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SMART HELMET

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ABSTRACT

The impact when a motorcyclist involves in a high-speed accident without wearing a helmet is very dangerous and can cause fatality. Wearing a helmet can reduce shock from the impact and may save a life. There are many countries enforcing a regulation that requires the motorcycle's rider to wear a helmet when riding on their motorcycle, Malaysia is an example.

A smart helmet is a special idea which makes motorcycle driving safer than before. This is implemented using GSM and GPS technology. The working of this 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 gives 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. It also has an alcohol detector sensor which detects whether the person is drunk and switches off the engine if the sensor output is high.

KEYWORDS: Arduino UNO, Vibration Sensor, Alcohol Sensor, Temperature Sensor, GSM, GPS.

I. INTRODUCTION

Now a days most of the countries are enforcing their citizens to wear helmet while riding bike and not to ride a bike when the person is under the influence of alcohol, but still rules are being violated.

1.1. Motivation

The motivation of this project comes from the real-world challenges that we face daily on the roads. Road accidents are on the rise day by day and in countries like India where bikes are more prevalent many people die to carelessness carried in wearing helmets. In present day scenario we encounter numerous cases of death due to two-wheeler road accidents. Despite of the fact that helmets are available everywhere, people are not wearing them. In the event of road accidents, the message is sent to the emergency contact through GSM.

1.2. Problem Definition

As the bikers in our country are increasing, the road mishaps are also increasing day by day, due to which many deaths occur, most of them are caused due to most common negligence of not wearing helmets, also many deaths occur due to lack of prompt medical attention needed by the injured person. The project aims at the security and safety of the bikers against road accidents.

1.3. Objective of the Project

The objectives of this project are to design the circuit that can improve safety of motorcyclists, to develop a smart safety helmet for complete rider.

1.4. Limitations of the Project

- Person rides the bike even in the areas where mobile network lacks, so GSM network is required for sending SMS. It is expensive.
- When the helmet is dropped down accidentally, the system treats it as an accident.

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II. ANALYSIS

2.1. Introduction

There has been a sharp rise in the total number of deaths that occur due to road accidents in the past few years. Reckless driving, ignorance of traffic rules and absence of protective shield have been some of the most important reasons for these deaths. Most of the accidents occur due to drinking and then driving bikes and death caused due to neglecting helmets. Government adopted few measures like helmet and alcohol checking by traffic police but they are hardly useful.

2.2. 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.

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.

This has following disadvantages:

- Rider does not wear helmet in regions where traffic checking is not done.
- Testing alcohol content present in blood in each individual rider in big countries like India is impossible.
- Difficulty of implementation of traffic rules by traffic police.

2.3. Proposed System

The helmet 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. In this system we use an Arduino microcontroller interfaced with alcohol sensor and it is used to monitor user's breath and constantly sends signals to microcontroller. The microcontroller on encountering alcohol signal from sensor and send the data to motor using RF transmitter and we connect a RF receiver to the motor driver which stops dc motor to demonstrate as engine locking. The system need push button to start the engine. If the alcohol is detected the system locks the engine.

The system also sends a message stating "Accident occurred" including the latitude and longitude location of the incident using GSM and GPS. It uses a vibration sensor to detect an accident. It also has a temperature sensor which notifies when the helmet gets heated up to avoid the circuit damage.

2.4. Software Requirement Specification

2.4.1. Purpose

As all the road accident fatalities involve motorcyclists, we see many accidents in the day to day life due to alcohol consumption so we are trying to implement a project that can avoid the accidents.

2.4.2. Scope

The scope of the project is the safe two-wheeler journey is possible which should decrease the head injuries during accidents and also reduce the accident rate due to driving bike after consuming alcohol.

2.4.3. Overall Description

Road accidents are on the rise day by day and in countries like India where bikes are more prevalent, many people die due to carelessness carried in wearing helmets. Smart helmet has a feature of detecting accidents with the help of knock sensor and informs to specific people.

It also includes another feature, if the driver is drunk and tries to drive, the system detects the alcohol presence in his breath and locks the engine, so that the vehicle fails to start. If the driver is not drunk while he starts the vehicle and engine is started but he drinks while driving the sensor still detects the alcohol in his breath and stops the engine so that the vehicle could not accelerate any further.

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2.4.4. External Interface Requirements

ARDUINO IDE is used for writing and dumping code into microcontroller. Operating system will be Windows versions.

III. MODULES

3.1. Module Description

Microcontroller (ARDUINO UNO)

The Arduino Uno is a microcontroller board based on the ATmega328. (It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller, simply connect it to computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform.

Figure 3.1.1: Arduino Uno

GPS Technology

The Global Positioning System (GPS) is a satellite-based navigation system that sends and receives radio signals. A GPS receiver acquires these signals and provides the user with information. Using GPS technology, one can determine location, velocity and time, 24 hours a day, in any weather conditions anywhere in the world for free.GPS was formally known as the NAVSTAR (Navigation Satellite Timing and Ranging).

Global Positioning System was originally developed for military. Because of its popular navigation capabilities and because GPS technology can be accessed using small, inexpensive equipment, the government made the system available for civilian use. The USA owns GPS technology and the Department of Defense maintains it.

How GPS works

- GPS provides specially coded satellite signals that can be processed in a GPS receiver, enabling the receiver to compute position, velocity and time.
- Four GPS satellite signals are used to compute positions in three dimensions and the time offset in the receiver clock.
- GPS is funded by and controlled by the U. S. Department of Defense (DOD). While there are many thousands of civil users of GPS worldwide, the system was designed for and is operated by the U. S. military.

The architectural components of GPS are typically referred to as the control segment (ground stations), the space segment (satellites) and the user segment (receivers).

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Determining Position

Upon taking in all available satellite signals, the receiver compares the time that the satellite sent the signal to the time it was received for each of the available signals. Trilateralization (similar to triangulation) then calculates the position by comparing the difference among the signals.

Figure 3.1.2: GPS Module

GSM Technology

Definition of GSM

GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services.

GSM (Global System for Mobile communication) is a digital mobile telephone system that is widely used in Europe and other parts of the world. GSM uses a variation of Time Division Multiple Access (TDMA) and is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA).

GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1,800 MHz frequency band. It supports voice calls and data transfer speeds of up to 9.6 Kbit/s, together with the transmission of SMS (Short Message Service).

Figure 3.1.3: GSM Module

Computers use AT commands to control modems. Both GSM modems and dial-up modems support a common set of standard AT commands. In addition to the standard AT commands, GSM modems support an extended set of AT commands. These extended AT commands are defined in the GSM standards. With the extended AT commands, the following operations can be performed:

- Reading, writing and deleting SMS messages.
- Sending SMS messages.
- Monitoring the signal strength.
- Reading, writing and searching phone book entries.

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The number of SMS messages that can be processed by a GSM modem per minute is very low i.e., about 6 to 10 SMS messages per minute.

Introduction to AT Commands

AT commands are instructions used to control a modem. AT is the abbreviation of ATtention. Every command line starts with "AT" or "at". That's the reason, modem commands are called AT commands. Many of the commands that are used to control wired dial-up modems, such as ATD (Dial), ATA (Answer), ATH (Hook control) and ATO (Return to online data state) are also supported by GSM modems and mobile phones.

Besides this common AT command set, GSM modems and mobile phones support an AT command set that is specific to the GSM technology, which includes SMS-related commands like AT+CMGS (Send SMS message), AT+CMSS (Send SMS message from storage), AT+CMGL (List SMS messages) and AT+CMGR (Read SMS messages).

Some of the tasks that can be done using AT commands with a GSM modem or mobile phone are listed below:

- Get basic information about the mobile phone or GSM modem. For example, name of manufacturer (AT+CGMI), model number (AT+CGMM), IMEI number (International Mobile Equipment Identity) (AT+CGSN) and software version (AT+CGMR).
- Get basic information about the subscriber. For example, MSISDN (AT+CNUM) and IMSI number (International Mobile Subscriber Identity) (AT+CIMI).
- Get the current status of the mobile phone or GSM/GPRS modem. For example, mobile phone activity status (AT+CPAS), mobile network registration status (AT+CREG), radio signal strength (AT+CSQ), battery charge level and battery charging status (AT+CBC).
- Establish a data connection or voice connection to a remote modem (ATD, ATA, etc.).
- Send (AT+CMGS, AT+CMSS), read (AT+CMGR, AT+CMGL), write (AT+CMGW) or delete (AT+CMGD) SMS messages and obtain notifications of newly received SMS messages (AT+CNMI).
- Read (AT+CPBR), write (AT+CPBW) or search (AT+CPBF) phonebook entries.
- Control the presentation of result codes / error messages of AT commands. For example, the user can control whether to enable certain error messages (AT+CMEE) and whether error messages should be displayed in numeric format or verbose format (AT+CMEE=1 or AT+CMEE=2).
- Get or change the configurations of the mobile phone or GSM/GPRS modem. For example, change the GSM network (AT+COPS), bearer service type (AT+CBST), radio link protocol parameters (AT+CRLP), SMS center address (AT+CSCA) and storage of SMS messages (AT+CPMS).
- Save and restore configurations of the mobile phone or GSM/GPRS modem. For example, save (AT+CSAS) and restore (AT+CRES) settings related to SMS messaging such as the SMS center address.

AT commands may be different from that defined in the standard. In general, GSM modems, designed for wireless applications, have better support of AT commands than ordinary mobile phones.

Serial Communication

The main requirements for serial communication are:

1. Microcontroller
2. PC
3. RS 232 cable
4. MAX 232 IC
5. HyperTerminal

When the pins P0.0 and P0.1 of microcontroller are set, UART which is inbuilt in the microcontroller will be enabled to start the serial communication.

Liquid Crystal Display

LCD stands for **L**iquid **C**rystal **D**isplay. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

1. The declining prices of LCDs.

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2. The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.
3. Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.
4. Ease of programming for characters and graphics.

These components are "specialized" for being used with the microcontrollers, which means that they cannot be activated by standard IC circuits. They are used for writing different messages on a miniature LCD.

Figure 3.1.5: LCD display

A model described here is for its low price and great possibilities most frequently used in practice. It is based on the HD44780 microcontroller (*Hitachi*) and can display messages in two lines with 16 characters each. It displays all the alphabets, Greek letters, punctuation marks, mathematical symbols etc. In addition, it is possible to display symbols that user makes up on its own.

Automatic shifting message on display (shift left and right), appearance of the pointer, backlight etc. are considered as useful characteristics.

LCD Connection

Depending on how many lines are used for connection to the microcontroller, there are 8-bit and 4-bit LCD modes. The appropriate mode is determined at the beginning of the process in a phase called "initialization". In the first case, the data are transferred through outputs D0-D7 as it has been already explained. In case of 4-bit LED mode, for the sake of saving valuable I/O pins of the microcontroller, there are only 4 higher bits (D4-D7) used for communication, while other may be left unconnected.

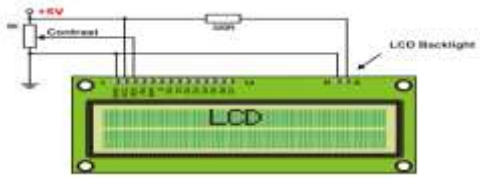

Figure 3.1.6: LCD Connection

LCD Initialization

Once the power supply is turned on, LCD is automatically cleared. This process lasts for approximately 15mS. After that, display is ready to operate. The mode of operating is set by default. This means that:

1. Display is cleared
2. Mode

DL = 1 Communication through 8-bit interface
N = 0 Messages are displayed in one line
F = 0 Character font 5 x 8 dots

3. Display/Cursor on/off

D = 0 Display off
U = 0 Cursor off
B = 0 Cursor blink off

4. Character entry

ID = 1 Addresses on display are automatically incremented by 1
S = 0 Display shift off

Automatic reset is mainly performed without any problems. If for any reason power supply voltage does not reach full value in the course of 10mS, display will start perform completely unpredictably.

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Motor

Electric motors involve rotating coils of wire which are driven by the magnetic force exerted by a magnetic field on an electric current. They transform electrical energy into mechanical energy.

There are several types of electric motors available today. The following outline gives an overview of several popular ones. There are two main classes of motors: AC and DC. AC motors require an alternating current or voltage source (like the power coming out of the wall outlets in your house) to make them work. DC motors require a direct current or voltage source (like the voltage coming out of batteries) to make them work. Universal motors can work on either type of power. Not only is the construction of the motors different, but the means used to control the speed and torque created by each of these motors also varies, although the principles of power conversion are common to both.

RF Technology

Radio frequency (**RF**) is a frequency or rate of oscillation within the range of about 3 Hz to 300 GHz. This range corresponds to frequency of alternating current electrical signals used to produce and detect radio waves. Since mostof this range is beyond the vibration rate that most mechanical systems can respond to, RFusually refers to oscillations in electrical circuits or electromagnetic radiation.

RF Advantages

- No line of sight is needed.
- Not blocked by common materials: It can penetrate most solids and pass through walls.
- Longer range.
- It is not sensitive to the light.
- It is not much sensitive to the environmental changes and weather conditions.

The data is received by the RF receiver from the antenna pin and this data is available on the data pins. Two Data pins are provided in the receiver module. Thus, this data can be used for further applications.

Alcohol Sensor (MQ2)

This module is useful for gas leakage detection (in home and industry). It is suitablefor detecting H2, LPG, CH4, CO, Alcohol, Smoke orPropane. Dueto its high sensitivity and fast response time, measurement can be taken as soon as possible. The sensitivity of the sensor can be adjusted by potentiometer.

Features

- Wide detecting scope
- Stable and long life
- Fast response and High sensitivity

Vibration Sensor

A **piezoelectric sensor** is a device that uses the piezoelectriceffect, to measure changes in pressure, acceleration, temperature, strain, or force by converting them to an electrical charge. The prefix *piezo-* is Greek for 'press' or 'squeeze'.

Piezoelectric sensors are versatile tools for the measurement of various processes. They are used for quality assurance, process control, and for research and development in many industries. Pierre Curie discovered the piezoelectric effect in 1880, but only in the 1950s did manufacturers begin to use the piezoelectric effect in industrial sensing applications. Since then, this measuring principle has been increasingly used, and has become a mature technology with excellent inherent reliability. They have been successfully used in various applications, such as in medical, aerospace, nuclear instrumentation, and as a tilt sensor in consumer electronics or a pressure sensor in the touch pads of mobile phones. In the automotive industry, piezoelectric elements are used to monitor combustion when developing internal combustion engines. The sensors are either directly mounted into additional holes into the cylinder head or the spark/glow plug is equipped with a built-in miniature piezoelectric sensor.

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3.2. Project Architecture

Helmet Side

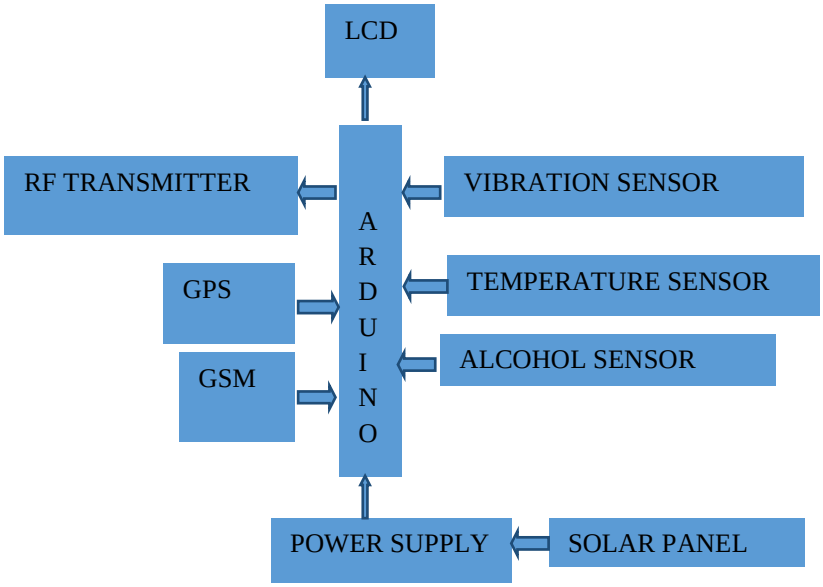

Figure 3.2.1: Block Diagram of Helmet Module

Bike Side

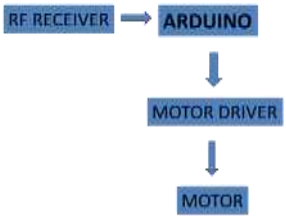

Figure 3.2.2: Block Diagram of Bike Module

IV. CONCLUSION

The developed project efficiently ensures:

- Rider is wearing helmet throughout the ride.
- Rider should not be under the influence of alcohol.
- Accident detection.

By implementing this project, a safe two-wheeler journey is possible which would decrease the head injuries during accidents and also reduce the accident rate due to driving bike after consuming alcohol.

The helmet may not be a 100% foolproof but is definitely the first line of defense for the rider in case of an accident to prevent fatal injuries.

V. FUTURE ENHANCEMENT

It can be used in real time safety system. We can implement the whole circuit into small module later.
This safety system technology can further be enhanced into four-wheeler also by replacing helmet with seatbelt

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