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Smart Helmet Prototype Using NodeMCU and IFTTT Services IoT based Accident Alert System

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***Abstract*— The prototype proposes to solve the real-life problem of an increase in road accidents. This project will focus on improving the method of emergency alerts that are required in order to ensure the safety of the rider post the accident. The improved IoT technology systems have enabled us to solve this problem by making the data and information exchange much more efficient and optimal. With the help of this widely grown technology, it enables us to perform various functionalities such as sending locations, triggering alerts, and so on. The proposition can be achieved with help of Microprocessors and Microcontrollers such as NodeMCU, Raspberry PI, Arduino, and so on. The Helmet safety prototype is built using NodeMCU, ADXL335 Module, ADS1015 Module, GPS Module, IFTTT, and Adafruit IO.**

Keywords*— *IOT, NodeMCU, ADXL335, IFTTT, GPS Module, Smart Helmet.

I. INTRODUCTION

The Growth of technology has enabled us to explore various possible solutions that are needed to solve the prevailing problems in our life that sometimes turn out to be fatal as well. The development in the field of IoT in the past two decades has enabled technology visionaries to solve real-world problems very easily. Taking one such issue here, we are aiming to solve the problems of communication during an accident scenario, an Alert-based system that has capabilities to trigger alerts to nearby medical care centres, ambulances, closed ones, and so on. According to the World Health Organization's survey reports of the past few years, most of the accidents that tend to turn out to be fatal are due to head injuries and most of them due to them not being able to seek medical attention to the victim in the right time. Close to one-fourth of the people involved in accidents are motorcyclists. The main cause of death in two-wheeler drivers is over speeding and careless driving. Numerous lives could have been saved if the emergency medical service could get accident information and reach in time to the scene. Up to 75% of all deaths occur within the first hour of impact. Thus, in this crucial phase of time, if proper aid reaches the victims, mortality rates can be reduced. The proposed system aims to resolve this issue and enable us to dissolve the risk factor of accidents and save lives.

A. Objective

The objective of the proposed model is to develop a Smart Helmet prototype that has capabilities to detect accident and get triggered to send alerts in order to get medical attention to the victim as soon as possible and bring down the critical risk factor.

II. PROPOSED MODEL

The contribution intended by this paper is to prevent accident, developing accident management system and reducing the impact on the causality.

In this paper, we have proposed a model that will let us perform accident management very efficiently. The soft model prototype made here consists of hardware components such as NodeMCU, ADXL335, ADS1015 and NEO-6M whereas the software requirements that are needed to make this model work are Adafruit IO Feed, IFTT services, Google Assistant, Webhooks and SMS system. NodeMCU (esp8266 module) used here lets us act as the middleman between the sensors and the data transmission which is done in order to create a trigger in the first place. The Wi- Fi facilities provided in the esp8266 enables us to perform the communication of the data that the sensors collect. Fig 1 given below explains the flow of the proposed model.

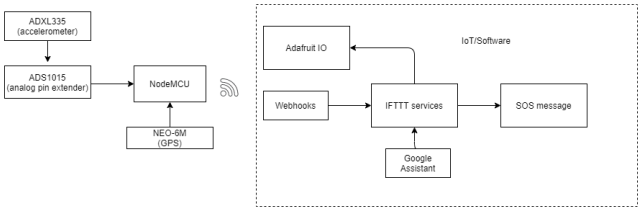

Fig 1 – Block Diagram of the Smart Helmet System

III. RELATED WORKS

[1] This model has used The TI CC3200 which is a Wi-Fi enabled controller, that allows us to connects to a data network for accessing cloud services. This expands the computational and storage capabilities of the system. The system on the helmet communicates with the cloud-based incident response and notification system via a RESTful architecture over HTTP using JSON. This microcontroller also has an onboard Gyroscope. The inbuilt gyroscope and the use of a custom API gives it an edge, although the model isn't economical and also

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has communication delay which is very crucial in an accident management system.

[2] In this paper, they have proposed a model of a smart helmet for accident identification and preventing the accident. They use IR sensors, gas sensors, and load sensors for preventing an accident. The 3-axis accelerometer is used for detecting any accident. Arduino is used for processing sensors data and building a communication system between sensors and mobile applications. The mobile application is connected with a central monitoring system and authority can monitor every user accident history. When any accidents occur, the accident location sends to the monitoring database, and the monitoring system sends the location to the nearest hospital and police centres. The microcontrollers used are economical and the data is encoded, although it does have its cons as well. The RF transmitter used requires more battery power, the circuitry is very complex and it also works on two circuits as well, one is on the vehicle and the other on the helmet which unveils the features provided if the user is to use a different vehicle.

[3] In this paper, a new safety system "Aagaahi - A Smart Helmet" for the safety of two-wheeler riders has been proposed. This system is limited only to the user and does not require any external intervention for the road safety regulations to be followed. It detects the presence and checks the sobriety of the driver efficiently. The system is well executed. It has a rechargeable power system. It has an accident detection system and provision of providing immediate notification to the family members. The designed system is compatible with any type of communication protocol. The system is very user-friendly. The advantages are that there are various parameters that are being checked and the battery used is rechargeable as well. The con of this model is that the circuitry yet again is very complex. The circuit present in the vehicle can also be exposed to damage, thus providing a possibility of it becoming dysfunctional during a cause of an accident.

[4] The proposed model in this paper has 3 modules: Vehicle module, Sign board detection module and accident detection module. The vehicle module includes the LCD Display, which lets the users know about upcoming obstacles detected using the sign board detection module. This works with the help of RF modules located on the sign boards and in the vehicle circuitry. An accident detection system is also equipped into the helmet which sends an SOS message on detection. The Unique sign board detection is a very unique feature relative to any other model, although the setup is very expensive and the practicality of installing RF modules on every sign board is a tedious process and may not be feasible.

[5] The paper describes the prototype of a smart helmet which aims to detect and report accidents occurring in two wheelers. Microcontroller interfaced with accelerometer and GSM module and cloud service infrastructures are utilized to achieve the final objectives of notification and reporting. The helmet is developed in a way to detect an accident in two wheelers and send the geographical coordinates of the accident to the emergency authorities and the emergency contacts of the victim. A 6-axis accelerometer is mounted on the helmet which continuously monitors the acceleration levels of the helmet. When an accident is detected due to inconsistent acceleration levels and exceeds the threshold, it gathers the GPS coordinates from the GPS module and sends a message to the emergency authorities' web server which then sends an emergency message to the assigned emergency contact of the victim. The advantage of this model is that they use a custom web server and multiple parameters are checked as well but the precision and accuracy is on the lower end and there is no inbuilt Wi-Fi Module.

IV. METHODOLOGY

A. Accelerometer

The accelerometer sensor used in this model is ADXL335. Accelerometer is generally used to calculate the acceleration which is basically change of velocity of on object. The ADXL35 measure acceleration in 3 axes individually, using which the RMS value of acceleration is found. Since the ADXL335 requires 3 analog pins and the NodeMCU has only one, an analog pin extender (ADS1015) is used.

$$RMS = \sqrt{(a_x^2 + a_y^2 + a_z^2)} \qquad (1)$$

Equation (1) gives us the formula to calculate the RMS value of acceleration which will be vital on providing data as input to the sensors to set the threshold.

B. GPS Module

NEO-6M is the GPS receiver being used in this model. It provides us with a strong satellite search feature. We can also monitor the status of the module with power and signal. The working is very simple, the receiver receives a signal from GPS satellites and the satellite transmits these signals and further being used. NEO-6M lets us know the location of user and transmit that data. This sensor reads data in Degree Minutes (Dm) format which is converted to Decimal Degree (DD) format to suit the google map link.

C. IFTTT Services

IFTTT provides us with automation services. It can be used in various other applications such as social media posting, home automation system, RSS feeds and so on. IFTTT services enables us to create alarm triggers which will trigger to send an SMS alert during the emergency in case of our application. It is also used to interrupt an emergency request in case of a false alarm.

D. Adafruit IO

The whole smart helmet system is activated only if the status on the Adafruit IO cloud feed is set to ON. In case of a false alarm interruption from the user, the feed is set to OFF and then set back ON after a short delay. This is facilitated by IFTTT services.

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E. Working Principle

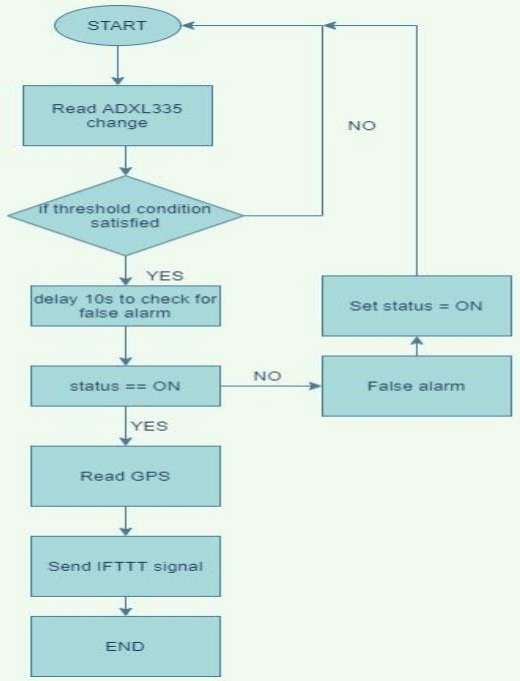

Fig 2 – Algorithm Flowchart

The working principle can be clearly be seen in Fig 2 above. The accelerometer (ADXL335) sensor detects the acceleration in all 3 axes at an interval of 100ms. The relative RMS value of acceleration is checked for a sudden change in acceleration. If the relative RMS value is greater than 100, it is considered as an accident and a 10 second delay is initiated. In this delay, the users are free to interrupt the emergency message from getting delivered using the Google assistant. If there is no interruption from the user, an emergency message is broadcasted to the emergency contact on the user's phone. In this emergency message, the location of the accident is sent as a Google maps link. This link contains the coordinates of the location of the accident which is computed by the GPS sensor (NEO-6M). The emergency broadcast and the false alarm interrupt are facilitated by the IFTTT services.

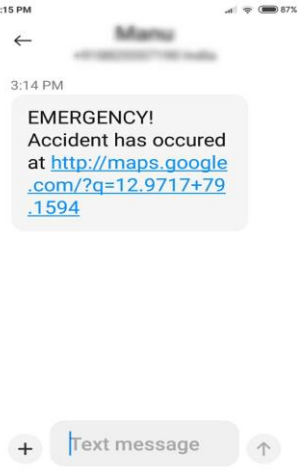

Fig 3 – Alert trigger made

V. CONCLUSION

In this proposed model we have seen that it is possible to make a smart helmet based on Internet of Things can detect a crash and send an alert along with the location to a nearby medical centre/Hospital which can help in giving the medical attention much faster and can arrive to the location as soon as possible. In a practical real-life model, it is indeed possible to have to make the product as a much smaller model where the microcontroller will have only the necessary ports with more robust connections to the peripherals making it more reliable and feasible to be implemented as a real-life working model.

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