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SMART HELMET WITH REAR VIEW AND ACCIDENT DETECTION SYSTEM FOR ENHANCING SAFETY

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A.ABSTRACT:

This document describes a smart helmet that uses a base station and an Ai camera to show the rider what he is looking at. Speedometers help drivers stay within the speed limit. The collision detection system is powered by a heart rate sensor. In the event of an accident, an automatic notification will be sent to the relevant office at while the location is determined using the IOT platform and mobile GPS. A heart rate monitor is also used to measure sleepiness, and a vibrator alerts the driver to sleep. Intelligent navigation warns the driver behind the motorcycle of a turn. This smart helmet app aims to make motorcycle riding more comfortable

Keywords - Smart Helmet, Wearable Technology, LCD Screen, Raspberry Pi, Camera, Arduino, Heart Rate Sensor, GPS, GSM, Problem Detection

B.INTRODUCTION

Nowadays, especially among the young generation, the use of motorcycles is really remarkable. As the number of drivers increases, so does the frequency of traffic accidents. That is why many deaths occur and most of them are due to the carelessness of the rider. One of the reasons for this accident is that riders cannot see behind them when riding with a helmet on. Riders also do not monitor the speed of the motorcycle. This causes the rider to have less than enough reaction time to react to sudden changes in the road. If an accident occurs, immediate medical attention is required. often unavailable due to lack of reporting to the appropriate authority with exact location. In addition, the rider may feel drowsy while riding, which may lead to an accident. In addition, drivers often forget to use their turn signals when turning. Recently, a number of researches have been carried out with the aim of ensuring the safety of cyclists. The helmet is equipped with various sensors that provide various safety features. To ensure that the driver is not drunk, a gas sensor is used as an alcohol detector, which acts as a stimulus signal to start the bike. The speed sensing function is also used in various research works to facilitate the driver with speed limit indicator. The need for an accident detection system along with accurate event location is also implemented. Accident detection is performed using a pressure sensor, a vibration sensor, and an impact sensor. The use of GSM and GPS technology is also seen in various research works to know the exact location of the accident. The use of Arduino, raspberry pi and pic microcontroller is widely present in many prototypes. Commercially available smart helmets for consumers are few. However, these are expensive and unavailable in developing countries. Conventional helmets that are available in developing countries do not offer any solutions to solve safety problems. This article presents a smart integrated helmet for enhanced safety and perfect random condition detection. The camera used in this smart helmet allows the rider to see vehicles behind him. Raspberry pi zero transmits the view from the raspberry pi camera (v1.3) to an LCD display (3.5 inch TFT) mounted in front of the helmet tilted at 10° from horizontal. The speed is monitored

by the Arduino Nano using a GPS module. When the predetermined speed limit is exceeded, the rider is warned by a series of bright red LEDs located just above the display. An Arduino-based infrared heart rate sensor (KY-039) is used to design the crash detection system, which continuously monitors the rider's heart rate. This sensor attaches to the rider's left ear when the helmet is on. When an accident occurs, the sensor detects an irregular heart rate pattern. This will start an automated short message service (SMS) to a predefined mobile number of family members and an emergency service using a GSM module (SIM800L quad-band 800 MHz). At the same time, should the rider feel drowsy, causing a lower than normal heart rate, a vibrator is activated to wake the rider up and keep them alert during the ride. Finally, the intelligent direction indicator is implemented using a 3-axis gyroscope (MPU-6050) that detects the lateral movement of the rider's head. This is a gesture input for turning on the right and left indicators located on the back of the helmet.

C. SMART HELMET FOR ENHANCING SAFETY:

Arduino UNO

Arduino is a development board where we connect sensors and WSN modules to make a completely successful project. The **ATMEGA 328 P controller** is known as the heart of the entire system which will check for the input and operate the output accordingly. It will also check for serial data receiving through Serial ports and send data through the serial port to the needed peripheral devices It will check for the sensor values connected with it and take necessary action when the values go abnormal. Such as temperature heart rate and also reducing and stopping the motor speed according to the drowsiness level. Arduino consists of both a piece of software, or IDE (Integrated Development Environment), and a physical programmable circuit board (often referred to as a microcontroller). Codes can be written and uploaded to the physical board. Interactive objects can be developed by taking inputs from sensors, and a variety of lights, motors, and other outputs can be controlled by it. These projects can be stand-alone or can communicate with software running on your computer. **ATmega328** is the microcontroller board on which Arduino Uno is based. Out of the 14 digital input/output pins, there are 6 pins that can be used as PWM outputs, a 16MHz Ceramic Resonator, 6 Analog inputs, a USB connection, a Reset button, a Power jack, and an ICSP Header. Everything needed to support a Microcontroller is present in it. To start it we just need to connect it to a USB and an AC- DC adapter.

Linux kernel

The android uses the powerful Linux kernel and it supports wide range of hardware drivers. The kernel is the heart of the operating system that manages input and output requests from software. This provides basic system functionalities like process management, memory management, device management like camera, keypad, display etc the kernel handles all the things. The Linux is really good at networking and it is not necessary to interface it to the peripheral hardware. The kernel itself does not interact directly with the user but rather interacts with the shell and other programs as well as with the hard ware devices on the system.

The HT12E encoder is a CMOS IC built especially for remote control system applications. It is capable of encoding 8 bits of address (A0-A7) and 4 bits of data (AD8-AD11) information. Each address/data input can be set to one of the two logic states, 0 or 1. Grounding the pins is taken as a 0 while a high can be given by giving +5V or leaving the pins open (no connection). Upon reception of transmit enable (TE-active low), the programmed address/data are transmitted together with the header bits via an RF medium.

Micro camera:

The 0.3MP OV7670 Camera Module with High-Quality SCCB Connector is a low voltage CMOS image sensor; that provides the full functionality of a single-chip VGA(Video Graphics Array) camera and image processor in a small footprint package. The OV7670/OV7171 provides full-frame, sub-sampled or windowed 8-bit images in a wide range of formats; controlled through the **Serial Camera Control Bus (SCCB)** interface. This 0.3MP OV7670 Camera Module has an image array capable of operating at up to 30 **frames per second (fps)** in VGA; with complete user control over image quality, formatting and output data transfer. All required image processing functions, including exposure control, gamma, white balance; color saturation, hue control and more, are also programmable through the SCCB interface.

Accelerometer:

An accelerometer is an electromechanical device that will measure acceleration force. It shows acceleration, only due to cause of gravity i.e. g force. It measures acceleration in g unit. On the earth, 1g means acceleration of 9.8 m/s2 is present. On moon, it is 1/6th of earth and on mars it is 1/3rd of earth. Accelerometer can be used for tilt-sensing applications as well as dynamic acceleration resulting from motion, shock, or vibration.

Arduino Nano

The Arduino Nano, based on the ATmega328microcontroller, is a very compact but complete board with similar functionality of an Arduino Uno. It operates on 5Vand has 30KB of onboard memory (excluding bootloader),2KB of SRAM, 16MHz clock speed, 8 analog and 14 digital i/o pins of which 6 are PWM. Although the Nano by default supports

only one serial communication at a time, through use of software serial it was possible to use both a GPS and a GSM serial communication using the PWM pins.

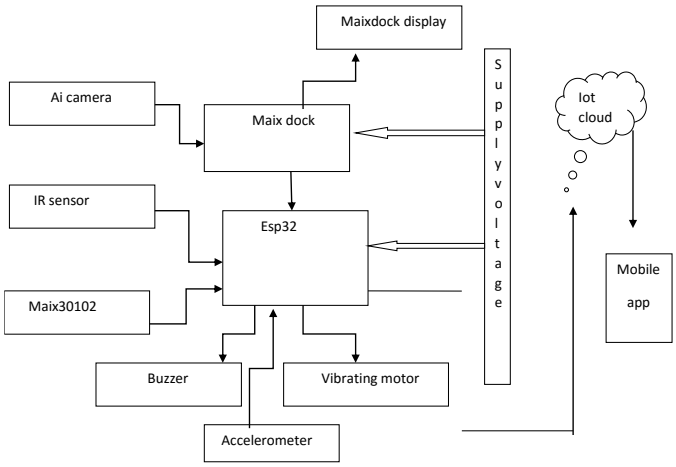
HEART RATE SENSOR

It is an integrated pulse oximeter and heart-rate monitor sensor solution. It's an optical sensor that derives its readings from emitting two wavelengths of light from two LEDs – a red and an infrared one – then measuring the absorbance of pulsing blood through a photodetector. This particular LED colour combination is optimized for reading the data through the tip of one's finger. It is fully configurable through software registers and the digital output data is stored in a 16-deep FIFO within the device.It has an I2C digital interface to communicate with a host microcontroller.

Gyroscope

The gyroscope module is built around IC MPU-6050. The IC features Tri-Axis angular rate sensor (gyro) with sensitivity up to 131LSB/DPS. The tri-axis accelerometer included in the IC is programmable with full scale range of ±2g, ±4g, ±8g and ±16g. It also features sensor timing synchronization and gesture detection. The embedded algorithms perform run-tome bias and compass calibration without user intervention. It is powered by supply of 3v to 5v with operating current of 3.6mA. The standby current consumption is 5uA.

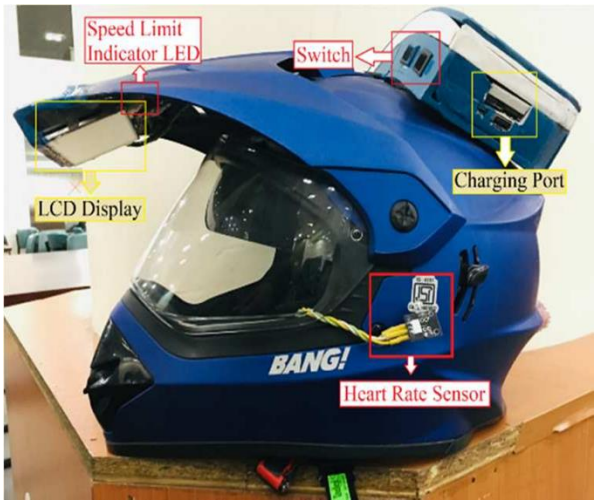
BLOCK DIAGRAM

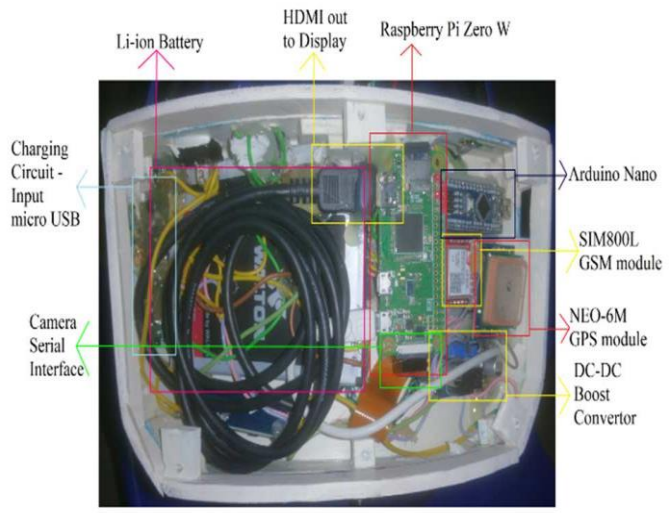


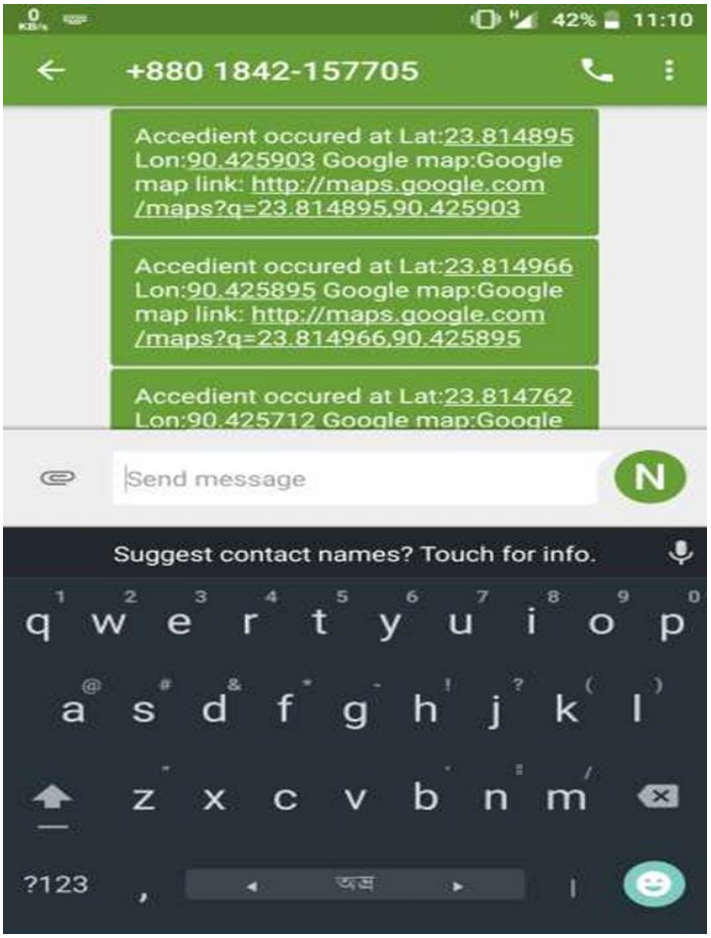
METHODOLOGY

GPS for speed and location. Also, temporary (volatile) variables were used for GPS instead of those that pre-allocate memory because the Arduino Nano has limited memory.

The Arduino was used for both GSM and GPS, both of which use serial communication, so the Nano had to be programmed to use two software serials instead of a single hardware serial in order to use both services. However, since only either of the two software series can be used, it has been coded as such, so that it only uses GSM when sending SMS and whenever else. The helmet had an extended top that served as a mount on which the rear display was mounted. The rest of the components were housed in a plastic box with cutouts for the charging ports and switches and cables leading to the display on the front, the heart rate sensor on the left ear and the camera module on the back. On the back, the Raspberry Pi camera module is fixed diagonally to the chassis so that the driver can see behind clearly and conveniently. This is verified by wearing an actual helmet and adjusting the camera and display functions while the system is running. In addition, the LED lights are located in the lower part so as not to block the view of the camera, so that the vehicles behind you are clearly visible even during the day. The box contains all the main components of our system: Raspberry Pi, Arduino Nano, Battery, Charging module, Boost converter, GSM module, GPS module and Gyro sensor. They were carefully placed and attached and glued so it can handle rough movement and still work perfectly. On the back, the Raspberry Pi camera module is fixed at an angle to the chassis so that the driver can clearly and easily see what is behind them. This is verified by wearing an actual helmet and adjusting the camera and display functions while the system is running. In addition, the LED lights are located at the bottom so as not to block the camera's view, allowing you to clearly see the vehicles driving behind you even during the day. Then testing the device, it was also found that the GPS signal was weak with the cover on the box, so we had to cut out a section just above the GPS module so that the module could connect to the satellites and get a position data accurately.







CONCLUSION

The main objective of developing this system is to provide a basic platform for motorcycle riders and prevention of accidents. The system can be more improved than the current form. In the context of improving this system further work can be done by including an OLED screen instead of the TFT screen. OLED screens have the thinnest profile of all color LCD technology displays. It has the ability to operate to -40C without a heater. Its demand is increasing for its low power consumption (great for battery driven products).It also provides sharp, vibrant colors. The results of this paper have shown that riders are able to have a safer journey as they are more aware of their surroundings as they very easily see behind them. Also, the riders are able to conveniently know when they have exceeded the safe speed limit without having to check the speed meter constantly. Any sort of accident is quickly reported due to the built-in alert system and the location of the accident is easily found thanks to the GPS co-ordinates. Also, even when really sleepy the helmet keeps the rider awake so no accident occurs, and finally the convenient and smart gesture-based turn indicator makes turning at intersections or switching lanes much safer. From the starting of development to the finished prototype, the inclusion of required feature and minimum cost has always been our goal. It is essential for us to consider the buying ability of bikers in this country. Thus, Smart Helmet can undergo development and turn in profit for investors.

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].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)

[3].Sreenithy Chandran, Sneha Chandrasekar, Edna Elizabeth N, “Konnect: An Internet of Things (IoT) based Smart Helmet for Accident Detection and Notification.”

[4].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).

[5].JesudossA, Vybhavi R, Anusha B “Design of Smart Helmet for Accident Avoidance” International Conference on Communication and Signal Processing, April 4-6, 2019,India.

[6].K.M.Mehata, S.K.Shankar, Karthikeyan N, Nandhinee K, Robin Hedwig P “IoT Based Safety and Health Monitoring for Construction Workers.Helmet System with Data Log System” International Conference.

[7].DivyasudhaN,ArulmozhivarmanP,RajkumarE.R "Analysis of Smart helmets and Designing an IoT based smart helmet: A cost effective solution for Riders" @IEEE.
[8].Manish Uniyal, Manu Srivastava, Himanshu Rawat, Vivek Kumar Srivastava "IOT based Smart Helmet System with Data Log System" International Conference on Advances in Computing, Communication Control and Networking.
[9].SreenithyChandran, Sneha Chandra sekar, Edna Elizabeth N "Konnect: An Internet of Things(IoT) based Smart Helmet for Accident Detection and Notification.
[10].Archana.D,Boomija.G,Manisha.J,Kalaiselvi.V.KG "Mission On! Innovations in Bike Systems to Provide a Safe Ride Basedon IOT"@IEEE 2017.
[11].Rashmi Vashisth, Sanchit Gupta presented the work on smart helmets consisting of two modules, one on the helmet and other on bike, each of which is synchronized to ensure that the rider wears a helmet. The helmet provides features such as automatically deducting the required amount from the user's virtual wallet, wirelessly preventing the rider from stopping and paying, using alcohol sensors to prevent drunk and driving scenarios, detecting and notifying an accident, detect over speeding.

[12].SayanTapadar, ShinjiniRay,Arnab Kumar Saha, Robin Karlose, Dr. Himadri NathSaha "Accident and Alcohol Detection in Bluetooth enabled Smart Helmets for Motorbikes" @IEEE2018.
[13].AgungRahmat Budiman,DodiWisaksono Sudiharto, Tri Brotoharsono "The Prototype of Smart Helmet with Safety Riding Notification for Motorcycle Rider" 2018 3rd International Conference on Information Technology,Information Systems and Electrical Engineering (ICITISEE), Yogyakarta, Indonesia.