

Smart Helmet with Internet of Things Capabilities

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Abstract

India now has the world's largest two-wheeler market (China comes in second). However, this leads to an increase in traffic accidents and, as a result, an increase in the fatality rate. The most common causes of injury are excessive speed and failure to wear a helmet. As a result, helmets must be worn when riding a motorcycle. The majority of fatalities occur during the first few minutes following impact. Thus, if patients receive competent medical care during this critical period, fatality rates can be minimised. Smart helmets make motorcyclists' journeys safer and more comfortable. The smart helmet offers comprehensive safety features like accident recognition and SOS notification immediately after impact, uploading accident footage to the cloud, and receiving alerts of other cars coming from behind. Smart helmets encourage helmet use by enticing users with features such as phone connectivity, sharing journey clips with friends and family, weather updates, and GPS instructions through voice.

Keywords: *- Safe Journey, SOS, Safety Measures, Smart Helmet, Accident Detection, Road Accidents, Medical Help.*

INTRODUCTION

Smart helmets use the Internet of Things (IoT) to make the rider's journey safer and more comfortable. It offers comprehensive safety precautions, such as detecting an

accident and telling the user's friends and family (or selected emergency contact) about the impact, as well as the user's current position, so that the user may receive rapid medical attention and avert

death. Other essential functions include uploading accident footage to the cloud, which may be used as evidence in a police investigation, and receiving voice warnings of cars approaching the rider's vehicle from the rear side, allowing the user to take the necessary action.

Smart helmets encourage helmet use by enticing consumers with capabilities like connecting with a phone to accept incoming calls on the move, sharing footage of a voyage with friends and family via IoT, receiving weather updates, and receiving GPS directions via voice instructions. The goal of this project is to make riders' journeys safer and more enjoyable by making the helmet smart, utilising emerging technologies such as IoT, and generating a variety of features that are not presently accessible in the market.

LITERATURE REVIEW

Ajay and G. Vishnu suggested working on an intelligent helmet system. This technology detects the accident and tells the operator through GPS and GSM. Pressure sensors are used to identify accidents. The GPS system is utilised to determine the current position. This position is transmitted to the emergency contacts via GPS.

GPS is also used in navigation systems to provide location information. This is accomplished by integrating Google Maps and the voice readout, which is shown through speakers in the helmet, so that Google Voice will provide the individual with the quickest and most direct route to the place. As a result, services such as location monitoring and accident notification are extremely valuable [1].

Karthik P. and Muthu Kumar suggested a system that employs a novel method of accident detection and notification. It is divided into two parts: the helmet and the vehicle. And they're both communicating with each other via radio frequencies. A piezoelectric sensor is used to detect accidents. The signal is transferred from the helmet side to the vehicle side based on the output, and relevant measures are subsequently conducted. The GSM module is utilised for emergency messages [2].

Sreenithy Chandran, Sneha Chandrasekar, and **Edna Elizabeth N** proposed developing a smart helmet with a Wi-Fi enabled chipset and IoT capabilities. It uses an accelerometer sensor and cloud computing to deliver functions such as accident detection and notification. The system requires a decent internet connection to function effectively. This

system has a safeguard to prevent an accident from being accidentally triggered. This is accomplished by setting a timer for a few seconds, during which the message can be prompted [3].

Muthiah M1 and Aswin Natesh V2 proposed developing a prototype model to assist motorcyclists in improving their eyesight and road safety. When circumstances such as the right tension of the helmet belt are met, intelligent management of the headlights utilising the servomotors utilised here becomes active, which in turn fulfils the next appearance in the receiver circuit, causing the motorbike to start operating.

As a result, the driver may not be permitted to ride without an appropriate helmet. This system provides additional features that improve user safety, such as built-in sleep sensors, monitoring drivers, and sirens, which reduce the chance of falling asleep [4].

Rashmi Vashisth and Sanchit Gupta presented their work on smart helmets, which consists of two modules, one on the helmet and one on the bike, which are synced to guarantee that the rider wears a helmet. The helmet has capabilities such as immediately withdrawing the appropriate

money from the user's virtual wallet, wirelessly blocking the rider from stopping and paying, recognising and informing an accident, and detecting overspeeding [5].

PROPOSED WORK

This project makes use of IoT technology, which makes the system smart. Figure 1 depicts the proposed system's block diagram. Here The main or master processor is a Wi-Fi capable CPU. All slaves, which are sensors and other modules like accelerometers, proximity sensors, microphones, speakers, cameras, and so on, are linked to the master, which is linked to the cloud storage.

Data from sensors is collected by Master and sent to cloud storage. That data is analysed and returned to the controller for action. This data may be viewed or monitored remotely using an IoT cloud web site. Master may analyse data and take appropriate decisions.

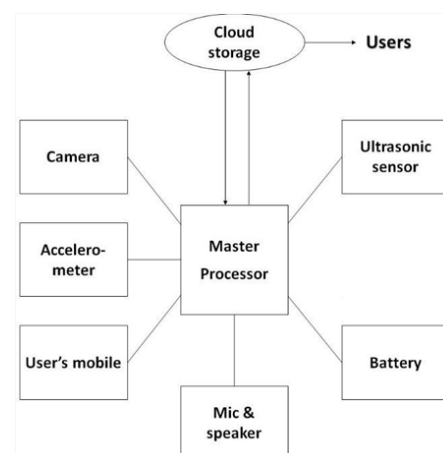


Fig. 1. Proposed system block diagram

IMPLEMENTATION SCHEME

Following are the features provided by smart helmet:

- Take a photo and/ or video clip of accident and upload on the cloud.
- Send SOS message to the pre-set emergency contacts in case of accidents.
- Track the location of user and status from the android app (as per permission preferences).
- Get weather information at the current location of user every hour.
- Voice warnings about the vehicles approaching closer from the rear side
- Connection with mobile (for incoming calls and music with connected speakers)

The feature wise modules are explained as below:

Capturing photos and videos and uploading on free cloud storage

In this module, a picture or video is recorded and uploaded to a free cloud storage service, such as Dropbox. The videos are captured every 5 minutes and saved to the camera's internal memory. When an accident occurrence occurs, the footage is transmitted to a Dropbox and can be used in the event of an investigation. A camera has been interfaced with the Raspberry Pi, and the Raspberry Pi has been linked to the mobile internet in order to post the footage. The operation of this module is shown in Fig. 2.

Figure 3 depicts the work flow. It includes the necessary installations and methods for effective image capture and uploading.

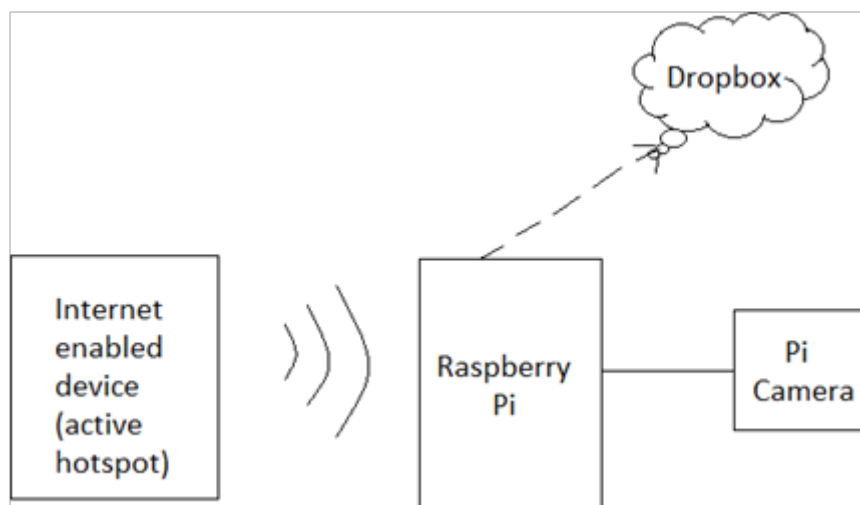


Fig. 2. Block diagram

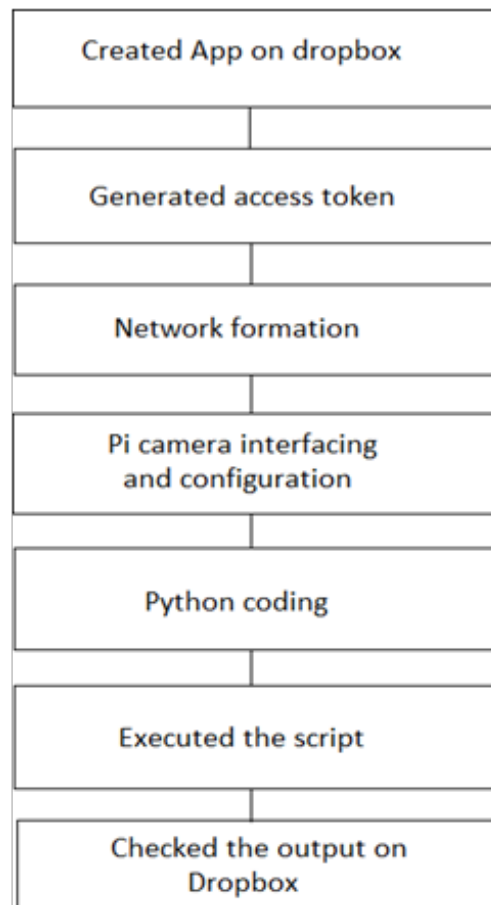


Fig. 3. Work flowchart

The following procedure can be followed to form the network connection:-

- Connect Raspberry Pi through ethernet cable to the laptop.
- Using `ipconfig` command get ip assigned to the ethernet port.
- Using “Wireshark” software get the IP address of the Raspberry pi.
- Load the ssh file using `echo>F:\ssh`
- Login into pi in the putty software using the IP detected in Wireshark.
- To connect to the WiFi add the network credentials in the in the `wpa-supPLICANT.conf` file. (Use command

```

sudo nano
/etc/wpa_supplicant/wpa_supplicant.conf)
  
```

- Then reboot the pi.
- Check for new ip assigned to the pi when connected to wifi using `ifconfig` command.

After doing these required connections and following the procedure, the images are captured and uploaded successfully as shown in Fig. 4 and Fig. 5.

Accident detection and notification

In this module, an accident is detected by using an accelerometer module. An I2C

protocol has been used. The steps that we followed are as follows:

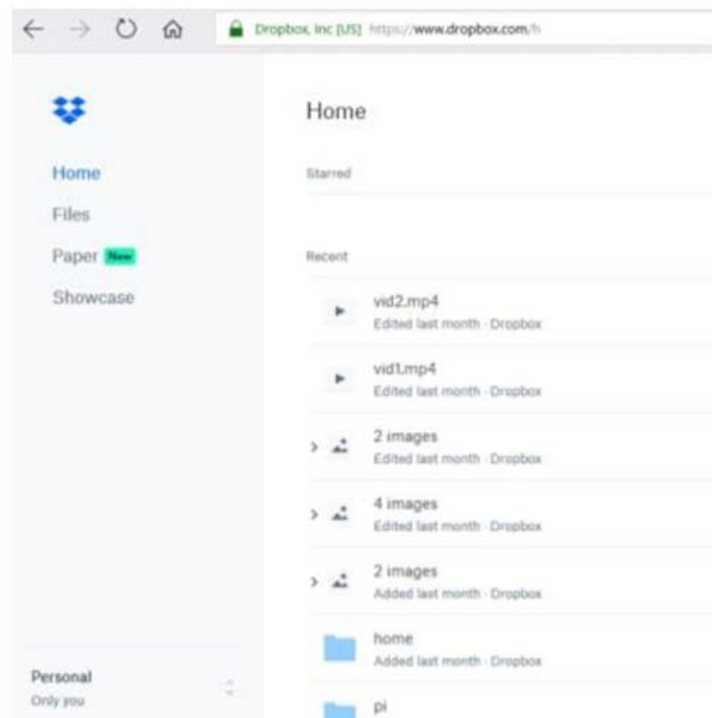


Fig. 4. Output (Images uploaded)



Fig. 5. Output (Image captured and uploaded)

- a. Interfacing the accelerometer
- b. Enabling the I2C using sudo raspi-config command.
- c. Installing essential package and set it up.
- d. Using command sudo i2cdetect -y 1 to check the physical connection
- e. Coding (In this code, we are detecting free fall event)

A website is constructed that constantly examines the value supplied by the accelerometer. When the accelerometer detects a free fall event, it sends the "true value" to the webpage, and an accident is identified. An Android application sends the "SOS" message to the registered emergency contacts.

As seen in Fig. 6, the results may be seen at the receiver end. The accident message is delivered to the user's registered emergency contact number and includes a link to the user's current position, which may be retrieved through Google Maps.

Getting weather and location updates

The current location is retrieved from the user's mobile device via the Android application and sent to the processor, where the location coordinates are used to obtain weather information. To obtain weather information, a weather API is needed. This API is mostly used for

weather predictions and visualization. At the specified time, a spoken summary of the weather is directed through the speakers for the user's convenience. Figure 7 shows a snapshot of an Android application with a location page.

Figure 7 shows the location's address

Getting voice warnings about the vehicles approaching from rear side

The ultrasonic sensor is used to obtain information about cars in the rear that are approaching closer than the sensor's specific limit. The result is given in Fig. 8. When the sensor produces a positive output, the user receives an audio notice over the speakers that a vehicle approaching from the rear is in close proximity to the rider.

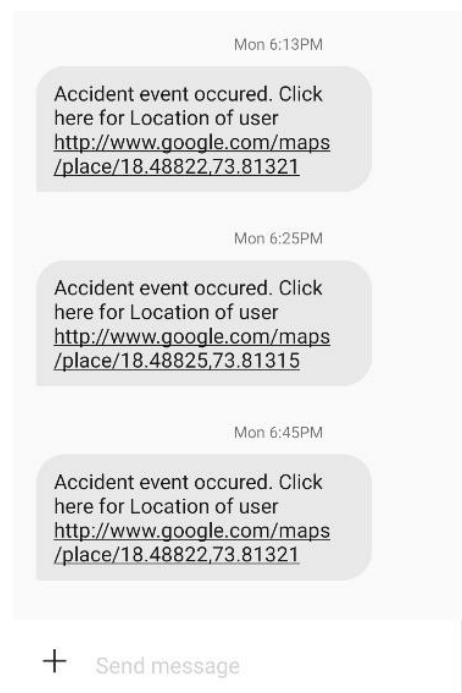


Fig. 6. Screen shot of received SOS

message in case of accident

Address
9, Vishwashanti Marg, Rambaug Colony, Kothrud,
Pune, Maharashtra 411038, India

18.51924 73.81514

Get Location

Map

Fig. 7. Screen shot from android application for location updates

```
pi@raspberrypi: ~/smart_helmet_codes
192.168.43.168 - - [16/May/2019 16:26:22] "GET / HTTP/1.1" 200 -
-2.863542 -0.196133 8.943665
False
192.168.43.168 - - [16/May/2019 16:26:23] "GET / HTTP/1.1" 200 -
-2.667409 -0.902212 8.472946
False
192.168.43.168 - - [16/May/2019 16:26:24] "GET / HTTP/1.1" 200 -
-3.530394 -1.098345 8.943665
False
192.168.43.168 - - [16/May/2019 16:26:25] "GET / HTTP/1.1" 200 -
-3.020448 0.000000 4.079566
True
192.168.43.168 - - [16/May/2019 16:26:26] "GET / HTTP/1.1" 200 -
-3.177355 0.078453 9.335931
False
192.168.43.168 - - [16/May/2019 16:26:27] "GET / HTTP/1.1" 200 -
-2.471276 0.039227 8.590625
False
192.168.43.168 - - [16/May/2019 16:26:28] "GET / HTTP/1.1" 200 -
-5.805537 0.392266 10.591182
False
192.168.43.168 - - [16/May/2019 16:26:29] "GET / HTTP/1.1" 200 -
-3.177355 -0.549172 8.080680
False
192.168.43.168 - - [16/May/2019 16:26:30] "GET / HTTP/1.1" 200 -
-2.785089 -0.823759 8.041453
False
192.168.43.168 - - [16/May/2019 16:26:31] "GET / HTTP/1.1" 200 -
-2.824315 -0.470719 8.708305
False
192.168.43.168 - - [16/May/2019 16:26:32] "GET / HTTP/1.1" 200 -
-3.295034 -1.961330 8.237586
```

Figure 8: Output of notification system to notify about rear vehicles.

For voice command, an offline text to speech converter is used for a quick and accurate response.

Android Application for the smart helmet

The android application is created to connect the user's mobile to the helmet. User enters the hotspot credentials to get connected with helmet and allow helmet to use the internet. Through the mobile application user can get location and weather updates as well as connectivity status and notifications for helmet. User interface consists of 8 buttons having different purposes.

As demonstrated in Figure 10, the Start button has capabilities such as activating

accident detection and configuring emergency contacts. The Position button displays the current location as well as access to maps, where instructions to the desired destination may be entered. Using his hotspot credentials, the user may connect a new device to the helmet using the hotspot button. In the event of an emergency, my information page is used. It contains the user's fundamental information, such as name, address, blood group, and so on. Dropbox is used to access the photographs and videos that have been uploaded. A capture button takes the current image and uploads it to Dropbox. These are the functions offered by the smart helmet via the Android application, as seen in Fig. 9.

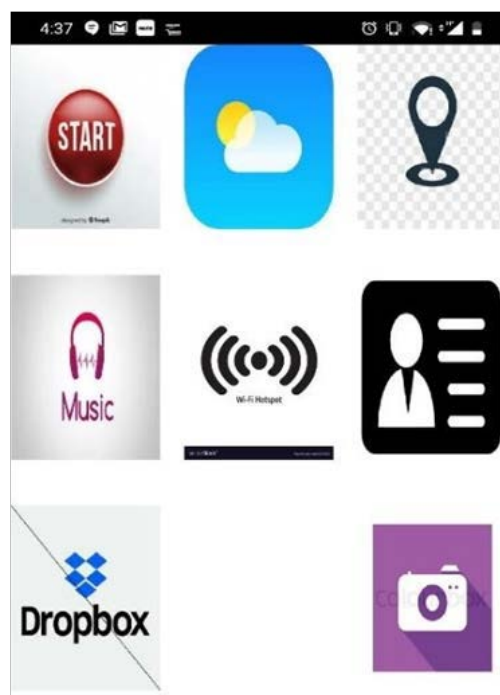


Fig. 9. Smart helmet application user interface

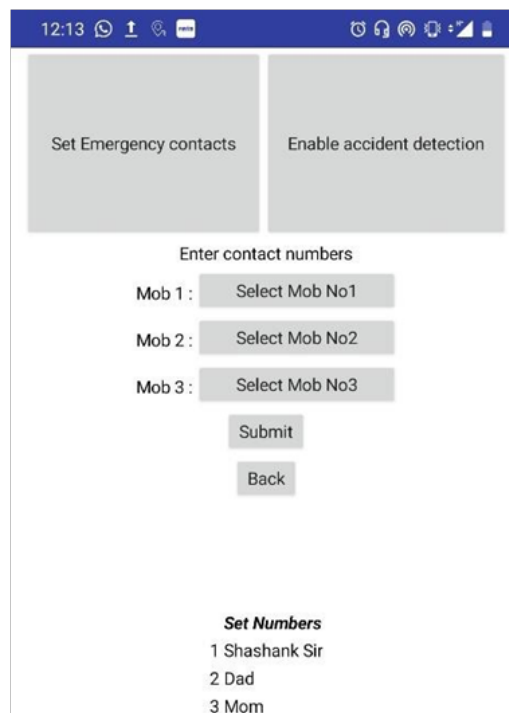


Fig. 10. Smart helmet mobile application

CONCLUSION

IoT technology was employed in the project because it allows the system to utilise internet services to become smarter and more accurate. The characteristics of the helmet make the rider's journey safe, pleasant, and convenient. An Android application has been built to give extra functionality to the helmet for the riders' comfort.

The smart helmet assists motorcyclists in saving their lives by delivering prompt medical attention in the event of an accident. Furthermore, the qualities of this helmet entice consumers to use it, which eventually fulfils the aim of boosting helmet use.

FUTURE SCOPE

In future, communication between multiple helmets to make it more user friendly can be targeted. Also, a force sensing resistor can be used to avoid the wrong accident triggering by enabling the features of helmet only when it is worn. Additionally, a solar panel can be implemented to increase the power backup and to make efficient use of natural resource.

REFERENCES

1. A. Ajay, G. Vishnu, V. Kishoreswaminathan, V. Vishwanth, UG Scholar
"Accidental Identification and Navigation System in Helmet"

- 2017 International Conference on Nextgen Electronic Technologies.
2. Mohd Khairul Afiq Mohd Rasli, Nina Korlina Madzhi, Juliana Johari, "Smart Helmet with Sensors for Accident Prevention", 2013 International Conference on Electrical, Electronics and System Engineering.
 3. Muthiah M1, Aswin Natesh V2, Sathiendran R K3, "Smart Helmets for Automatic Control of Headlamps", 2015 International Conference on Smart Sensors and Systems (IC-SSS).
 4. Sreenithy Chandran, Sneha Chandrasekar, Edna Elizabeth N, "Konnnect: An Internet of Things (IoT) based Smart Helmet for Accident Detection and Notification."
 5. Karthik P, Muthu Kumar. B, Suresh K, Sindhu I.M, Gopalakrishna Murthy C.R, "Design and Implementation of Helmet to Track the Accident Zone and Recovery using GPS and GSM" 2016 International Conference on Advanced Communication Control and Computing Technologies (ICACCCT)