Smart Helmet with Black Box Technology

A Novel Approach for Enhancing Two Wheeler Safety

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***Abstract* - The thought of developing this project comes from our social responsibility towards the society. As we can see, in many accidents occurring around us there is a loss of life. People prefer motorcycles over car as it is much cheaper to run, easier to repair, easier to park and flexible in traffic. According to a survey in India, there are about 698 accidents occurring due to bike crashes per year. The reasons for the accidents may be many such as no proper driving knowledge, no fitness of the bike, rash driving, drink and drive etc. If accidents are one issue, lack of treatment in proper time is another reason for deaths. This survey itself indicates the necessity of a reliable system which can prevent these situations.**

Key words - Microcontroller,Black box technology, ZigBee, Accident, Running headlamp.

I. INTRODUCTION

It is quite clear that the human beings behind the wheel are mainly responsible for crashes and fatalities. In fact, studies prove that the 78.8% of crashes are caused due to "driver's fault" and more than 56% of the total deaths were due to speeding [4]. Across the globe, speeding, driving under the influence of alcohol or drugs and not wearing helmets and seatbelts has been identified as the main factors behind the crashes and high fatalities. All these relate to the behaviour of drivers. Also, late arrival of ambulance, no person at the place of accident to give information to the ambulance etc., may also be the reasons. This is the situation in our day to day life; a thought of finding some solution to this problem came upwith the idea of giving the information about accident as soon as possible and in time, because after all time matters a lot, if everything is done in time, at least we can save half the lives that are lost due to bike accidents. So, a thought from our social responsibility towards the society led to this innovation named SMART HELMET.

II. PROPOSED SYSTEM

We propose to develop a prototype model that illustrates the steps which can be taken so as to enhance safety of two-wheeler riders and to pass the message about the occurrence of accident to the persons concerned such as police; ambulance etc.The contact information can be modified as per the users need. The safety of riders is enhanced by ensuring that they will be able to turn on the vehicle only if they wear the helmet properly and they have not consumed alcohol. A black box technology is also incorporated which will record various vehicle parameters, which can be retrieved later. It will provide vital clues about the cause of accident. Along with other features we also incorporate AHO (Automatic Headlights On) and a buzzer for providing rescue alarm. The AHO or running headlamp feature will ensure that the headlamp will be turned on as soon as the engine is turned on, regardless of whether it is day or night time. No switch will be provided to turn ON/OFF the headlamps. It will help oncoming traffic to spot the two-wheeler from far away and hence accidents can be avoided to a large extent. In case of an accident, the buzzer will be activated continuously until it is turned off manually. This will alert other vehicles and people in the vicinity regarding the occurrence of accident. This will increase the chance of getting rescued easily.

III. SYSTEM DEVELOPMENT

A. Helmet Side

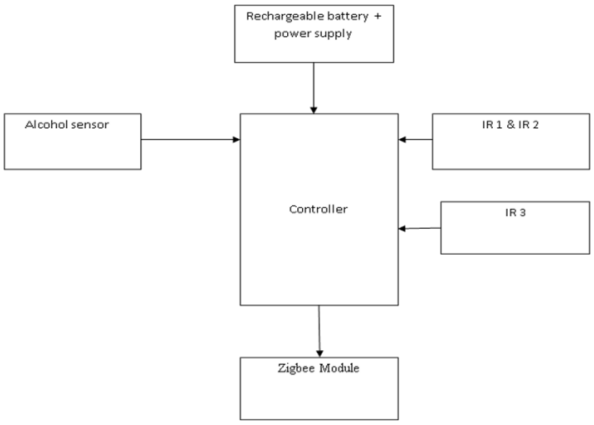

Fig.1 Block diagram of helmet side

B. VEHICLE SIDE

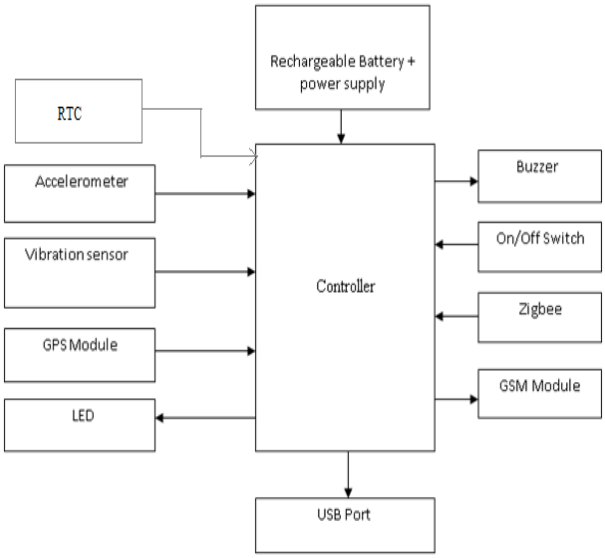

Fig.2 Block diagram of vehicle side

IV. PROPOSED TOPOLOGY

C. Helmet Side

A rechargeable battery is used to power the system. The controller is PIC16f877A.The crystal provided is of 16MHz. The controller is used to control and coordinate the functioning of different devices connected to it. IR1 and IR2 are infrared sensors used to ensure that the helmet is worn on the head properly. IR3 is the infrared sensor used to ensure that strap of the helmet is fastened properly. Alcohol sensor is used to detect whether the rider has consumed alcohol or not. Sensor provides an analog resistive outputbased on the alcohol concentration [3]. If the controller gets a positive response from all these sensors, then it will send an ok signal to the vehicle side through ZigBee.

D. Vehicle Side

Only after the reception of ok signal at the vehicle side through ZigBee, the vehicle will be able to start. Now if the on/off push button switch which is equivalent to electric start switch in vehicles is pressed, the LED will turn on which indicates that the engine is turned on. Additional features are incorporated so as to pass the information regarding the cause of the accident. Accelerometer is used to identify the condition of the vehicle, horizontal as on road or fallen on the ground ie, inclined position. Vibration sensor is used to detect shocks due to collisions during accident [4]. If any value above the threshold is obtained from these sensors, an alert or rescue message is send as SMS along with the location of the vehicle to the police or ambulance using GSM module. The buzzer is activated when an accident is detected. This will alert people in the vicinity regarding the accident, which improve the possibility of quick rescue. The location is obtained using GPS. A black box technology is also incorporated. So, the data from accelerometer and vibration sensor which can provide vital clues regarding the cause of accident will be recorded continuously in an external EEPROM. The RTC will keep a track of time of occurrence of accident, which is also recorded. These recorded data can be retrieved by connecting our system to a computer, through the USB port [4].

V. PROPOSED CIRCUIT

E. Helmet Side

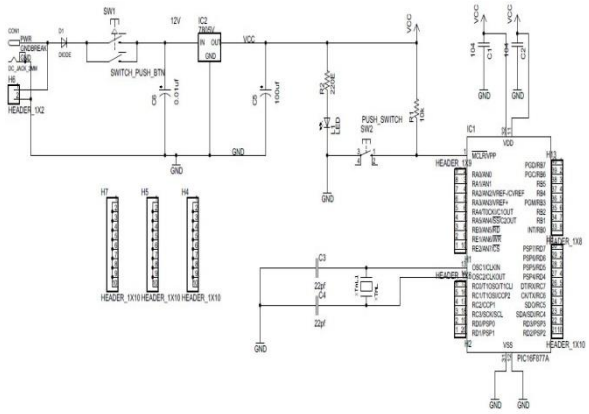

Fig.3 Circuit diagram of helmet side

The source of power can be a 12v battery or a 12v adapter. Diode eliminates any unwanted ac components from passing through it [4]. The capacitor is used to eliminate undesirable fluctuation or ripples both at input and output side. IC 7805 is a linear monolithic voltage regulator providing 5V dc output.Switch1 is used to turn on circuit when we require, so as preventing power wastage. LED is used to know whether circuit is powered or not. Switch 2 is the reset switch. When it is pressed pin 1 of controller is grounded, thus reset occurs.

The controller is PIC16f877A and is provided with frequency of 16MHz.the crystal along with the two capacitors form the oscillator circuit which provide clock signals to our digital IC. The headers beside IC are for connecting the modules (IR, alcohol, and ZigBee) ie one pin from sensor is connected to controller using jumper leads. Multiple pins are required for ZigBee. The headers away from ic is for 12V,Gnd,5V supplies, as different modules require different voltages to operate.

F.Vehicle Side

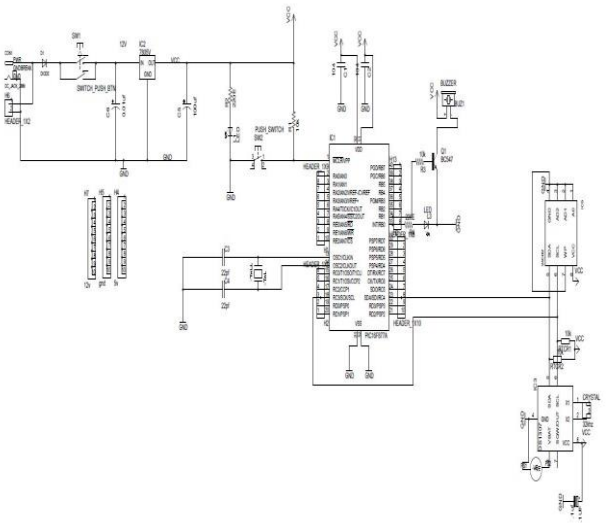

Fig.4 Circuit diagram of vehicle side

Power supply section is same as in the helmet side. The LED connected to controller glows when the ok signal send from helmet is received in the vehicle. If not, the buzzer is activated for some time to alert the user. Transistor is used as switch to turn the buzzer on and off selectively. Modules such as GPS, GSM, and accelerometer and vibration sensor are connected to headers provided beside the IC. Almost all communications between controller and modules is normally through UART, either hardware or software UART.

But for RTC and EEPROM we prefer i2c communication as it is faster. Controller has only one I2C bus, but multiple devices connected to it are identified by their unique predefined addresses. This is taken care of while programming. The SCL and SDA pins constitute I2C bus .It cannot be changed even by program. The SCL and SDA pins of both modules are shorted correspondingly and connected to corresponding pins of controller [5]. A pull up is also provided to these lines. A CMOS battery of 3V is also required for rtc module to work even in event of supply failure. RTC also requires a crystal oscillator to provide clock signal to it. Crystal frequency is 32 KHz.

The LED also illustrates the AHO (Automatic Headlights On) feature ie, indicating that headlamp is turned on as soon as engine turns on. The buzzer is operated by switching the transistor. When an accident is detected the controller pin connected to base of transistor is turned high. As a result buzzer gets activated. This can only be turned off manually by resetting the controller.

VI. ADVANTAGES

- Violation of rules can be avoided.
- Safety and convenience.
- Improved diagnostics.

VII. CONCLUSION

Wearing a helmet can reduce the risk of severe injury by 72% and the risk of death by 39%, according to the World Health Organisation [6]. This system is very effective for the safety purpose of the user. User has to wear helmet to ride two wheeler vehicles and hence traffic rules will follow with this. By implementing this system a safe two wheeler journey is possible which would decrease the head injuries during accidents and also reduce the accident rate due to drunken driving.

VIII. FUTURE SCOPE

- Disabling the call while driving.
- Provision to check whether the user have driving license or not.

IX. REFERENCES

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