

AUTOMATIC CHINSTRAP LOCKING AND AIRBAG DEPLOYMENT SYSTEM FOR HELMET

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Abstract - This paper describes the automatic chinstrap locking and airbag deployment system to enhance the safety feature of the rider. Most of the people just wear their helmet but they failed to lock their chin strap, which leads to severe injury and risk of lives. The present helmet design doesn't give protection to the spinal cord region. To overcome these disadvantages, helmet with automatic chinstrap locking and airbag deployment system is designed for protection of spinal cord region. The project includes Arduino nano to control motor via motor driver and solenoid valve to release airbag. The Helmet and Bike is connected via Bluetooth connection.

Key Words: Arduino nano, airbag, automatic lock, CO₂ cartridge.

1. INTRODUCTION

Traffic collisions in India are a major source of deaths, injuries and property damage every year. India's average traffic collision fatality rate was similar to the world average rate of 17.4 deaths per 100,000 people. A number of physical injuries can commonly result from the blunt force trauma caused by a collision, ranging from bruising and contusions to catastrophic physical injury (e.g., paralysis) or death. In India, widening of road is not an alternative solution to avoid traffic collision. The problem is that rider should wear safety gears properly in order to avoid injuries.

Here we designed a system which lock the chin strap automatically and deploy a airbag to protect spinal cord so that the impact can be reduced. The system consist of arduino, vibration sensor and solenoid valve. The vibration sensor is used to detect the vibration during collision, the output is fed to the arduino controller. The solenoid valve is used to control the inflation of airbag. Both the sensor and solenoid valve are fitted in the helmet. Most of the accidents lead to amputation of a spinal cord or paralysis. The proposed system will help to reduce the

collision impact experienced by the rider, thus ensuring safety of the rider.

2. EXISTING SYSTEM

In the existing system, microcontroller checks whether the driver is wearing helmet or not and then allows to start the bike engine whereas bluetooth helmet is used to attend calls and alert message from mobile phones.

HUD helmets displays navigation details on visor of the helmet.

3. PROPOSED SYSTEM

In the proposed system, microcontroller checks whether the driver is wearing helmet and automatically locks the chin strap based on bikes ignition state. In addition to this, a airbag module is added to the helmet in order to safeguard the spinal cord region of the driver.

4. HARDWARE

4.1 ARDUINO NANO

Arduino Nano is a small, compatible, flexible and breadboard friendly Microcontroller board, developed by Arduino.cc in Italy, based on ATmega328P (Arduino Nano V3.x) / Atmega168 (Arduino Nano V3.x). It contains 14 digital pins, 8 analog Pins, 2 Reset Pins and 6 Power Pins. Each of these Digital & Analog Pins are assigned with multiple functions but their main function is to be configured as input or output. Arduino Nano comes with a crystal oscillator of frequency 16 MHz. It is used to produce a clock of precise frequency using constant voltage.

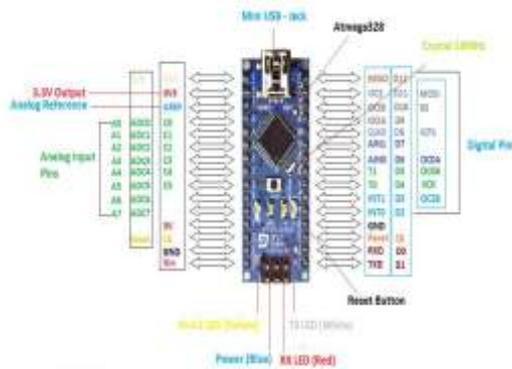


Fig 4.1 Arduino Nano

4.2 HC-05 BLUETOOTH MODULE

HC-05 Bluetooth Module is an Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Its communication is via serial communication which makes an easy way to interface with controller or PC. HC-05 Bluetooth module provides switching mode between master and slave mode which means it able to use neither receiving nor transmitting data.



Fig 4.2 Bluetooth module

4.3 VIBRATION SENSOR

The vibration sensor is also called a piezoelectric sensor. These sensors are flexible devices which are used for measuring various processes. This sensor uses the piezoelectric effects while measuring the changes within acceleration, pressure, temperature, force otherwise strain by changing to an electrical charge. This sensor is also used for deciding fragrances within the air by immediately measuring capacitance as well as quality. The working principle of vibration sensor is a sensor which operates based on different optical

otherwise mechanical principles for detecting observed system vibrations. The sensitivity of these sensors normally ranges from 10 mV/g to 100 mV/g, and there are lower and higher sensitivities are also accessible.



Fig 4.3 Vibration Sensor

4.4 DC MOTOR

A DC motor is any of a class of rotary electrical motor that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.



Fig 4.4 DC motor

4.5 RELAY

The relay module is an electrically operated switch that allows you to turn on or off a circuit using voltage and/or current much higher than a microcontroller could handle. There is no connection between the low voltage circuit operated by the microcontroller and the high power circuit.



Fig 4.5 Relay Module

4.6 L293D MOTOR DRIVER

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC.



Fig 4.6 L293D Driver

4.7 SOLENOID VALVE

A Solenoid valves are used to close, dose, distribute or mix the flow of gas or liquid in a pipe. The specific purpose of a solenoid valve is expressed by its circuit function. A 2/2 way valve has two ports (inlet and outlet) and two positions (open or closed).



Fig 4.7 Solenoid Valve

5. SOFTWARES

5.1 ARDUINO IDE

Arduino IDE is an open source software that is mainly used for writing and compiling the code into the Arduino Module. It is easily available for operating systems like MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment. The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board. The IDE environment mainly contains two basic

parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module. This environment supports both C and C++ languages.

6. BLOCK DIAGRAM

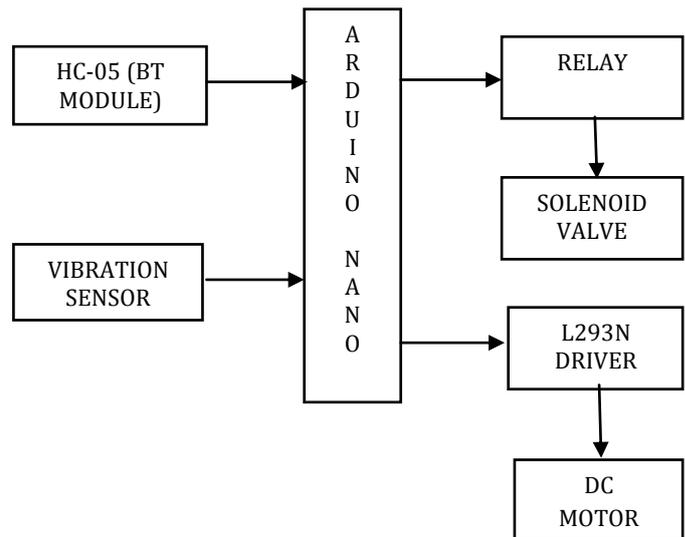


Fig 6.1 Block Diagram of Proposed System

7. WORKING PRINCIPLE

7.1 DETECTION

Vibration sensors are most commonly used in the detection of change in pressure, acceleration, temperature, force and strain. Shear mode accelerometer (vibration sensor) designs feature sensing crystals attached between a centre post and a seismic mass. Under acceleration, the mass causes a shear stress to be applied to the sensing crystals. This stress results in a proportional electrical output by the piezoelectric material.

7.2 LOCKING

The locking system consist of one fixed end and one movable end. The movable end is connected with DC motor. When the bike ignition is turned on, the motor starts to move to another side of the helmet . When the ignition is turned off, the DC motor returns to its original position. The movement of DC motor is controlled by L293D motor driver.

7.3 INFLATING

When the vibration sensor detects sudden change in acceleration and if reading received is above threshold value, solenoid valve opens. The CO₂ cartridge inflates the airbag. The cartridge can be replaced after every use.

8. RESULTS AND DISCUSSION

The final output of the module will be inflation of airbag when vibration sensor frequency is above the threshold frequency and the chin strap locks when bike's ignition is turned on.

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