

Motorcycle and Helmet Automation Safety System

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Abstract—In the past few decades, the cases of bike accidents have increased tremendously. The main reason for the loss of the life of the victim is the lack of proper treatment on time. When observed precisely it can be concluded that much time is wasted in the process of identifying the victim and his/her basic details (e.g., blood group, age, emergency contacts etc). In case if the accident has taken place at any remote area where it is difficult to notice the accident and inform the emergency contacts.

Due to its accurate, fast and real-time monitoring features, the popularity and use of the technology of the internet of things has increased remarkably. In this context, the paper describes the use the technology of Internet of things (IoT) and its integration with embedded system in actively monitoring of the accident of the biker. With the contribution of technology Internet of things (IoT), we can design a smart helmet which will help in identifying the victim of the bike accident and will also ensure that the news of the accident reaches to the emergency contacts of the victim. This smart helmet will beep and also play the basic details of the victim so that the people who are within reach to the accident can identify and help the victim. The inspiration of the project is to design a safer system for bikers so that lives can be saved and treatment can be given in time. The proposed automated system will ensure that the victim gets proper treatment in less time.

Index Terms— Internet of Things (IoT), embedded system, automated system.

I. INTRODUCTION

Motorcycle and helmet automation safety system aims at safety of rider by actively monitoring for accident and sends alerts to the emergency contacts of the victim in case of an accident.

The helmet of the motorcyclist is embedded with an accelerometer and 3-axis gyroscope, which determines the X, Y and Z co-ordinates of the motorcyclist's head along with a buzzer and speaker and optional solar panel for charging the helmet while driving. Additionally, the system also comprises a RF transmitter and receiver module attached to the motorcycle that controls the ignition of the motorcycle.

In case of the accident, the helmet communicates with riders mobile and sends S.O.S. message containing location details to the emergency contacts of the user. Moreover, the helmet also beeps and announces the important and basic information of the victim such as their name, age, family contact information as well as their blood group so that people present at the vicinity of the accident could easily recognize the victim. Thus, this automated monitoring system will ensure that the proper aid is provided to the victim in short time span.

The following block diagram illustrates the basic functionalities provided by the system as soon as it encounters any accident:

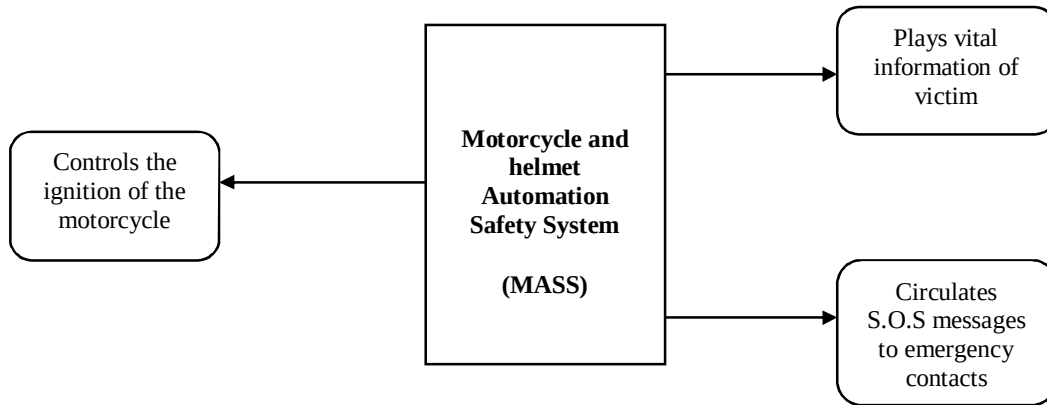


Figure 1. Functions carried out by the system in case of an accident

II. LITERATURE REVIEW

Various real-time accident monitoring systems using Internet of Things have been developed over the time. A system was developed by Narayanan et al. [1] which detects the location of accident using GPS module. The system senses the occurrence of an accident and sends the information for further activities. However, this system does not cover the aspect of false alarm or false accident detection.

Another system by Shaik et al. [3] discusses about an actively monitored car accident system. In case if any car accident was detected the location was send to the cloud and a notification was sent to the emergency contacts, hospital and ambulance. However, the system was limited to car accidents.

Parmar et al. [5] outlined the working of 3-axis accelerometer and gyroscope in an automated system that detects a vehicle collision. It states that we can acknowledge the accident just by the change in coordinates of the vehicle. The 3-axis accelerometer and gyroscope provide an accurate result and therefore we used similar approach in our smart helmet.

Our paper is inspired by the system developed [7] by Sreenithy Chandran et al. was system on the helmet communicates with the cloud-based incidence response and notification system via a RESTful architecture over HTTP using JSON. The weakness of the system was that, that the system did not cover the possibility of false alarm this means that in case of any false alarm user has no control to override it.

In order to deal with existing limitations in the accident recognition schemes, we proposed a system that uses ESP-8266 microcontroller integrated helmet which uses low power while providing consistent and accurate result. Furthermore, the system covers the possibility of false alarm, i.e., if in case any accident detected turns out to be a false alarm then in that situation the user can intervene and cancel the message which was to be send if accident had occurred.

III. APPROACH

The Motorcycle and helmet Automation Safety System has the following approach:

- 1) The helmet of the rider is equipped with a micro-controller, a buzzer and the following sensors:
 - An accelerometer (MPU-6050) which determines the X, Y and Z coordinates of the rider's head.
 - A 3- axis gyroscope which is in the same SIP (system in package), i.e. MPU 6050, which is used for orientation of the head in orthogonal axes.
- 2) In case of accident the sensor recognizes so (because of change in coordinates of the helmet) and the message gets circulated to the emergency contacts.
- 3) Along with this the helmet also beeps and plays the basic details of the victim, Such as name, blood group and emergency contact number.
- 4) A small authenticator device is also attached to the motorcycle which prevents the bike from turning ignition on if the rider is not wearing his helmet and also shuts it down in case of an accident. it works with RF transmitter and receiver inside the smart helmet and motorcycle module respectively.

IV. PROPOSED METHODOLOGY

In order to achieve our goal, we decided to put a sensor and a microcontroller board inside the helmet of biker, a small authenticator module embedded in the motorbike and a mobile application to login the user. The mobile application is used to pair the helmet to user profile, uploading user emergency data to helmet such as name, blood group, and emergency contact details. which can be played as audio alarm in case of accident. Besides this, the app can be used to troubleshoot reset or update the helmet firmware via OTA. An Authenticator module is used to enable the ignition after the rider wears the helmet. This module ensures that the engine will start only when the helmet authenticates with the module which is possible only after the rider wears helmet. Also, after any accident when the alarm is triggered, the module will shut down ignition automatically to prevent any fire hazard.

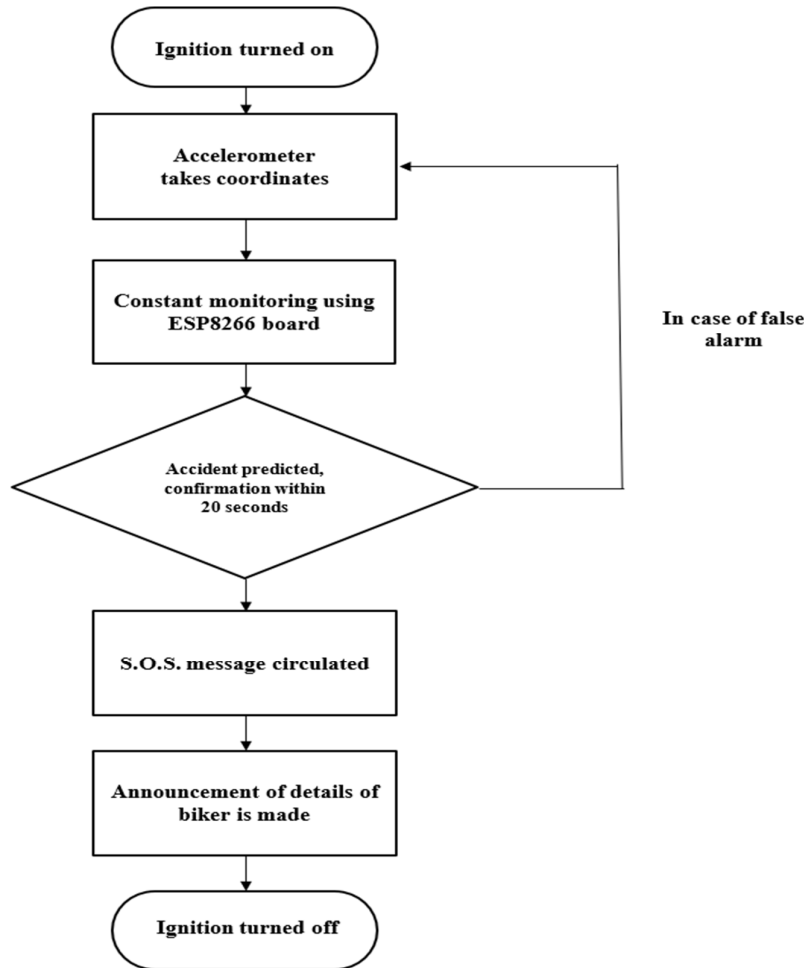


Figure 2. Flowchart representing the proposed methodology of the system

V. RESULTS

The MPU 6050 3-axis digital accelerometer and gyroscope is best suited for tracking the position of the X, Y and Z coordinates. It can be used to monitor the motion of the biker. Hence, we integrated the ESP-8266 in the helmet of the biker and interfaced MPU 6050 sensor with the board. Then we obtained sensor data and compiled them in a graphical format which can be understood with the help of graphs in Fig. (3 – 10) below, which shows various scenarios in which the head of rider can be oriented and/or impacted while driving and during an accident. All the graphs have been obtained on serial plotter of Arduino IDE software using MPU 6050 sensor and ESP-8266 board. In the graphs the X coordinate is represented as green, Y coordinate is represented as

purple and Z coordinate is represented as blue. The X axis of the graph represents acceleration due to gravity (g) and is in unit of m/s^2 . The y-axis represents time in milliseconds (m/s).

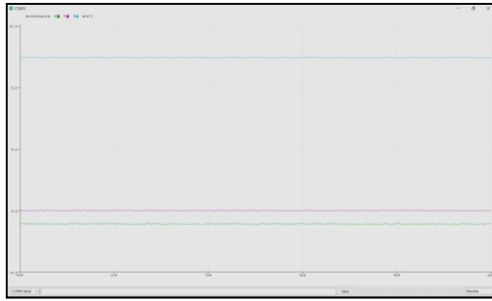


Figure 3. Ideal case

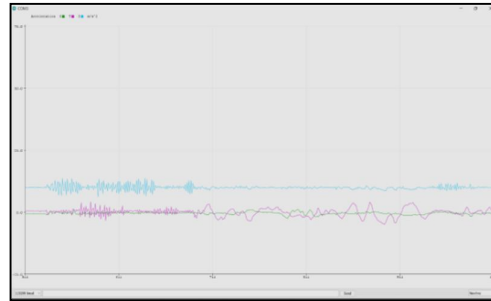


Figure 4. During Motion

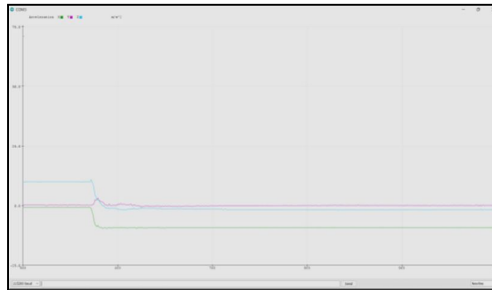


Figure 5. Back tilt of the helmet

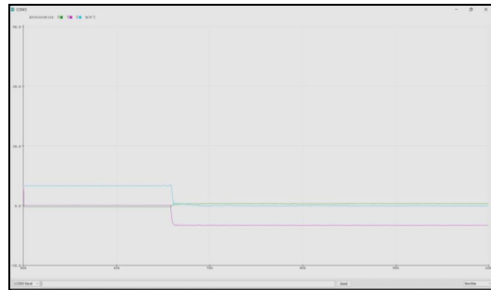


Figure 6. Forward Tilt of the helmet

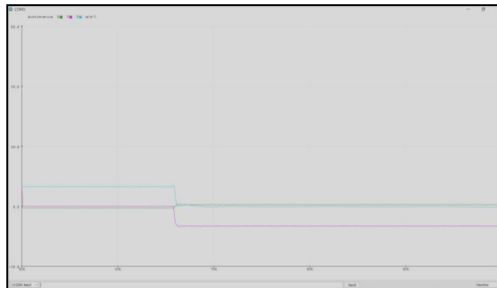


Figure 7. Left tilt of the helmet

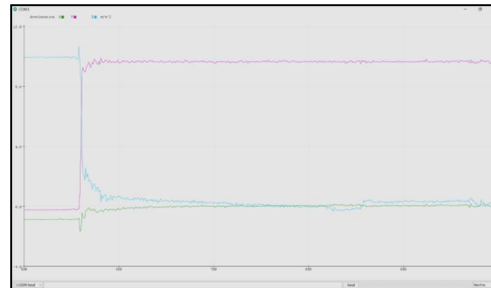


Figure 8. Right Tilt of the helmet

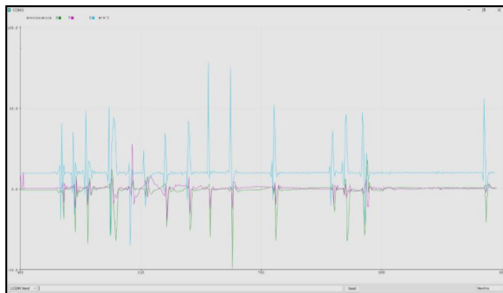


Figure 9. Heavy Jerks

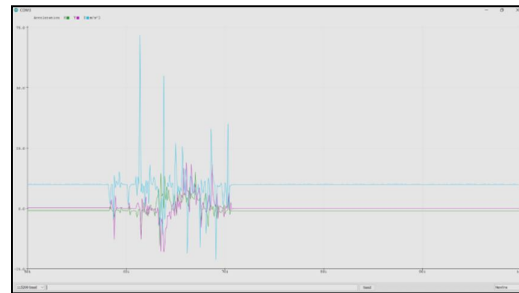


Figure 10. Collision Jerks

VI. ADVANTAGES

1. Completely autonomous system with no technical expertise required to setup and operate.
2. Numerous fail-safe measures to prevent accidental triggers.
3. Based on IoT which is efficient and reliable.

4. Also promotes healthy habit for rider to wear helmet always as the ignition will not turn on without helmet authentication thus acting as a passive safety-guard measure.
5. Power efficient System.

VII. CONCLUSION

The motorcycle and helmet automation system can prove itself as one of the most reliable and a faster damage control system. The system requires negligible human intervention and it actively monitors accidents and also informs the emergency contacts about the location of accident as well as about the basic details of the victim to people near vicinity of the accident. Moreover, the system gets activated only when the Motorcyclist wears the helmet after which it activates ignition of the motorcycle. This automation system will ensure that no accident whether it has taken place in any remote area is left unattended or unidentified.

LIMITATIONS

Although various steps have been taken to minimize error and make the system reliable, yet some of the limitations of the system are:

- 1) Bluetooth connection is somewhat unreliable and may get interference and sometimes disconnect without notice.
- 2) If the cell phone of rider gets damaged during accident the location S.O.S. message can't be sent to the emergency contacts.
- 3) System cannot run properly if the battery of the helmet is low.

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