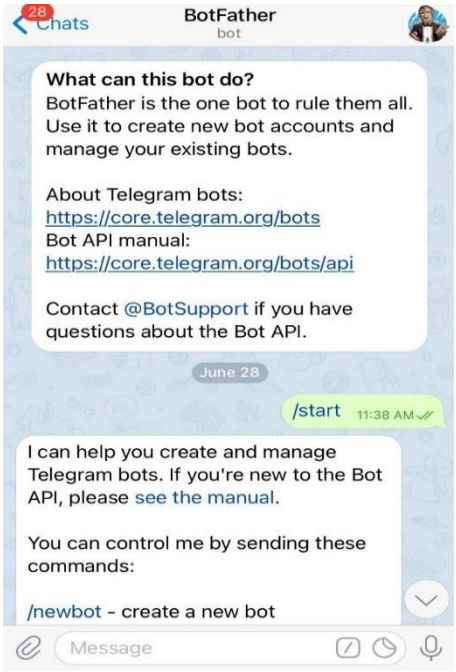
Fig 1: Methodology Diagram

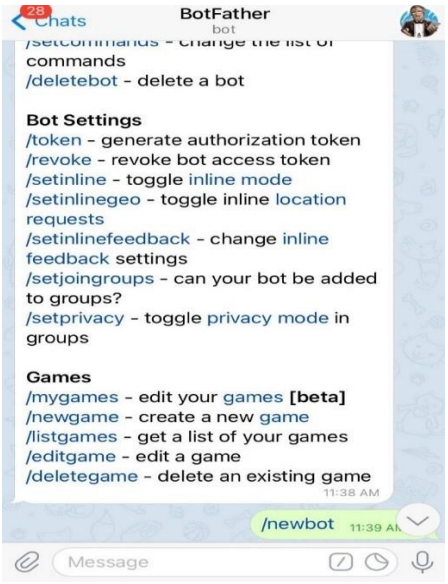
In order to prevent the risk of accidents, we have proposed the system which provides safety for a driver through the air bags. Both the driver and passengers should be the RFID (Radio-Frequency Identification) card holders. They are supposed to scan their cards through RFID reader. Before vehicle starts ignition, the system will check for the alcohol consumption of the driver. If the person has consumed the alcohol, the system automatically interlocks and he is unable to drive the car. LCD board has been used to display the alert messages in the car. Inbuilt break failure system in the car is used to detect break failure if the accident happens due to break failure. We also implemented a MEMS Accelerometer sensor, the change in co-ordinates of this sensor detects the accident. Once the accident happens, air bags will open automatically, the buzzer activates so that people nearest to the accident area can help the injured persons in the vehicle and the accident location will be sent to the concerned person. So that we can save the injured persons.

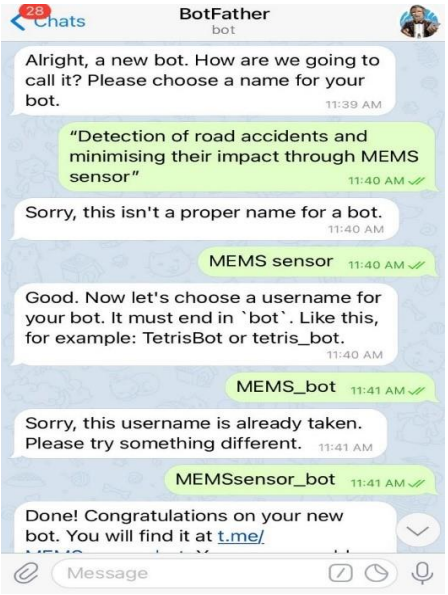
At the time of the accident the system will sends the message to the nearest police station and also for the ambulance. The system also sends the text message to the concerned care taker of that particular injured person and also the text message will be sent to the last person in his/her call list.

IV.RESULTS

Telegram application:







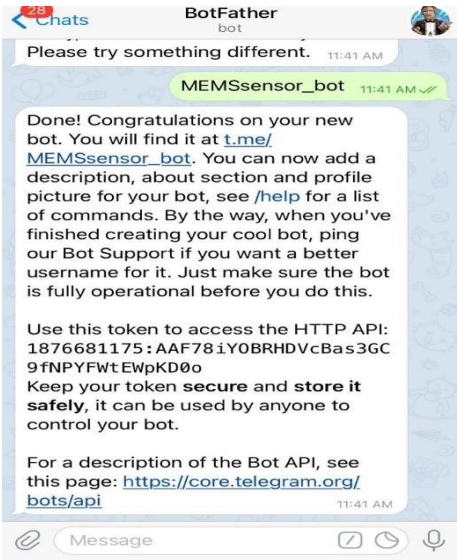


Fig 2: Telegram bot

After installing the Telegram application, search for 'BotFather' in the search bar and click on start. List of bot options are displayed, select the '/newbot' and give the new name for the bot. And also give username for the bot.

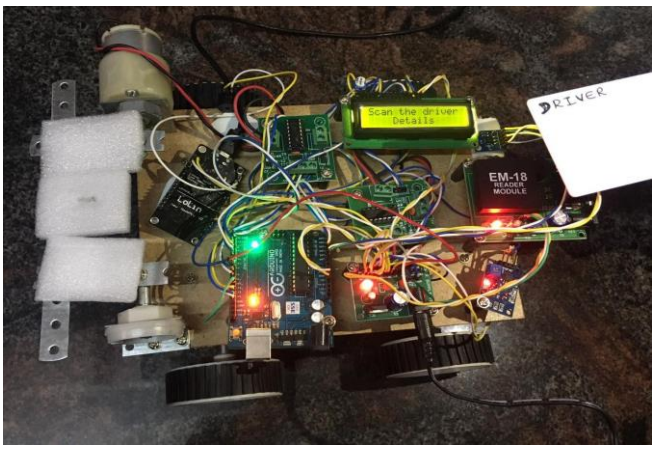


Fig 3: Scanning Driver tag

This figure shows scanning the RFID tag of Driver.

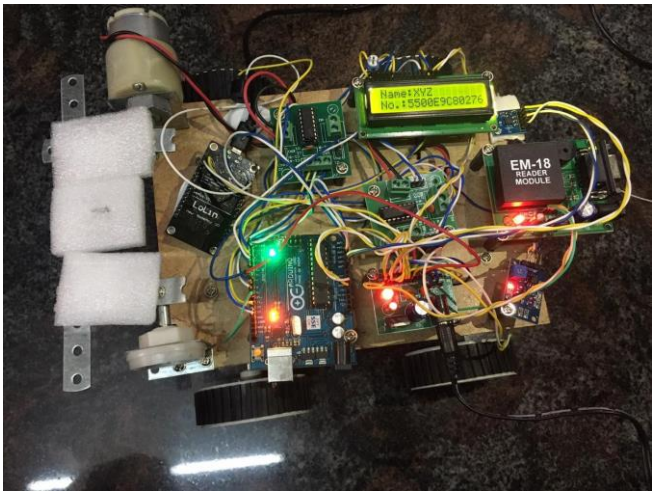


Fig 4: Details of Driver

This figure shows the Detail of Driver which includes Driver Name and Driver ID Number.

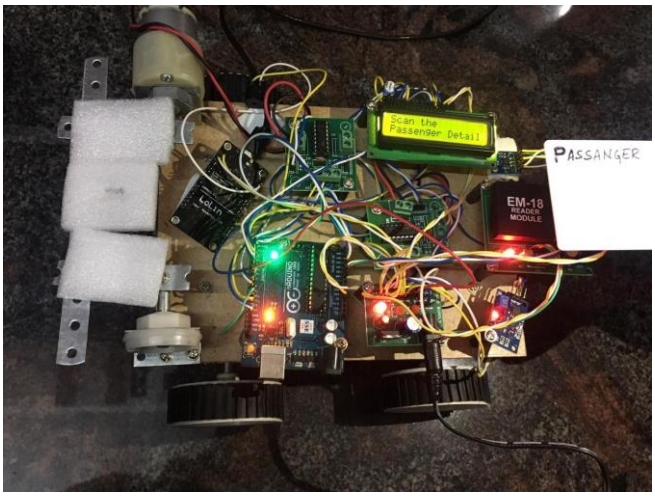


Fig 5: Scanning Passenger tag

This figure shows scanning the RFID tag of Passenger.

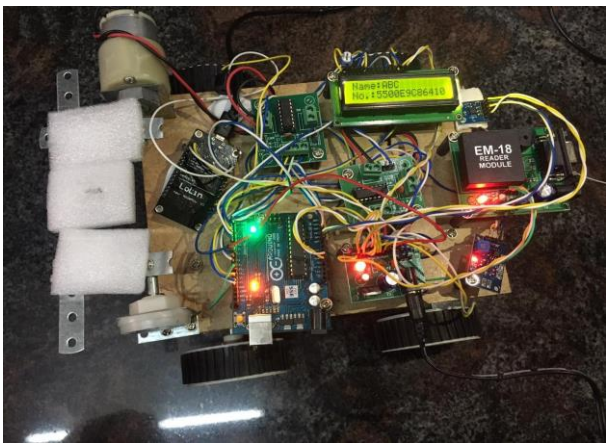


Fig 6: Details of Passenger

This figure shows the Detail of Passenger which includes Passenger Name and Passenger ID Number.

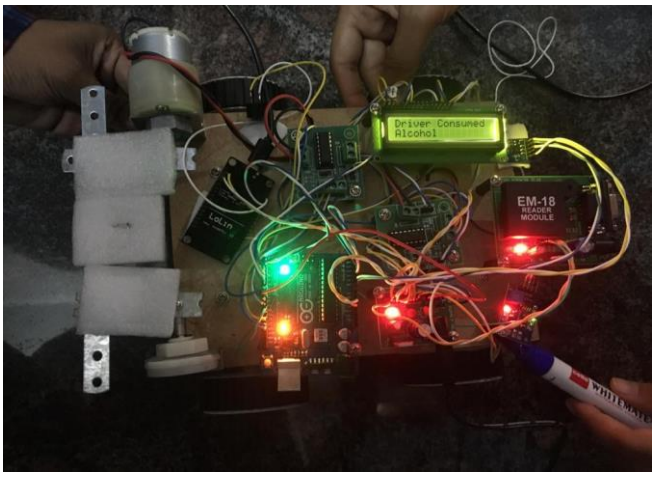


Fig 7: Alcohol Consumption Test

This figure shows the checking of alcohol consumption of driver.

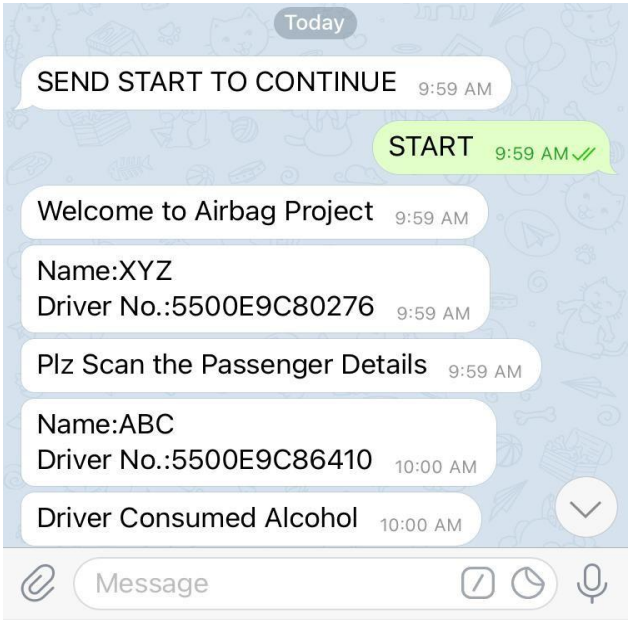


Fig 8: Telegram Message

This figure shows the messages that are received in telegram application after every event occurred.

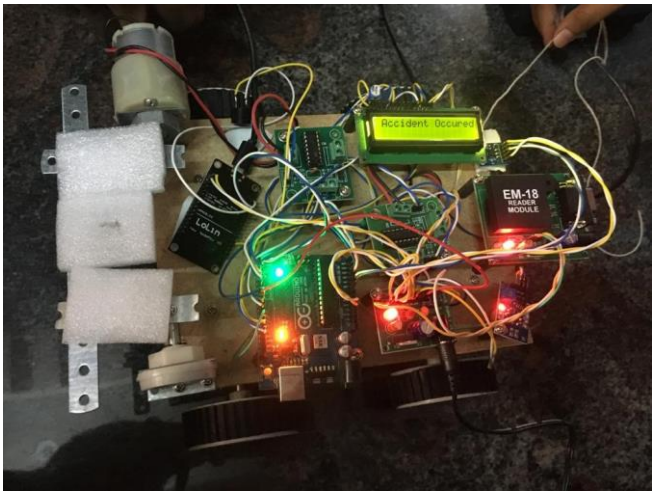


Fig 9: Accident

This figure shows the occurrence of accident on the LED display when the co-ordinates of the MEMS sensor change.

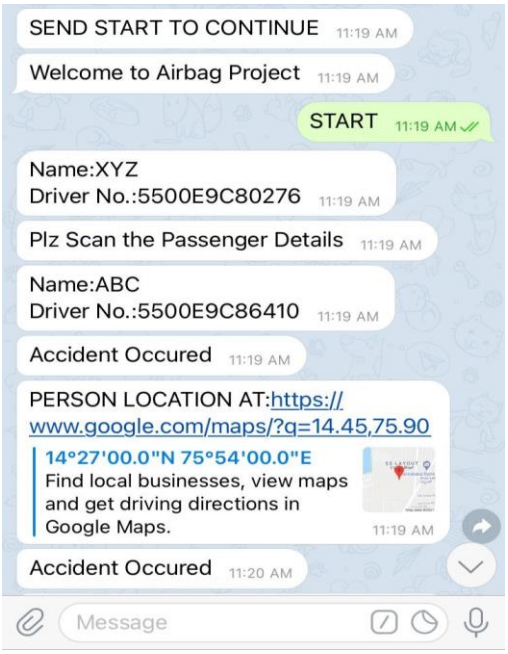


Fig 10: Telegram Message

This figure shows the messages that are received in telegram application after occurrence of accident.

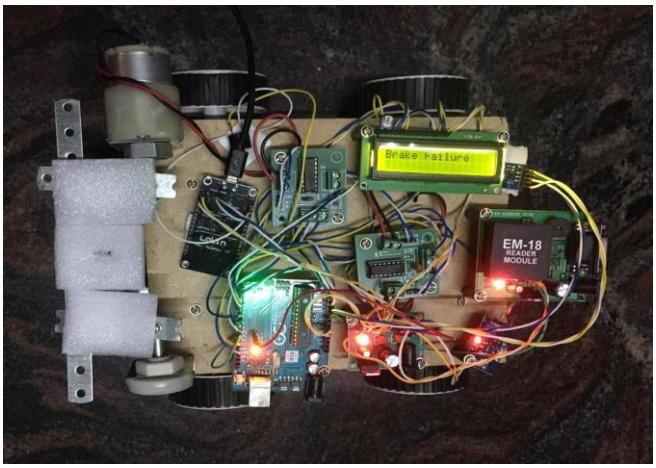


Fig 11: Break failure system

This figure shows the break failure of the system when 'sw 7th' pin is removed from the Arduino UNO board.

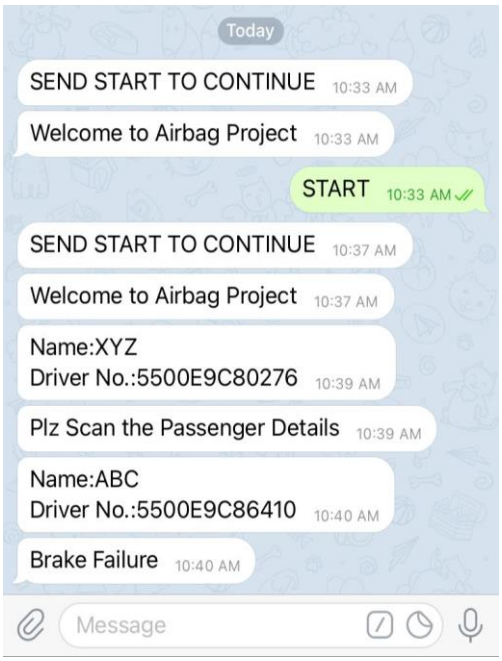


Fig 12: Telegram message

This figure shows the messages that are received in telegram application when break failure occurs.

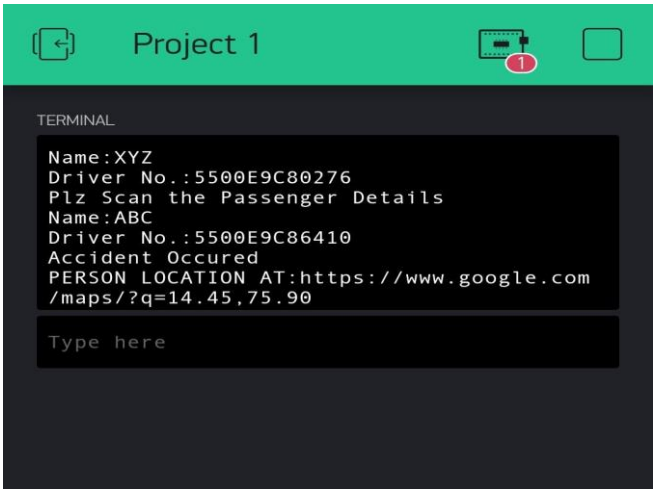


Fig 13: BLYNK message

This figure shows the messages received in BLYNK application.

V. CONCLUSION

The number of persons killed or injured in traffic has dropped continuously since the development of air bag system. Here in this system alcohol sensor and MEMS sensor has been used. Implementation of these safety restraint systems with due care and regulation can further drop the fatality rate and serious injuries at the time of road accidents. Further, after the accident, a message is sent to the concerned person. Based on the notification in the passenger's mobile, we get to know the driver's name and also it will be helpful for police to investigate.

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