SMART HELMET

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ABSTRACT

The prime objective of this paper is to force the rider to wear the helmet throughout. Considering the increasing number of motor cycle riders in our country and the number of accidents happening each year, it is evident that in most cases the rider suffers injuries to the head and it leads to fatal causalities. This has thrown light on the importance of forcing the rider to wear helmet to reduce the extent of impact. The paper focuses on the methods that can be implemented to reduce the impact of road accidents. In this paper, we propose building a system that can be implemented by installing it on a bike which works with the helmet that is being worn to make the rider to wear the helmet before riding the bike.

Keywords

Microcontroller - Arduino Nano, Radio Transceiver - NRF24L01, Ultrasonic sensor - HCSR04, Speech synthesizer – easyVR, Arduino IDE Software.

1. INTRODUCTION

In this competitive world one of the surveys says that the death tolls due to motor-bike accidents are increasing day-by-day out of which most of these casualties occur because of the absence of helmet. Traffic police cannot cover remote roads of the city. That's why our primary target is to make the usage of the helmet for two-wheelers "compulsory". Thus, no one other than the owner himself, who doesn't have the 'Password' which would have been created by the owner, can use the bike. This would, in other sense, also ensure the safety of the bike when we have to abandon the mercy of parking lots for several hours. Thus to make the riding of a bike "Helmet Centric" the project has been proposed. The helmet would be used to communicate with the motor bike all the time during the initiation of the ride to detect if the person is wearing the helmet or not and then the rider is asked for a password in the form of speech to unlock and ignite the bike by matching a user-independent password just like any other personal computers, and to stop the engine as well.

2. LITERATURE REVIEW

The thought of developing this paper comes from social responsibility towards the society. As we can see many accidents occurring around us, there is a lot of loss of life. According to a survey, around "750" people die in road accidents occurring due to bike crashes per year.

The reasons for the accidents may be many such as no proper driving knowledge, damaged bikes, rash driving, 'drink and drive' etc. But the major reason was found to be the absence of helmet on that person's head, resulting in an immediate death due to brain damage.

Hence the prime objective of our paper is to force the rider to wear the helmet throughout the ride. So, this sense of moral responsibility towards the society, laid the foundation of our project "**Smart Helmet."**

So the basic idea for developing this project "Smart Helmet" is taken from [1] [2] & the basic idea about the working of Arduino nano microcontroller is taken from [3] & [4] And the further more detailing regarding the functionality of each and every hardware and the software components used are such as Radio transceiver is taken from[5] and information and working of Ultrasonic sensor from [6] .The main component or the microcontroller used, that is Arduino nano. The working principles and the circuit connections etc are taken from the references,[7] [8] & [9]. Thus, these are all the references helping the development of the project.

3. EXISTING SYSTEM

The existing project basically has a wireless telecommunication, and is connected to a smart phone. This prototype uses sensors to detect a crash or accidents and the communication hardware is used to automatically dial a predefined emergency contact. Thus helping the victim to reach doctors as early as possible.

The other existing system is to control the speed in which the biker is going in. The helmet is fixed with all the components and sensors that read the speed of the bike and accordingly instruct the rider to reduce or increase the speed based on the obstacles ahead the bike.

Along with the speed limit sensors the helmet also checks if the rider is drunk and driving. If the rider is drunk then the ignition of the bike is avoided and the hence not letting the rider to ride the bike.

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4. PROPOSED SYSTEM

The idea of our project "SMART HELMET" is to first check if the rider has actually worn the helmet, in other words the availability of the rider's head inside the helmet. For this purpose, we are using an ultrasonic sensor for detection.

Detecting alone is not sufficient. Now for the determination of true owner or his/her friend, we have used a voice encrypted password mechanism. The user is asked for a password upon detection. A microphone connected to a Voice module (speech processor & synthesizer) for voice intake. This system is a 'user-independent' system. That is the system does not take the voice of the rider into consideration but the content of the speech or password in other words into consideration and evaluates it. Thus an alphanumeric password is verified and the further steps are carried out. That is based on the alphanumeric password the engine of the bike ignites or not when the password is correct or not respectively.

To run the Ultrasonic and radio modules we use Arduino NANO board which has ATmega328 microcontroller. The Arduino is a very user friendly device which can be easily interfaced with any sensors or modules and is very compact in size. Now we are clear that the Arduino will send an affirmation to the bike for an ignition request. But how shall the communication take place? For this purpose, we used NRF-24L01 radio transceiver module.

The ultrasonic sensor is placed in the helmet in such a way that it does not face any difficulty while detecting the person. Its distance of operation is already set by us in a range that only provides accurate result and does not produce results for any garbage value/error value.
This is the methodology used in the project; let me once again give a brief description about the working of project. When the rider wears this helmet, the helmet detects his/her presence by measuring the distance between object (head) and sensor. This distance is matched with the range already specified, failing which the LCD on bike module shall show a message of either 'rider not available' or 'rider away'. Then a voice password in the form of speech is requested and verified and the bike starts.
This paper on "Smart Helmet" basically stands upon three main modules, namely: Helmet module, Voice module, Bike module.

Helmet Module

This module basically deals with the checksum of the rider if he is wearing the helmet or not on the first place. To achieve the same, an ultrasonic sensor is used. Based on which the signals are sent to the next module, the voice recognition module for the authentication purpose.

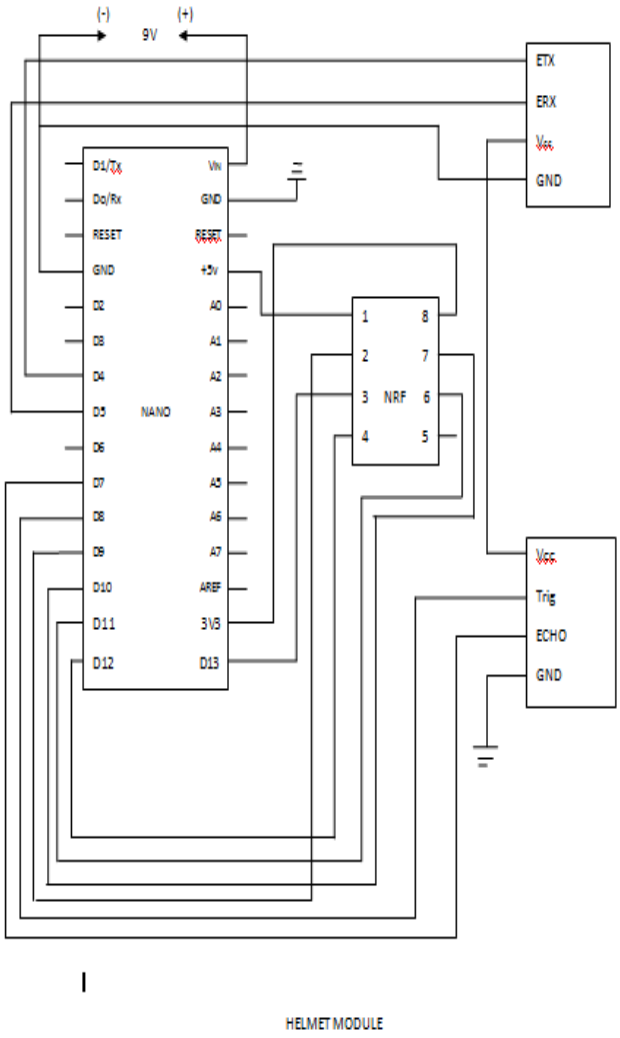

Fig 1: Helmet Module Circuit Design

Voice Module

Detecting alone is not sufficient, hence for the determination of the true owner of the bike, a voice encrypted password mechanism is used. That is the user is asked to tell the password upon detection. A microphone is connected to this module (speech processor & synthesizer) for voice intake. This system is a 'user-independent' system. That means it does not assess the voice but it evaluates the data in the speech. Thus an alphanumeric password is verified by the helmet and the result of verification is sent to bike.

Bike Module

On the verification of the alphanumeric password by the helmet the result is received by the bike module. Based on the verification result, the bike module decides whether the bike engine is to be ignited or not. That is if the password given is wrong then the bike engine refuses to start the bike, but if the password given is right then the bike engine is initiated.

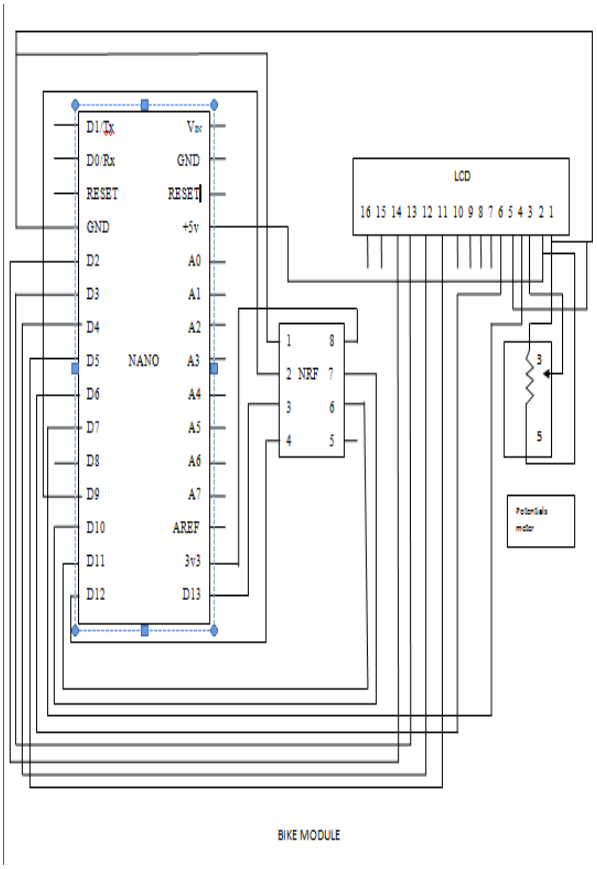

Fig 2: Bike Module Circuit Design

5. COMPONENTS

Microcontroller - Arduino Nano

Arduino is an open source tool for making computers that can sense and control more of the physical world than your desktop computer. 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, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can communicate with software running on your computer (e.g. Flash, Processing, MaxMSP) The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free. The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

Radio Transceiver - NRF24L01

nRF2401 is a single-chip radio transceiver for the world wide 2.4 - 2.5 GHz ISM band. The transceiver consists of a fully integrated frequency synthesizer, a power amplifier, a crystal oscillator and a modulator. Output power and frequency channels are easily programmable by use of the 3-wire serial interface. Current consumption is very low, only 10.5mA at an output power of -5dBm and 18mA in receive mode. Built-in Power Down modes makes power saving easily realizable.

In the Radio transceiver [nRF2401], a usable band is determined by local regulations. The crystal frequency may be chosen from 5 different values (4, 8, 12, 16, and 20MHz). 16MHz are required for 1Mbps operation. Data rate must be either 250kbps or 1000kbps. Antenna load impedance = 100+j175 Antenna load impedance = 100+j175. Effective data rate 250kbps or 1Mbps. Antenna load impedance = 100+j175. Effective data rate 10kbps.
Current if 4 MHz crystal is used. Speed- 250-1000kbps.

Ultrasonic sensor - HCSR04

Ultrasonic sensors (also known as transceivers when they both send and receive, but more generally called transducers) work on a principle similar to radar or sonar which evaluates attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.

This technology can be used for measuring wind speed and direction (anemometer), tank or channel level, and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure tank or channel level, the sensor measures the distance to the surface of the fluid. Further applications include: humidifiers, sonar, medical ultra sound, burglar alarms.

Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed.

Speech synthesizer – easyVR

EasyVR is the second generation version of the successful VRbot Module. It is a multipurpose speech recognition module designed to easily add versatile, robust and cost effective speech recognition capabilities to virtually any application.
The EasyVR module can be used with any host with an UART interface powered at 3.3V 5V, such as PIC and Arduino boards. Some application examples include home automation, such as voice controlled light switches, locks or beds, or adding “hearing” to the most popular robots on the market.

A host of built-in Speaker Independent (SI) commands for ready to run basic controls, in the followings languages: English (US), Italian, German, French, Spanish, and Japanese.

6. ARCHITECTURE DESIGN

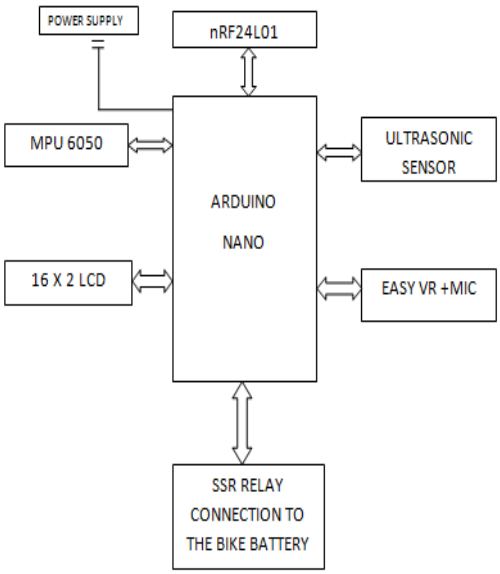

Fig 3: Architecture Design

7. RESULT

All the modules were designed and all the components were assembled. The testing of each module was carried out successfully.

The serial data from all the sensors was successfully recorded and analyzed. This was transmitted wirelessly from one module to the other successfully through Nrf24l01 radio module.

Thus the testing phase was completed. This study was performed in a controlled manner. Thus, there is a need to conduct further experiments in environments more similar to real riding conditions. In future, the sensor installed on the helmet can be applied to a system in which the sensor reports an emergency by transmitting emergency signals to mobile devices when a fall occurs during a bike ride.

8. CONCLUSION

This paper is very useful in day to day life and adds extra safety while riding the bike. It is like a virtual traffic police inspector, that is the ultrasonic sensor checking time to time if the helmet is still on or not. The main advantage of this project is that you don't have to pay fine in latter case; it's just your bike which is going to be switched off. Use of this project makes ones bike secure at crucial times, especially
Use of this project makes ones bike secure at crucial times, especially when one is away from the bike and someone is trying to steal it or in other words if there are any chances of theft that can occur.

9. REFERENCES

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[2] 1ghz analog comparator and switch matrixfor 8-channel analog data acquisition system pierre-henri boutigny, huyanhnguyen, denis raoulx laboratoires d'Electroniqueet de Physique appliquée13 Avenue Descartes 94451 LIMEIL BREVANNES Cedex, France. Grietinfo.in/projects/MAIN/ECE2013/cd-11-\doc%20Project%20Report.pdf.

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