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Solar Powered IOT based Smart Helmet

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Abstract*: In our day-to-day life large percent people die from road accident. A solution needed to solve problem using a "Smart Helmet". This smart helmet is a special idea which makes rides safer than before. The main aim of this helmet unless, the person must worn the helmet. It uses wirelessly switching on a bike, so that it will not start without both key and helmet. The concept of GSM and GPS to track the location and provide medical attention to rider and message sent to predefined numbers (police, relative and ambulance). It providing a over speed limit (alert), and emergency call alert to the user\rider. The project runs in a solar power.*

The trending technology, the Internet of Things (IOT) that is changing our lives day by day. It is creating a new world, quantifiable and measurable world where people and businesses can manage their assets in better informed way and make more timely decisions. This paper proposes a smart helmet for the accident detection using sensors and Raspberry pi with IOT as a domain. The main feature of designing this helmet is to not only to make the helmet smart but also to provide safety to rider.

Keywords: *Safety, Smart helmet, Raspberry pi, Single hub processing unit, Solar-powered, In-Helmet Display*

I. INTRODUCTION

The Modern technology has improved the safety features of most regular vehicles, but motorcycles have seemingly not benefitted from the same technological revolution. What motorcyclists need is a solution to safety concerns that all motorists have, while additionally assisting the driver in a few quality of life improvements on the road.

This system aims to do just that by giving motorcyclists an easy and effective way of staying aware of the potential dangers lingering outside of their natural field of view. By incorporating a Heads-Up Display (HUD) on the front of the helmet, motorcyclists should not have to rotate their entire body and head away from their line of travel to know if there are vehicles to the side, back, or even their blind spots. With our solution the driver will have an effective way of visually (and also audibly in critical scenarios) being notified of vehicles surrounding the bike to potentially save the rider's life.

Although not designed to be a complete replacement to manually checking hazards, our device will help in the occurrences where a simple mistake could have led to a fatal outcome. The device will be lightweight and easily portable. It will be divided into two parts: wireless attached helmet HUD, and a Rear-Mounted area detection sensor which will be connected to a motorcycle interface. Although meant to interface with the motorcycle (to detect turn signals and other information about the bike), the entire device is meant to be mounted on and used by any motorcycle with supported standard connections.

The sensor and bike interface will be powered via the on-vehicle battery, and will send the critical information, wirelessly, to the helmet HUD. While riding, the helmet will always be listening for information sent from the bike, and will very frequently update, so the rider can always see current

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bike information. Low range wireless is planned, not only to prolong battery life, but to also avoid possible interference with communication.

The helmet HUD will be battery powered, and designed to run at very low power. It will last for hours on a single charge, and, with solar power, even longer. Home charging will also be available for the then helmet is not in use. Since the helmet HUD is the only part of the device that will need charging, user maintenance of the device will be simple and straightforward.

Others have attempted to deliver similar functionality, but they are either too unreliable or too overpriced for the realistic consumer. Our device aims to be a dependable and simple solution at a fraction of the price. The planned consumers for our project will be vendors, seeking to sell next generation safety equipment to motorcyclists. The design goals listed will be used as guidelines when developing the hardware and software requirements. In summary, our project seeks to meet the following goals:

- Research, design, and implement a cost-efficient motorcycle proximity detection solution.
- Incorporate distance sensing methodologies to detect objects from a far.
- Implement the design to be easily applicable for other automobile systems.
- Design the Smart Helmet to be operable by many types of users with little to no training required.
- Follow industry standards to ensure safety, reliability and environmental care

Assuming all of the above goals are met, our project will also attempt to meet the following extended goals:

- Incorporate a flexible, transparent display for the helmet module.
- Utilize a Global Positioning System (GPS) device to include navigation data to the user.
- Provide customization settings for the visual display that the user can configure.
- Integrate mobile technology, such as a cell phone, into the project to diagnose the Smart Helmet.
- Implement a News, Calendar; Time Temperature API's to provide real-time highlighted news & weather details to the user.

II. LITERATURE REVIEW

Mangesh Jadhawar [1] focuses on reducing the rate of 2 wheeler accidents. The reasons for the accident considered in the paper are listed here-One among the main reason for bike crash is; the rider might have consumed alcohol. An author of this paper brings out a solution to reduce the accident due to drunken drive with the help of MQ3 sensor. This system can be integrated with the ignition system of the bike thus allowing only sober citizens to drive the bike. MQ3 alcohol sensor is suitable for detecting alcohol concentration on the rider's breath. It is just like a common breathalyzer. It has a high sensitivity and fast response time. It can be placed just below the face shield. Other reasons include carelessness of the rider. Taking this reason into consideration, IR sensor is employed which is used as obstacle detectors. One IR sensor is used on bike module for safe zone detection. If any obstacle is detected, it gives signal to microcontroller and microcontroller take action and gives an alert to the rider.

Padmapriya N [2] focuses on road safety in a different perspective with additional feature. Baseline that the paper emphasis is that: most of the time rider hesitates to wear helmet which could result in fatal accidents. Drunken driving and Drowsy driving are the major factors for such road accidents. The primary concern of all riders is safety. A new smart helmet with Brainwave technology is introduced to avoid these kinds of accident. This helmet warns the rider if he is having distracted state of mind or drunken and it also prevent accidents and makes the rider drive safely.

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The breath alcohol sensitizer in the smart helmet helps to identify BAC and prevents him/her from drunken driving and thus reduces accidents. The Smart MP3 player adjusts the volume of the music automatically while rider is listening to the music as a safety precaution. The rider can use GPS technology to locate himself/herself and can navigate to the destination. In case of accidents GSM/GPRS modem send a message to a person regarding rider's location. This smart helmet mainly concerned on safety and comfortableness of the rider.

Aviral Vijay [3] focuses on the fact that riders usually forget to wear the helmet before starting to commute. Problem solution framed is; one technology which can be used for this purpose is compulsion of wearing the helmet to the bikers as well as an automatic SMS alert in the accidental situation with exact location of the biker. The ignition system of bike would start only when relay is connected and it could be only possible when receiver circuit would get the signal from transmitter at the helmet.

A. Srikrishnan [4] surveyed on detection of alcohol using a smart helmet system is presented. It checks whether the user is wearing the helmet and has non- alcoholic breath while driving the vehicle. The system is divided into two halves: A transmitter section and a receiver section. There is a switch placed on the helmet, which powers the helmet and the pressure sensors placed to ensure the proper wearing of helmet on the head. An alcohol sensor MQ3 is placed near to the mouth of the driver in the helmet to detect the presence of alcohol. The vehicular engine should not be started, if any of the two conditions is violated. Microcontroller Unit (MCU) controls the function of relay and thus the ignition, it control the engine through a relay and a relay interfacing circuit.

Sangeeta Nagpure [5], working of smart helmet is very simple, vibration sensors are placed in different places of helmet where the probability of hitting is more which are connected to microcontroller board. So when the rider crashes and the helmet hit the ground, these sensors sense and give to the microcontroller board, then controller extract GPS data using the GPS module that is interfaced to it. When the data exceeds minimum stress limit then GSM module automatically sends message to ambulance or family members.

III. PRAPOSED METHODOLOGY

The architecture that was created was a system where the proximity sensors were directly mounted on the helmet. This type of system would have two main subsystems the master Bike-Mounted Module and the Slave Helmet HUD Module. The Bike-Mounted Module is powered by the motorcycle, which would contain a voltage regulator that would control the incoming voltage from 12V to 5V. From there the Raspberry Pi MCU would intercept the turn signal flags from the motorcycle. If the flags are raised high, the Pi MCU on the Bike-Mounted Module would structure the data for transmission to the Helmet HUD Module. The two subsystems would communicate with a Server/Client Wi-Fi connection. If the Helmet HUD Module receives a ping from the Bike-Mounted Module, the Raspberry pi mounted on the helmet would awake from idle, initiate the sensors, and gather range data. The HUD Module will then convert the range data into the proper display format and display it to the rider on the visual displays mounted onto the helmet visor.

The RPi board is utilized for controlling the total system with the Cam module, accelerometer, MQ-3 Alcohol sensor, GPS and the GSM module. Co-ordinates identified utilizing GPS module and the GSM module for sending alert messages (SMS) to guardian, police, nearer ambulance & Raspberry Pi Cam module for capturing live moment picture & then upload on local drive and also on cloud. If driver drunk identified utilizing MQ-3 sensor and then send alert by message. The LCD show is utilized for showing the status of the framework as Time, Weather report, Live Highlighted News, Calendar and even the co-ordinates. Fig.1 shows the Block Diagram of the framework. This system is

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basically used for performing five major operations, i.e., Vehicle Tracking, Accident detection, Alcohol detection and call communication and the most important is Data collection for cloud.

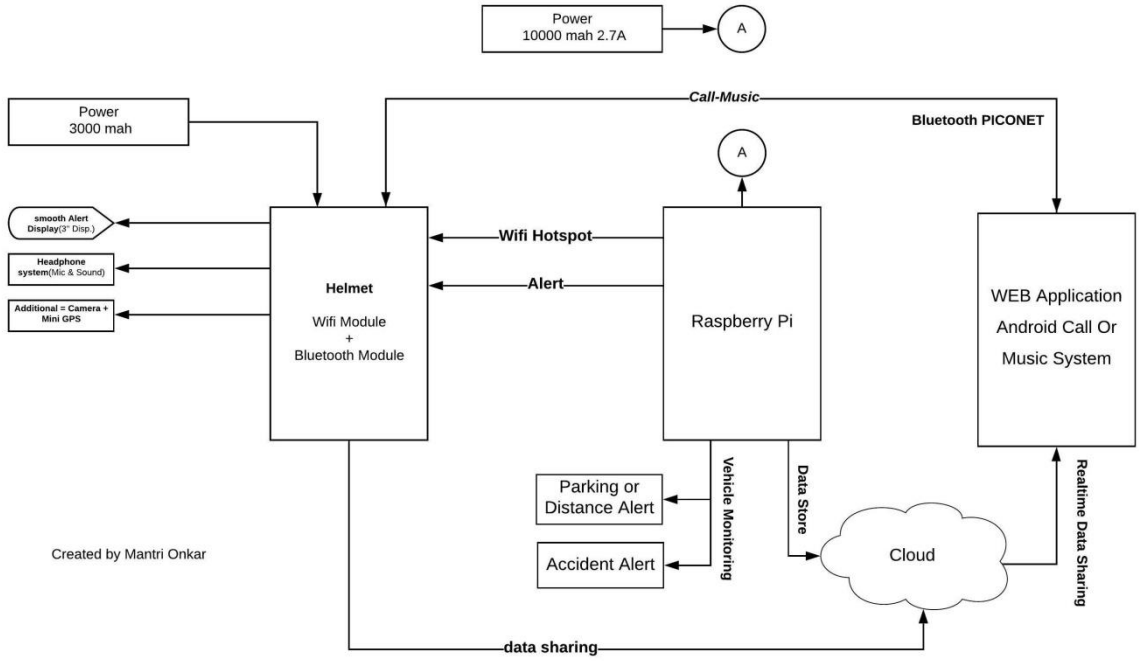

Fig 1 Block Diagram

1. Vehicle Tracking

On fuelling up the framework and establishment in the vehicle to be followed, a SMS is to be sent: "Track the vehicle" to the framework set in the vehicle. For appropriate ID of the string the prefix (#) or the postfix (*) can be utilized. ("#Track the vehicle*"). The SMS that is sent is gotten by the GSM module and it sends the information to the Raspberry pi and henceforth the SMS is perused and removed by the Raspberry pi on examination with the pre-characterized message. On coordinating with the pre-characterized message RPi peruses the co-ordinates utilizing the GPS module by extricating the $GPGGA string. When the coordinates are gotten and also drunk status gotten, they are sent to the client utilizing the GSM module. Henceforth the vehicle is followed.

2. Accident Detection

Another part of the mishap identification activity is the accelerometer. The accelerometer recognizes the mishap on premise of the adjustment in the pivot of development. In this way at whatever point there is a mishap, the tilt in the vehicle is utilized to change the hub estimations of the accelerometer. This adjustment in pivot esteems is perused by the RPi and the qualities are contrasted and the edge esteems. When the variety is distinguished, the RPi peruses the coordinates utilizing the $GPGGA string from GPS module information and the framework checks for the terminate key status. In the event that the driver can press the end key, the co-ordinates removed are disposed of and the framework is reset. Else, the extricated co-ordinates are sent to the crisis contacts like police, ambulance, and family and so on. These coordinates can be utilized to find the mishap area and henceforth crisis administrations can be effectively given.

3. Alcohol Detection

The Alcohol sensor MQ-3 is selected in this system due to its high sensitivity in detection and has good resistance to disturb of gasoline, smoke and vapour. The sensor able to detect Blood Alcohol Content (BAC) with different concentration and classified to the range of BAC detected into a few level. Alcohol sensor MQ3 is suitable for detecting alcohol concentration just like our

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common breathalyser. It has a high sensitivity and fast response time. Sensor provides an analog resistive output based on alcohol concentration which is given to inbuilt ADC of microcontroller.

The system begins to operate when the alcohol sensor detected BAC level from the driver. Then it will send the signal to Arduino AT mega for further process which will involve the display, alarm and ignition system. BAC level detected by alcohol sensor is based on gas/ alcohol concentration in ppm (parts per million).

This system is tested by alcoholic drinks/after shave lotion as the input to the experiment. The alcohol sensor can sense an alcohol from human breath from 0 ppm until 1000 ppm. In this system is the alcoholic intoxication is displayed in the percentage, for that purpose we program as per our condition that voltage samples is converted into percentage using Mapping Concept. The result is categorized into three conditions of the driver with different value (in percentage) of BAC level which are intoxication, drunkenness and over limit drunk.

TABLE **1**
ALCOHOL DETECTION

Output	Level of Drunkenness		
	0% - 25%	26% - 50%	50% - 99%
Display	Intoxication	Drunkenness	Over limit drunk
SMS by GSM	No	Yes	Yes

4. Intercom System

It is a talkback, two-way, stand-alone voice communication system that contains circuitry for purpose of transmitting and receiving audio. NRF24L01 is the latest technology to hit the motorcycle intercoms. Not only can these systems communicate totally wirelessly from rider to passenger, they can be used to communicate from bike to bike. The system can work well in the range of 20-30m .This system works at the RF frequencies where cellular range is not available. The system is cost effective, handy and easy to use.

5. Data Collection for Cloud

A cloud server is powerful physical or virtual infrastructure that performs application- and information processing storage. Cloud servers are created using virtualization software to divide a physical (bare metal) server into multiple virtual servers. Cloud storage is a cloud computing model in which the data is stored on remote servers and maintained by a cloud storage service provider. This allows users to customize their data and share it with friends and business partners over the Internet. Including that we have implemented our project in the college network, we use mainly restricted network with firewall and blocked ports. Thus, port forwarding is not a possible option for the scope of our project. Weaved uses a tunnel protocol to resolve this problem. It provides a unique global IP for the device that is Function of their actual address. Thus, we can say that it makes a path or tunnel to the destination server and server Route 80 port requests on it.

IV. CONCLUSION

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The Proposed model equipped with a camera mounted to the helmet and entire video will be recorded and stored in the data storage of the helmet, like a BLACK BOX which improves safety to the rider. The alcohol detection will prevent drink and drive scenario and the effects of drink and driving to public and the rider himself. Web application built for the system will ensure the smooth functioning of the system. Speed monitoring of the vehicle will prevent over speeding rash riding and violation of traffic rules.

REFERENCES

[1] Dave Evans, "The Internet of Things How the Next Evolution of the Internet Is changing everything" http://www.cisco.com/c/dam/en_us/about/ac79/ docs/innov/IoT_IBSG_0411FINAL.pdf

[2] Jennifer William, Kaustubh Padwal, Nexon Samuel, Akshay Bawkar, Smita Rukhande, "Intelligent Helmet" - International Journal of Scientific & Engineering Research, Volume 7, Issue 3, March-2016 ISSN 2229-5518 IJSER 2016 Page:591 to 594

[3] Mangesh Jadhawar, Gauri Kandepalli, Ashlesha Kohade, Rajkumar Komati "Smart Helmet Safety System using ATMEGA 32" - International Journal of Research in Engineering and Technology, Volume 9, Issue 3, September-2016 ISSN 2229-5518 IJSER © 2016 Page:491 to 494

[4] Kavianand G , Padmapriya N "Brainwave and Alcohol Sensitising Helmet for Riders Safety"- International Journal for Research in Applied Science & Engineering Technology, Volume 3 Issue III, March 2015, Volume 2, Issue 6, October-2015 ISSN 2229-5518 IJSER © 2015 Page:391 to 394

[5] Aviral Vijay, Ajay Singh, Bhanwar Veer Singh, Abhimanyu Yadav, Blessy Varghese and Ankit Vijay, "Hitech Helmet and Accidental Free Transportation System"- International Journal of Advanced Technology and Engineering Exploration ISSN (Print): 2394-5443 ISSN (Online): 2394-7454 Volume-2 Issue-6 May2015.

[6] Jennifer William, Kaustubh Padwal, Nexon Samuel, Akshay Bawkar, Smita Rukhande, "Intelligent Helmet" International Journal of Scientific & Engineering Research, Volume 7, Issue 3, March-2016 ISSN 2229-5518 IJSER, pp. 591-594, 2016.

[7] Shabbeer, Shoeb Ahmed, and Merin Meleet. "Smart helmet for accident detection and notification" 2017 2nd International Conference on Computational Systems and Information Technology for Sustainable Solution (CSITSS). IEEE, 2017.

[8] Divyasudha, N., P. Arulmozhivarman, and E. R. Rajkumar. "Analysis of Smart helmets and Designing an IoT based smart helmet: A cost effective solution for Riders" 2019 1st International Conference on Innovations in Information and Communication Technology (ICIICT). IEEE, 2019.

[9] Tapadar, Sayan, Shinjini Ray, Himadri Nath Saha, Arnab Kumar Saha, and Robin Karlose. "Accident and alcohol detection in bluetooth enabled smart helmets for motorbikes" In 2018 IEEE 8th Annual Computing and Communication Workshop and Conference (CCWC), pp. 584-590. IEEE, 2018.

[10] Rupesh, Leena, Aarti Jain, Subham Sarda, Shivam Gupta, S. I. Sajeesh, and Dhayanithi Palanisamy. "IoT and Cloud Based Integrated System for Accident Reporting and Vehicular Health Monitoring" In 2018 Fourth International Conference on Research in Computational Intelligence and Communication Networks (ICRCICN), pp. 23-26. IEEE, 2018.

ISSN: 2233-7853 IJFGCN

[11] Jesudoss, A., R. Vybhavi, and B. Anusha. "Design of smart helmet for accident avoidance" In 2019 International Conference on Communication and Signal Processing (ICCSP), pp. 0774-0778. IEEE, 2019.

ISSN: 2233-7853 IJFGCN