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Two Wheeler Safety System using Wireless Sensor Network

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***Abstract*— Smart helmets as a subsequent step to human safety, are one of the great challenges in the area of active safety for two wheelers. With the proliferation of two wheeler road accidents, in India the total annual deaths has crossed 1.98 lac, according to the report of National Crime Records Bureau (NCRB). Through our project we aim to mitigate the probability of the deaths caused in two wheeler accidents. In this project, we proposed a WSN based solution which restricts the driver to wear helmet while riding a two wheeler. Unlike the current solutions i.e. the expensive smart helmets that use high level Artificial Intelligence and also rely on heavy infrastructure, in our vehicular safety solution only tiny low cost sensor are deployed, which will be used to detect the presence of helmet on the rider's head. The communication between the sensors and vehicle will be achieved using Bluetooth connectivity and through a simulator called Arduino. For pairing the correct helmet, authentication will be done using NFC tags. It can also serve as an alternative solution for unsophisticated vehicles that are not equipped with onboard computers and cannot take advantage of the current Intelligent Transportation System and Services. To illustrate the basic idea of our system, we primarily focus on authenticating the helmet in order to start the vehicle.**

***Index Terms*— human safety; helmet; arduino; road accidents; bluetooth connectivity; two wheeler.**

I. INTRODUCTION

Invention of automobiles was one of the greatest commercial invention by mankind in the past century. This invention has contributed to the nation's growth widely. Amongst these automobiles one such automobile is Two Wheelers. However, we cannot ignore the casualties caused by these automobiles in which thousands of people lose their life or suffer life changing accidents. Causalities in traffic accidents are mainly caused by collision between vehicles and the loss of life is due to the lack of safety gears. In this paper we are not suggesting to how to avoid the accidents but we proposing a model which makes it compulsion for the two wheeler rider to wear the safety gear (helmet) while riding which may avoid the loss of life after experiencing a concussion in an accident. In our model we are going to make the use of existing technology like Bluetooth as a communication medium. Our model consist of a helmet which comprises of a pressure sensor on the inner side, and a Bluetooth module attached to an Arduino like microprocessor. On the vehicle there is

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another onboard Arduino module with a Bluetooth module connected to it.
Once the rider wears a helmet the pressure sensor senses a specific pressure and sends the data via the Bluetooth module on the helmet to the onboard module on the two wheeler. Now the data received from the helmet is computed and on the basis of the computation engine of the two wheeler can be started. If the pressure sensor fails to send the adequate data to the module, the engine of the two wheeler would not start.

II. Literature Survey

Listed below are the components used to design the model.

A. Arduino Uno

Arduino is a tool that makes the computers to sense and control the physical world. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board. Arduino can be used to develop interactive objects. Taking inputs from a variety of switches or sensors, controlling of variety of lights, motors, and other physical outputs can be achieved. Projects of Arduino can be stand-alone, or they can be communicating with software running on the computer (e.g. Flash, Processing, Max MSP) The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free. In this research work Arduino UNO has been utilized. It has 14 digital I/O and 6 Analog I/O. It works on +5volts DC, 10 bit analog to digital converter and 14kb ROM. (www. ATMEL.com). Fig.2 shows the image of an Arduino UNO controller. Table 1 shows the specifications of the microcontroller. [1][2][3]

Digital Input / Output
Digital input / output works with binary values 0 and 1, in some sources referred to as Low and High value. Logical 0 corresponds to 0 V and logical 1 corresponds to 5 V. Some older versions of Arduino (for instance one of the Pro or Mini Pro versions) have logical 1 corresponding to 3.3 V.

Analog input
Analog input of Arduino has a 10 bit analog - digital converter. This gives us a numerical value range from 0 to 1023 [3]. The value 1023 corresponds to 5 V and a value 0 corresponds to 0 V at the analog input. The difference between two values corresponds to 0.0048 V

Analog output
Analog output of Arduino has a 10 bit analog - digital converter. This gives us a numerical value range from 0 to 1023 [3]. The value 1023 corresponds to 5 V and a value 0 corresponds to 0 V at the analog input. The difference between two values corresponds to 0.0048 V.

Specification[3]

Microcontroller: ATmega328P
Input Voltage(*recommended***):** 7-12V
Digital I/O Pins: 14 (of which 6 provide PWM output)
Analog Input Pins: 6
DC Current for 3.3v Pin: 50mA
SRAM: 2KB
Clock Speed: 16 MHz
Width: 53.4 mm

Operating Voltage: 5V
Input Voltage(limit**):** 6-20V
PWM Digital I/O Pins: 6
DC Current Per I/O Pin: 20mA
Flash Memory: 32KB (ATmega328P)
EEPROM: 1KB
Length: 68.6 mm
Weight: 25g

B. Bluetooth HC-05 Module

This model of the Bluetooth module (shown in Fig. 1) can send and receive data simultaneously. This Bluetooth device is a trans-receiver and works as TTL. It can be used in master mode as well as in slave mode. It is a 3.3V and 5V module.

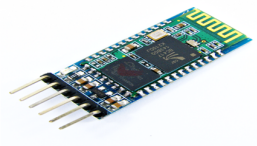

Fig. 1 Bluetooth Module HC-05

This module contain 6 pins. Those six pins are GND, VCC, RX, TX, KEY, STACK. The GND that is the ground pin which gets connected to the GND pin slot on the Arduino. VCC pin is the pin which powers the module with 5V. RX pin is the receiver pin. TX pin is the transmitter pin. KEY pin is a special pin which is used when the module is programmed, it connect with the 3.3V slot on the Arduino. STACK pin is used when the Bluetooth module needs to connect to multiple modules one by one.[5]
Also this Bluetooth HC-05 module has a reset button which can be used to reset all the setting of this module. This module can operate in 2 modes, mode-1: Slave mode, mode-2: Master mode.
Mode-1: In this mode the module acts like a slave, that is it waits for connection from other modules.
Mode-2: In this mode the module acts like a master and establish the connection with any other module it wants to get connected.

C. Pressure Sensor

The pressure sensor that will be used in the proposed model will be Force Pressure Sensor (Shown in Fig. 2). This sensor is a normal and easily available sensor used to sense the force pressure in new mobile communication model introduce by APPLE Inc. in their latest device the IPhone 6S and IPhone 6S Plus.

Fig. 2 Pressure Sensor

This is a small force sensitive resistor. It has a 0.16" (4 mm) diameter active sensing area. This FSR will vary its resistance depending on how much pressure is being applied to the sensing area. The harder the force, the lower the resistance[11]. When no pressure is being applied to the FSR, its resistance will be larger than 1Mê, with full pressure applied the resistance will be 2.5kê. Details Two pins extend from the bottom of the sensor with 0.1" pitch making it bread board friendly. These sensors are simple to set up and great for sensing pressure, but they aren't incredibly accurate. Use them to sense if it's being squeezed, but you may not want to use it as a scale[12]. Dimensions: Overall length: 1.75" Overall width: 0.28" Sensing area: 0.3".

III. MOTIVATION

As discussed above the innovations like automobiles have profited the nation in many ways, but also affected the society in negative sense as well. As per the National Crime Records Bureau in my country India till date there have been reports for 1.9lac deaths caused in Two Wheeler accidents per year.[4] With vast technology available to us in today's scenario we are still not able to protect human lives. The proposed model will enables us to avoid the above figures recorded by the NCRB and also reduce the deaths caused due to Two Wheeler accidents.
The reliable technology like Bluetooth communication plays an important role in this design, as it is used to send the data measured by the force pressure sensors, which in return enables the two wheeler engine to start.

IV. PROBLEM STAEMENT

To develop problem solving abilities for Vehicular Safety. To implement intelligent safety system for two wheeler vehicle in order to identify and authenticate the presence of helmet on Riders head. This model will make sure the riders wear helmet mandatorily while riding a Two Wheeler.

V. ARCHIETECTURE

Shown below (in Fig. 3) are two blocks each represents a model.
First model is deployed on the two wheeler that is a motorbike, and that model is wired to the kill switch of the motor bike. Now the other model is deployed on the safety gear that is the helmet. First model is powered by the Two Wheeler battery and the second model uses portable battery like power.

VI. MATHEMATICAL MODEL

let S be the sample set,
S={X,Y,i,f, DD, NDD,success, failure}

where

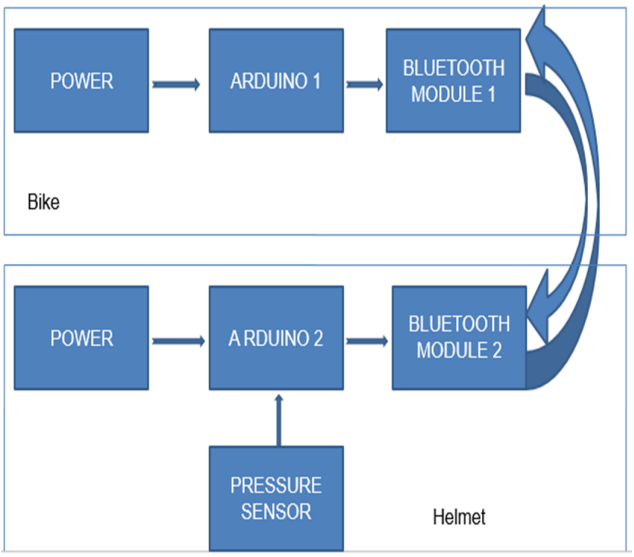

Fig. 3 Archietecture

X = {X1, X2.....Xn} where X is the set of all inputs
Y={Y1,Y2....n} where Y is the set of all outputs
i= initial state,
f=final state,
DD= Deterministic data,
NDD=Non Deterministic data
DD : {Helmet, Sensor nodes, Bluetooth connection}
NDD:{Type of Data sent by the sensors, working of the two wheeler}
i= helmet with sensors
X={X1,X2)
X1 = Input from the sensor placed in the helmet to Arduino
Y= Bike starts.
F= Function used to match the value of sensodr with predefined condition.
Success=Bike starts.
Failure =Authentication invalid, sensors not detected, bluetooth connectivity issue.
The State Transition diagram (shown in Fig. 4) supporting our mathematical model is as shown below.

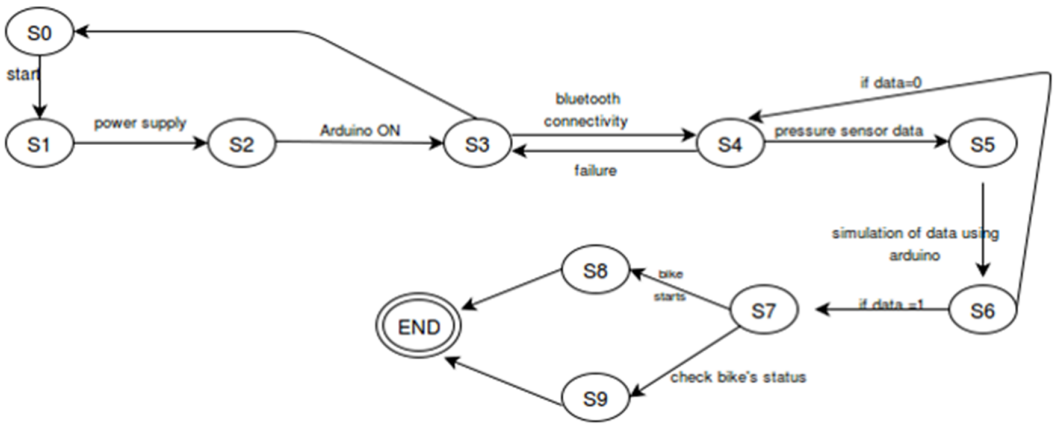

Fig. 4 State Transition Diagram

VII. Future Scope

1 Implementation of indicators on the helmet. We would like to add indicators on the helmet that will work in sync with the indicators of two wheeler.
2 We can implement the hands free system on our model, enabling the rider to use very basic mobile phone wirelessly.
3 Authentication using NFC. The Bluetooth pairing would be done using NFC tags, This will enable the rider to pair any helmet with the second model deployed on it to the model on the Two Wheeler.

VIII. Conclusion

A majority of victims of road traffic injuries are men in the age group of 1544 years and belong to the poorer sections of society. Also, a vast majority of those killed and injured are pedestrians, motorcyclists and pillions riders, and bicyclists. 70 percent of the people riding two wheelers in India avoid wearing helmets while riding, which causes accidental deaths. So, we have proposed a model which restricts riders to wear helmets while riding.

References

[1] Priyam Parikh, Keyur Joshi and Saurin Sheth, 'Color Guided Vehicle- An intelligent material handling Mechatronic system, '1st International conference INACOM13 at IIT roorkee on Machines and mechanism,' Dec2013 J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.
[2] A ppt by Dr. Kevin Craig, Rensselaer Polytechnic Institute, Root locus analysis and design.
[3] www.arduino.cc
[4] Manjesh N1,Prof.Sudarshan Raj2 Smart Helmet Using GSM and GPS Technology for Accident Detection and Reporting M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.
[5] Internet Computing, IEEE (Volume:5 , Issue: 3)Bluetooth: technology for short-range wireless apps
[6] "Automatic traffic accident detection and alarm system" International Journal of Technological Exploration and Learning (IJTEL) Volume 1 Issue 1 (August 2012).
[7] "Automatic accident notification system using gsm and gps modems with 3g technology for video video monitoring" International Journal of Emerging Trends in Electrical and Electronics (IJETEE) Vol. 1, Is-sue. 2, March-2013.
[8] "Vehicle accident alert and locator" International Journal of Electrical & Computer Sciences IJECS-IJENS Vol: 11 No: 02.
[9] G. Miklos et al., "Performance Aspects of Bluetooth Scatternet Formation," poster presentation at Mobile Ad Hoc Networks and Computing (MobiHOC 2000), IEEE/ACM workshop, Aug. 2000
[10] T. Salonidis et al., "Distributed Topology Construction of Bluetooth Personal Area Networks," Proc. IEEE Infocom 2001, IEEE Communication Society, New York, 2001.
[11] www.wikipedia.org/wiki/Force-sensing_resistor
[12] 12. Sensors and Actuators A: Physical, Volume 75, Issue 3, 8 June 1999, Pages 242-251 Wen H. Ko, Qiang Wang