iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** VI **Month of publication:** June 2021

DOI: https://doi.org/10.22214/ijraset.2021.35166

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VI Jun 2021- Available at www.ijraset.com

Smart Helmet System for Motorcyclists and Advanced Emergency Assistance using IoT

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Abstract: ***This paper proposes a low-cost smart helmet system using GPS and GSM modules which can give information about the location to the emergency number when the biker met with the accident. Wearing a helmet can reduce fatality and save a life. To ensure safety one must wear a helmet and for those, we can give additional safety by making the helmet smart. Many lives can be saved by treating them as soon as possible, this crucial phase of time can be achieved by the use of this smart helmet accident detection and notification. A wise helmet will be a great idea that makes motorcycle driving safer than before. In this paper, the GSM module and GPS are enclosed in the helmet which can provide the correct location of the accident with help of IoT application to the victim's family and concerned authorities. This proposed system used to avoid the delay in giving the proper first aid to the victim which prevents the major cause of death after an accident.***
Keywords*: Microcontroller, GPS module, GSM module, Vibration sensor, IoT*

I. INTRODUCTION

In recent years, the motorbike has become an essential mode of transport for the individual traveller. However, unpredictable risks are involved in travelling on a motorbike when the traveller does not obey the traffic rules and regulations. The motorbike users are severely affected during the accident resulting in extreme injuries and death. It is surmised in every 2 minutes, one accident takes place in India. In order to overcome these traffic violations, innovative technology can significantly support in maintaining the traffic rules on the road [1, 2, 3].

The main goal of this project is to provide safety and reliability on the smart helmet to the riders from the road accident. A smart helmet is an innovative idea to ensure motorbike riding safer than before and it has been implemented with help of GSM and GPS technology. The purpose of designing a smart helmet is to save the lives of motorbike riders by sending them to the nearest hospital and medical center at the right time. Many approaches and projects have been designed and implemented by various researchers. Nimisha Chaturvedi et al. proposed a system with GPS, GSM for purpose of accident detection. The author used a button sensor to detect an accident [4]. If an accident occurs, a buzzer is turned on to alert nearby occupants. The location will be sent to the contact list saved in EEPROM. If the rider pushes the reset button the sending of the message will be terminated. On the other hand, Manjesh demonstrated a vibration sensor-based smart helmet that senses when the riders crash and fall down on the ground. Accident information and GPS location are sent to the right person via GSM [5]. Rajput et al. designed a gas sensor based helmet which detects the alcohol level of motorbike riders who wore the helmet [6]. Shrutika S [7] proposed a force sensor based helmet to detect rider crashes. Navyasri et al. proposed an embedded system to control the ignition and detect the accident [8]

II. PROPOSED SYSTEM

In this paper, we proposed a mobile application (IoT) based smart helmet. A microcontroller is a core that controls the entire unit. The vibration sensor's functionality is to check if the rider has fallen and alerted the nearest residents. Other than that GPS and GSM are used to locate the accident area and send the message. The main purpose is to implement research correlation on GSM, GPS with 'ubidots' IoT application. In this project GSM module and GPS is enclosed in the helmet which can provide the correct location of the accident with help of IoT application to the victim's family and concerned authorities. This proposed system used to avoid the delay in giving the proper first aid to the victim which prevents the major cause of death after an accident.

III. BLOCK DIAGRAM

Fig.1 shows the fictional block diagram and the layout of the system to be placed on the helmet. The choice of the microcontroller is an important task in any kind of application. The microcontroller should be selected, according to various criteria such as power consumption, speed, size, and cost. In our system, Texas Instrument's CC3200 wireless microcontroller has been used. The first microcontroller which has built-in Wi-Fi connectivity in a single chip programmable MCU. It is developed for the Internet of Things (IoT) and the simple Link CC3200 device is a wireless MCU. It enhances the researchers to develop an application in a single microcontroller. The vibration sensor is an important component in the system which is used to measure vibration and touch in the helmet. A small Alternative Current and large voltage are created when the film is

touched or else moved. The sensitivity of the sensor can be chosen based on the need for our application. In this system, it is used to checks the vibration of the bike not exceeding 43.5 MHz. If exceeds it sends a signal to the CC3200 microcontroller. The Global Positioning System (GPS) is a navigation system that sends and receives radio signals through satellites. The 9v battery is connected to boost up the power for GPS. When the microcontroller receives a signal from the vibration sensor, CC3200 gets the incident location from the GPS module. Usually, GPS shows the latitude and longitude of the accident position. In our system, we designed to sending the visual images along with latitude and longitude of the accident location to cloud service via a mobile application. Global System for Mobile (GSM) is an open digital cellular technology used for transmitting data and voice services.GSM module is used to send the message to the victim's family and concerned authorities about the accident.

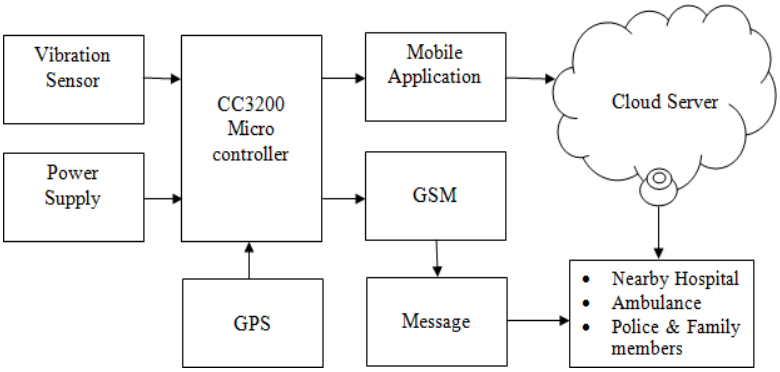

Fig. 1 Functional block diagram of proposed system

IV. WORKING PRINCIPLE

The principle operation is very simple. If the motorcycle rider meets the accident, the vibration sensor in the motorcycle receives the signal and sends the information to the CC3200 microcontroller. The vibration sensors are placed in various maximum possible striking spots of the helmet. The microcontroller keeps scanning the vibration value. In this proposed system one vibration sensor is placed where the CC3200 detects variation in the sensor according to the threshold value. A threshold value is predefined giving allowances for minor values of vibration. When a sudden change exceeding the threshold value is created which then compared with the vibration threshold. If the value gets crossed the limit, then as a result the processor detects a crash. When the controller detects the crash, it waits for 5sec to get any response from the rider. This user predefined waiting period is to avoid false positive triggering, when the helmet falls down accidentally or when the rider is fine in a crash. If there is no response from the rider for 5 seconds then the controller will send the signal to the GPS and GSM module to get the location of the incident and notify the predefined emergency contacts via SMS. Fig. 2 shows the hardware components and their connection to the helmet unit.

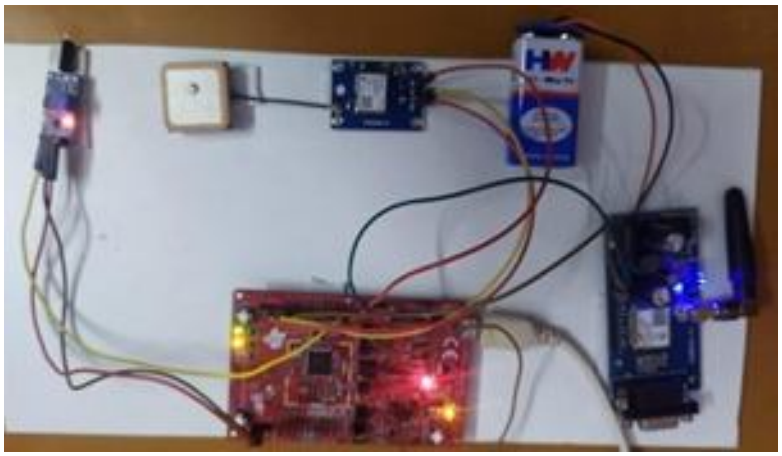

Fig. 2 Hardware setup attached to the helmet.

A. Core of Tools

The hardware that acts as a core of the operations is CC3200, GPS and UBIDOTS. The CC3200 microcontroller acts as the core of the project. Where the signals are sent to the other modules and get collected which is then analyzed to give the defined outputs. The GPS module plays a vital role in this paper of getting the location of the incident based on the signals it received from the microcontroller. UBIDOTS software application acts as a bridge to the output. This gives the status of the project and can be viewed digitally.

V. RESULT AND DISCUSSION

The smart helmet system was successfully examined and the outcome of the system was analyzed. The system can be integrated into the helmet after the resultant output was evaluated. Whenever the rider meets with the accident the vibration sensor senses the impact and sends the signals to the microcontroller. The microcontroller is ready to sends the message to the number which is stored in the EEPROM that is configured saying about the accident location. If the rider doesn't vulnerable to the accident, this operation can be stopped by the rider manually using ubidots mobile application. If the rider didn't press the switch in the ubidots mobile application within 1 min duration, the controller will send the signal to the GPS and GSM module to get the location of the incident. After that, the information will be sent to preloaded emergency contacts of the victim's family and concern authorities via SMS.

Fig. 3 (a) shows no fault screen in the ubidots mobile application when there is no accident detected. Fig. 3 (b) shows the fault detected screen which indicates that the accident has occurred. The rider doesn't press the switch in the ubidots mobile application after the accident, an emergency message is generated and sent to preloaded emergency contacts. Fig 3 (c) shows an example emergency message about the accident and its location data which was received on a GSM mobile by the victim's family.

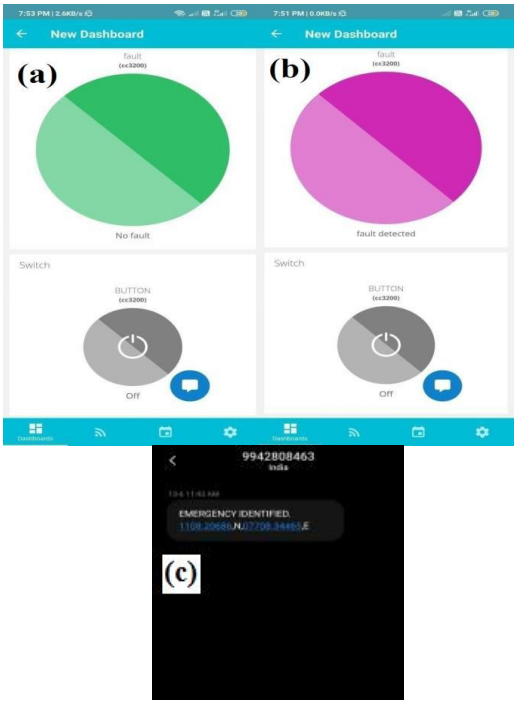

Fig. 3 (a) No fault (b) Fault detected screen of the UBIDOTS mobile application (c) SMS notification

VI. CONCLUSIONS

The main aim of this paper is to reduce the death rate of the biker met with accident and send the location information to the victim's family and concerned authorities about the accident. IoT based smart helmet system is developed which has a microcontroller used to control the entire system. In this system GSM module and GPS is enclosed in the helmet which can provide the correct location of the accident with help of IoT application to the victim's family and concerned authorities in the unfortunate event of an accident. This proposed system used to avoid the delay in giving the proper first aid to the victim which prevents the major cause of death after an accident.

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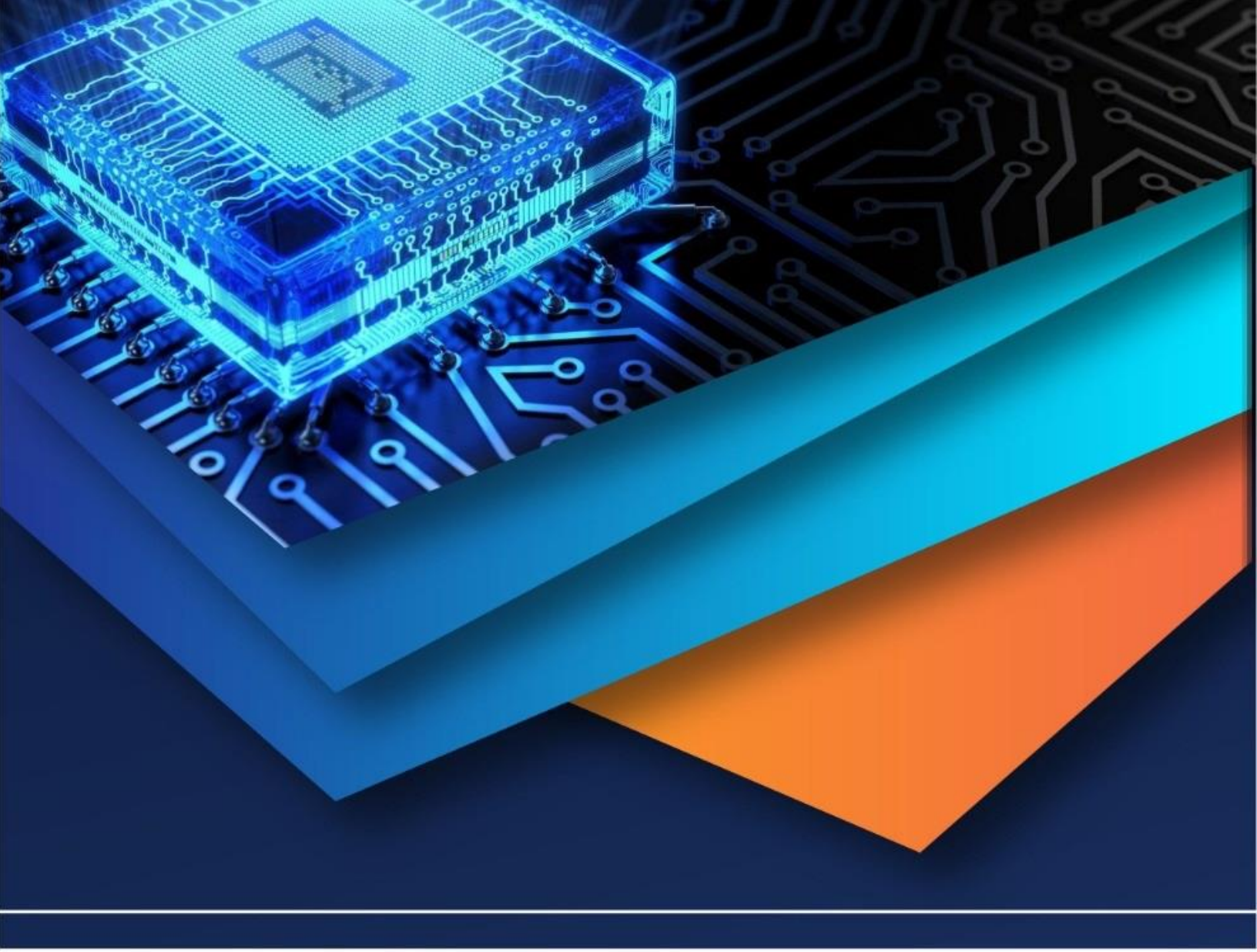

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