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Accident detection system based on Internet of Things (IoT)- Smart helmet

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ABSTRACT

The objective of our smart helmet is to provide the means for detecting and reporting accidents. The working of this smart helmet is very simple; vibration sensors are placed in different places of the helmet where the probability of hitting is more, which are connected to the microcontroller board. When the rider met with an accident and the helmet hits the ground, these sensors sense and gives to the microcontroller board, then controller extracts GPS location using the GPS module that is interfaced to it. When the data exceeds the minimum stress limit then the GSM module automatically sends a message to the registered emergency contacts and the link through which the location and the speed of the victim will be displayed in the mobile application and in a web application.

Keywords— *Camera, Emergency contacts, GPS, Internet of Things, Raspberry Pi, Smart helmet*

1. INTRODUCTION

"Internet of things" is now become an essential part of our day to day life. The usage of electronic and digital devices is increasing more than 13 billion, in equals of 2 devices per person. Suitable examples for the IoT is "Smart Home", the smartest devices are developed with programmable and remote controlled appliances. Future growth in IoT basically from every sector of the economy like a commercial, industrial, health care and public safety.[1]The utility components and all other everyday objects are combined with Internet connectivity and powerful data analytic capabilities, which are changing the way we live and work. Hence the term "Internet of Things" is defined as extending the network connectivity and computing capabilities, not only to computers but also to everyday items to generate exchange and consume data with minimal human intervention.[2]

2. RELATED WORK

The working scenario of the helmet is described (3), when the rider meets with an accident and the helmet falls on the ground, the sensors sense the vibration and sends to the microcontroller board (P89V51RD2), Then controller senses the location information using the GPS module that is interfaced to it. When the vibration exceeds minimum stress limit then GSM module (SIM300) automatically intimates the information by sending a message to the emergency responses. Authors proposed a new helmet model (4) when an accident occurs, cloud-based service is used to send the alert message with the details to the emergency contacts. The location of the vehicle is sensed through the GPS module. BMA222 accelerometer, Wi-Fi enabled processor (TI CC3200), sensors and cloud computing platforms The authors have designed a helmet for the riders to provide extra features like Listening to music while riding, sending SOS messages along with the location in case of emergency via a microcontroller (ATmega328P)[5]. This helmet is integrated with latest Bluetooth (HC-05 Module) technology through which it will get connected to the driver's Smartphone and can receive calls while driving through the Arduino Software (IDE) are used for constructing the system. The helmet is upgraded with a Peltier module for rider comfort (6), by Peltier module (TEC-12706T125), which maintains the heat inside the helmet by the thermoelectric effect. The temperature sensor (LM35D) is used to detect the temperature. If an accident occurs the GPS module sends the accurate location to the emergency contacts and in case of bleeding, it can be clotted by thermoelectric module so the risk of danger can be reduced. Smart helmet works on GPS and GSM technology (7). The accident is identified by the probability of vibration experienced by the helmet. Here vibration is detected by placing a vibration sensor on the helmet and gives to microcontroller board (P89V51RD2). Then the controller finds the location by GPS module and sends a message automatically to the pre-defined numbers by GSM module. To avoid accidents a GSM-based helmet model is introduced by developers which the helmet acts as an intelligent system (8). Here it checks whether the person is wearing the helmet and also senses the alcoholic smell before the rider starts the bike. If any of these conditions occur, the transmitter on the helmet sends a signal to the receiver on the bike via RF transmitter. These signals don't allow to start the bike and the signals are detected by a switch and alcohol sensor MQ-6. The signal and microcontroller (AT-89S552) are decoded by the receiver, and then messages are sent to concerned contacts by GSM module (SIMCOM SIM900A) accordingly. For detecting the rider's

head movement and detection of motorcycle's speed authors used, a Force Sensing Resistor (FSR) and BLDC Fan (9). To communicate between the transmitter circuit and receiver circuit, a 315 MHz Radio Frequency Module as a wireless link is used. The entire component in the system is controlled by PIC16F84a microcontroller is used. The motorcycle will be started only when the rider wears and lock the helmet. Whenever the speed limit exceeds 100km/hr, the motorcyclist will be warned and an LED light will glow. This paper about the two modules affixed on the bike (10), as well as helmet using an alcohol sensor MQ-3 is used to detect whether the rider has consumed alcohol or not. Detecting the accident and notify them to the nearest police station is also possible with the help of GSM module (SIM 900A). The rider can avoid the message from sending by pressing the abort switch when the accident is not major. In this paper (11),Smart Helmet is nothing but a Micro-controller (Intel Edison on Arduino Board) embedded inside the helmet along with Accelerometer (MPU6050), Headset (Intex), Camera (Logitech) and when the rider crashes and helmet hits the ground, from the accelerometer values Micro-controller detects accident and sends information to phone via Wi-Fi and finally Smart Helmet connects to Smartphone via Bluetooth to give audio guidelines for navigating the rider, inform about emails and phone calls. Here the Smart Helmet is proposed (12), having a Control System inside the helmet consisting of an RF transmitter through pin17 of HT12E and an RF receiver system. The bike will not get started without wearing helmet by the user, a user wears the helmet an RF signal radiates from transmitter and once this signal gets sensed by the receiver placed in the ignition switch of the bike, bike will get start and hence traffic rules will follow with this providing better security to the user. Smart Helmet is implemented with the features of alcohol detection, accident identification, location tracking, use as a hands-free device, solar powered, fall detection like a smart bike by authors in this paper (13). It is compulsory to wear a helmet, without a helmet ignition switch cannot ON. An RF Module's wireless link and an MQ-3 sensor enable communication between transmitter and receiver. If the rider gets drunk ignition switch is locked automatically and the message is sent to the registered numbers with the current location. When an accident occurs, it will send a message by GSM to registered numbers with the current location by GPS module. To communicate with the bike a proposed helmet model (14), during the initiation of the ride all the time to detect if the person is wearing the helmet or not using ultrasonic sensor (HCSR04) and then the rider is asked for a password in the form of speech to unlock and ignite the bike by matching a user-independent password using voice encrypted password mechanism via microcontroller ATmega 328. The primary objective is to force the rider to wear the helmet throughout. Smart Helmet is proposed with an Arduino controller, microcontroller (ATmegal1280) and Arduino Wi-Fi unit by authors [15]. The presence of alcohol sensor (MQ-3) in the vehicular setup of the system detects the presence of Alcohol Content in the person's breath and the pressure sensor (NPA 700) doesn't allow the vehicle to start in spite of the user wearing the helmet.

2.1 Motivation

Accident detection and reporting system based on the existing system makes use of the sensors, GSM module, GPS module, Wi-Fi enabled controller and cloud computing infrastructures for the development of the system [3]. The system builds a smart helmet for accident detection and notification. This system could be implemented only for the purpose of a smart helmet. The helmet is designed to detect an accident and immediately alert the emergency contacts. When an accident occurs and the data exceeds the threshold limit, a text message containing the location of the rider is automatically sent to the family members through the module [4]. The location details are sensed and reported by the GPS module. The related details of the rider are sent to the emergency contacts by utilizing a cloud-based service. A Wi-Fi enabled controller is used to connecting to a data network for accessing cloud services [15].

3. PROPOSED WORK

An accident is an unpredicted and unintentional event. Considering the alarming increase in the number of motorbike riders and the number of accidents happening in our country, this system ensures to make the two-wheeler driving safer than before for the rider. The lack of treatment in proper time is the major reason for half of the deaths in road accidents. At the time of the accident, the process of intimate and locating the place of the victim is a bit difficult task that is to be discovered. The credentials of the victim are unknown which is tedious during crucial moments for the people at the accidental spot. The main motive of the project is to design the IoT detection and reporting system. The unique feature of the system is to locate the victim and report the accident with the relevant information to ambulances and the rider's concerned people to provide a quick medical aid to the victim. A raspberry pi module is used and a unique code is programmed in this module to achieve this functionality. Vibration sensors are interfaced with the raspberry pi module which senses the vibration frequency of the accident. A maximum stress limit of the vibration threshold is programmed in the module. The GPS (Global Positioning System) Module senses and provides the exact current location of the rider. The GPS module is connected to the raspberry pi and all these are embedded in the helmet. The GPS module will be helpful for the family members and friends, to track the victim's location. The mobile application is installed in the rider's mobile and it is used to display the current geographical location of the victim. Ubidots is an application that acts as a bridge between your mobile application and device and sets the standard for developer updates. This application is installed on all the mobile devices of the registered emergency contacts. Any number of contacts could be stored in the raspberry pi and sent the message. Ubidots provides the way to send notifications from raspberry pi to mobile phones with simple scripting. The access tokens of the respective Ubidots applications are programmed in the raspberry pi module.

3.1 Flow chart

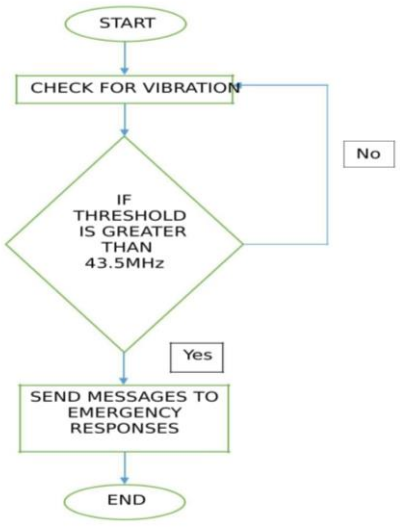

Fig. 1: Smart helmet flow diagram

3.2 Block diagram

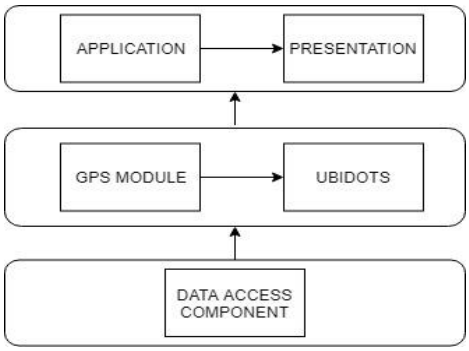

Fig. 2: Block diagram

4. RESULT

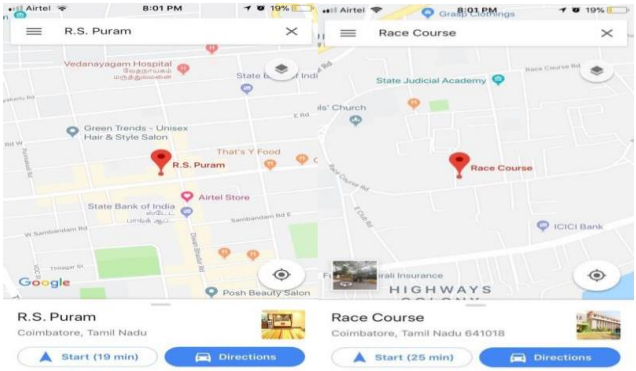

Fig. 3: Latitude and longitude

This proposed system displays the latitude and longitude with the current GPS and speed and this can be viewed in a mobile application or web application. The link for the application is provided with the message sent to the victims' family.

4.1 Mobile application

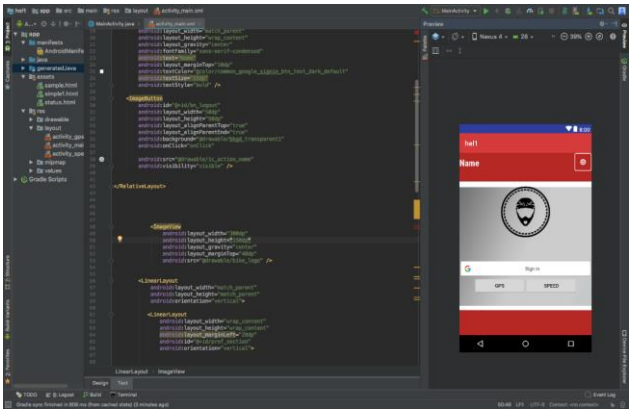

Fig. 4: A mobile application interface

4.2 Web application

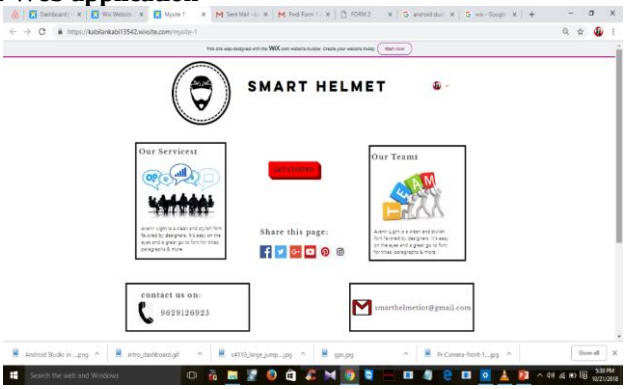

Fig. 5: Web application interface

5. CONCLUSION

In recent days, the occurrence of most of the accidents is by motorbikes. This alarming rise in motorbike accidents leads to loss of many lives. The lack of treatment in the proper time is the major reason for many deaths. The major causes may be the late arrival of the ambulance or no person at the place of accident to give information to the ambulance or family members. The system offers a solution to this problem by introducing accident detection and reporting system aiming to save at least half the lives that are lost due to bike accidents. In future, this system could be implemented for lock protection and for other safety purposes. It could also be implemented to control the speed of the vehicle and to prevent the rider from over speeding by passing the information to the rider's family. The early detection and reporting will account for the responsibility of saving many lives. The development of accident detection and reporting system with required specifications has resulted successfully. The test cases give expected output, without any dispute. The minor defects occurred during the tests are detected and rectified. The developed system works efficiently by providing quick and immediate responses.

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