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# ACCIDENT DETECTION AND ALERTING SYSTEM WITH CONTINUOUS HEART RATE MONITORING USING ARDUINO FOR TWO WHEELER

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**Abstract: - Road traffic has increased greatly in the recent day. Due to this heavy traffic, the number of accidents is also increased. According to some of the recent statistics maximum number of fatalities is being driven by two wheelers. So our intention through this paper is to develop an Arduino based device which can detect accident and send the location of the rider to a predefined number. Along with that there will be one band in the rider's hand which will note rider's pulse rate and upload it in a website.**

**Keywords: Arduino, Knock Sensor, Hall Effect Sensor, Accelerometer, GPS, GSM, ESP8266, Pulse, Sensor**

## I. INTRODUCTION

In the recent days the number of road accidents is increasing day by day. Studies says that in 2013 approximately 1, 37, 000 people were died in road accident. In India daily on an average 16 children were died in road accident. 1214 people died daily in road accident in India. In many cases the injury is very serious, where time is a very important factor. I n those cases if there is a system which can detect accident by itself, can reduce the response time. Here we are making such a device.It uses two Arduino NANO and one ESP8266 Wi-Fi based development board. Those two Arduino with the help of different sensor (Like knock Sensor, Hall-effect, Sensor, FSR, Accelerometer, GSM Module, GPS Module) detect the accident and send the biker's location to concern number and activate one alarm for 15 secs. On the other hand the ESP8266 continuously upload rider's heart pulse in web.Along with that there is a panic button attached with the ESP8266. If the rider thought that detected accident is not that much serious, no need to inform anyone. Then rider can press the panic button for three times withinthe time period of 15secs to inform the same.

*Related Work:*[1]In this paper they propose a system that will be installed on the rider's helmet.There will be one accelerometer and one pulse sensor in the helmet which will help to identify if the rider is wearing the helmet or not. If the rider is not wearing the helmet or there is alcohol in the rider's breath the bike will remain off. When the rider crashes and hits the ground, the sensor will detect the motion and tilt angle of the helmet, it will reports the incident to the predefined numbers. [2]In this paper they have developed one mobile application. This application will be connected with the hardware. This hardware will detect vibration with the help of the vibration sensor and then it will check the sudden change in tilt of the vehicle. They analyze the changes using their algorithm to identify the

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accident. In case of the confirm accident this system will send the notification to the concern person, nearest police and nearest medical care. In addition, the application will have one additional feature, which will allow the rider to cancel the message being sent. They have also installed one anti-theft system will allow the bike owner to track the bike

## II. INSTRUMENTATION SYSTEM AND METHOD

*2.1 Instrumentation system:* Here we are using thee microcontroller (two Arduino Nano and one ESP8266 microcontroller). Arduino uses ATmega328 microcontroller. By the help of these two Arduino, we can detect the accident and send the location of the rider to a certain predefined number. And the ESP8266 with the help of pulse sensor (optical sensing) it note the rider's pulse and upload it in the web.

*A. Arduino* **:**Arduino NANO is a small complete ATmega328(Arduino Nano 3.x) based board.It comes with Mini-B USB port instead of the regular one.To configure the board we have to use Arduino Software (IDE).

Specifications:

| | |
|---|---|
| Microcontroller | ATmega328 |
| Operating Voltage | 5 V |
| Flash Memory | 32 KB of which 2 KB used by bootloader |
| SRAM | 2 KB |
| Clock Speed | 16 MHz |
| Analog IN Pins | 8 |
| EEPROM | 1 KB |
| DC Current per I/O Pins | 40 mA (I/O Pins) |
| Input Voltage | 7-12 V |
| Digital I/O Pins | 22 (6 of which are PWM) |
| PWM Output | 6 |
| Power Consumption | 19 mA |

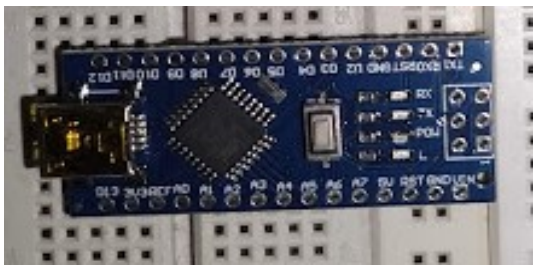


Fig: 1.a. Arduino NANO

**i) Knock Sensor:** In this module there is one conductor plate. One end of this plate is connected but another end is not connected. Whenever there is any jerking in the bike the plate will shake and completes the circuit. Thus it helps the Arduino to detect whether there is any jerking in the bike or not.**ii)ii) Hall Effect Sensor:** This module has mainly two parts. One is stationary and another one is moving. The Hall Effect transistor (in our case SIP4) is in the stationary part. And the magnets are in the moving part. Whenever this Hall Effect transistor comes towards the magnetic field (created by the permanent magnet) it starts conducting.

Hall Effect Transistor is basically containing a rectangular thin semiconductor (Like Indium Arsenide (InAs),Gallium Arsenide (GaAs) or Indium Antimonite (InSb)) plate. Whenever it is placed inside a magnetic field, the magnetic field deflects the charge carries (electrons and holes). As these charge carries move side wards it produces a potential difference between two sides. Thus the presence of magnetic field affected the semiconductor material.

Fig: 1.b.Hall Effect Sensor

*iii) FSR(Force Sensitive Register):*FSRs are low cost pressure, weight andsqueezing detecting sensor. Depending on how much pressure has been applied, it changes its resistance.

- Size: ½" Diameter 0.02"thickness.

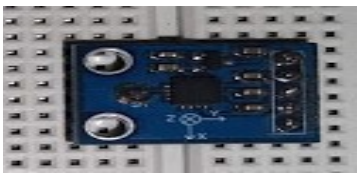


Fig: 1.c Accelerometer

- Resistance Range: infinity/open circuited (No Pressure is applied), about 100KΩ (Light Pressure is applied), 200Ω (Maximum Pressure is applied).

*iv)Accelerometer:* Nowadays technology becomes so innovative that it can easily detect the orientation of any material by settling a device which is an accelerometer. An accelerometer is an electromechanical device that is used to measure the acceleration forces of any particle. It also measures the vibrational forces of any particle. The dynamic acceleration is used to measure the gravitational forces to determine the angle with respect to time. The linear acceleration is used to measure the acceleration that is applied to the device without the contribution of a gravitational force. The change of velocity in acceleration is in meter per second squared (m/s2) [SI]. The acceleration device has a three-dimensional cartesian coordination system (x, y, z). By the measurement of the axises we can easily get the accurate position of the device from the earth surface.

The accelerometer consists of different parts with many works. The piezoelectric effect and the capacitance sensors are the main working component of an accelerometer. Analog and digital both displays are available in an accelerometer and the different components in the accelerometer are mounted through different software. Mostly accelerometer is made of a multidimensional axis. The smartphone uses 3d accelerometer and the car uses 2d to detect the position of the vehicles.

In this module an accelerometer is used to detect the original position of the bike. By knowing the position according to the X, Y, Z-axis it confirms the actual position (angle) of the bike. It will active when only the position angle of the bike will greater than the set angle in the accelerometer Arduino.

**v) GPS Module:**GPS (Global positioning system) is a satellite navigation system which is very useful in recent days. It determines the object position on the ground. United States military used GPS technology first in 1960. After that it was widely used by civilian.

30 well-spaced satellites in the orbit of earth help to the GPS system. GPS satellite send signal to the GPS receiver. By subtracting the receiving time and transmitting time,the GPS can calculate how far it is from each satellite. GPS receiver also knows the exact position of satellites by analyzing the received signal from satellite. Then GPS receiver can determine latitude and longitude of it.

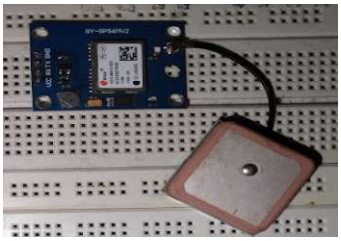


Fig: 1.d. GPS Module

"Trilateration" mathematical principal is GPS system operation. Distance between the satellites determines the receiver position on earth. Minimum three satellite help to determine one exact position.

GPS works in six steps:

I: GPS works by using a method called "triangulation" or "trilateration".

II: It needs to get a message from at least three, preferably four satellites

III: To "triangulate", a GPS receiver measures the distance between itself and each satellite. It can measure distance because it calculates the message arriving time from satellite. (Distance = time of arrival * speed of light)

IV: To measure travel time, GPS needs very accurate timing which it achieves with atomic clocks on board each satellite.

V: Along with distance, the device needs to know exactly where the satellites are in space at any given time. The GPS receiver consist that information.

In this module GPS is used to detect the actual location of the bike. After detecting the accelerometer it will help to get the actual location of the bike.

*vi) GSM Module:* GSM stands for global system for mobile communication which is a mobile communication model. The GSM module was invented at bells laboratory in 1970.GSM is an open and digital cellular technology used for transmitting mobile voice and data service operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands

It used Time Division Multiple Access (TDMA) technique for communication purpose. Mainly five different size of GSM chips are there in the market. Such as Umbrella Cell, Pico Cell, Micro Cell, Macro Cell.

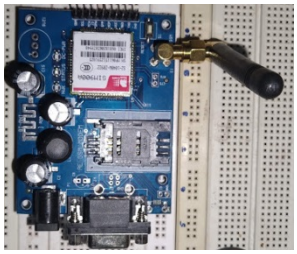


Fig: 1.e. GSM Module

GSM Architecture:

A GSM network consists of the following components:

A Mobile Station: It is the device where the transceiver is installed, along with the other devices it is controlled by a SIM card operating over the network.

Base Station Subsystem: Base Station Subsystem acts as an interface between network subsystem and mobile station. It basically consists of Base Transceiver Station (containing radio transceivers) and helps to maintain the protocol to communicate with the mobile.. It also consists of the Base Station Controller which controls the Base Transceiver station and acts as a interface between the mobile station and mobile switching center.

Network Subsystem: Network Subsystem helps by providing basic network connection to the mobile system. One of the main parts of network subsystem is Mobile service switching Centre. It provides the access to ISDN, PSTN etc. network. The call routing and roaming capabilities of GSM are provided by the Home Location Register and the Visitor Location Register. It also contains the Equipment Identity Register which maintains an account of all the mobile equipment wherein each mobile is identified by its own International Mobile Equipment Identity (IMEI) number.

GSM Modem

It is a device (can be a mobile, can be a modem device) which helps any processor to communicate over network. It should have an active SIM card over a network range subscribed by the network operator. It can be connected to the processor with USB, Serial or Bluetooth.

In this module after detecting the accelerometer and the exact location of the bike it will help to transfer the message to the nearest hospital, Police station and home. Thus it will be very helpful to rescue the biker at a short time

*vii) ESP 8266:* ESP 8266 is a low cost wireless transceiver development board. It can be used for IOT projects. It is coded with the help of an external microcontroller with a set of AT commands. This microcontrolleruses UART (with specific baud rate) to execute the communication with the module.

Fig: 1.f. ESP 8266

- Memory Specifications:
  - 64 KB boot ROM
  - 64 KB instruction RAM
  - 96 KB data RAM.
- Pin Outputs:
- **3V3**: It is a 3.3V voltage supply which can deliver up to 3.6V.
- **GND**: It is the ground pin of the module.
- **RST**: It is the Active Low Reset pin of the module.
- **EN**: It is the Active High Reset pin of the module.
- **TX**: It is the serial Transmit pin of UART(Universal Asynchronous receiver transmitter)
- **RX**: It is the serial Receiver pin of UART.
- **GPIO0** and **GPIO2**: It is the general input and output pins.

**viii) Pulse Sensor:** It is an electrocardiography sensor. It operates on 5 volt controlled dc supply. Its operation is very straight and simple. If the pin outputs are connected to the dedicated slots it will start working and giving the outputs. It consists of three pin outputs.

Pin outputs:

'+'=Positive part of supply voltage.

'-'=Negative part (ground part) of supply voltage.

'S'=Value output pin.

Basically there are two methods of working of the sensor. They are

1) Reflected Mode-- In this method an IR light sender and receiver present in the pulse sensor is kept at same side where the sender sends IR light to the target point and the reflected IR light comes to the light receiver and that's how it works.

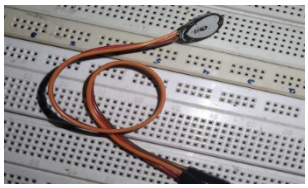


Fig: 1.g Pulse Sensor

2) Transmitted Mode-- In this method and IR light sender and receiver is present in the sensor are kept at it opposite direction to each other where the sender sends IR light to the target point and at the opposite side receiver receives and senses the pulse. That's how it works.
Here we are using the sensor which works in reflected mode.

*2.2ALGORITHM FOR ACCIDENT DTECTION:*

We have used two Arduino and one ESP8266in this project.Knock sensor, Hall-Effect Sensor, Pressure Sensor in the first Arduino. A bike makes a jerk when the accident takes place.Then the knock sensor detects the jerking of the bike. Then the pressure sensor send high signal to hall-Effect sensor. Hall-Effect sensor can monitor real time RPM of the wheel of the bike. If the RPM of the wheel of the bike decrease gradually ,then the senor send high value to the Arduino .If the speed of the bike is less than 15 kmph ,then the device do not follow the further process. If the speed of the bike is greater than 15 kmph,then pressure sensor will detect the pressure on the seat.

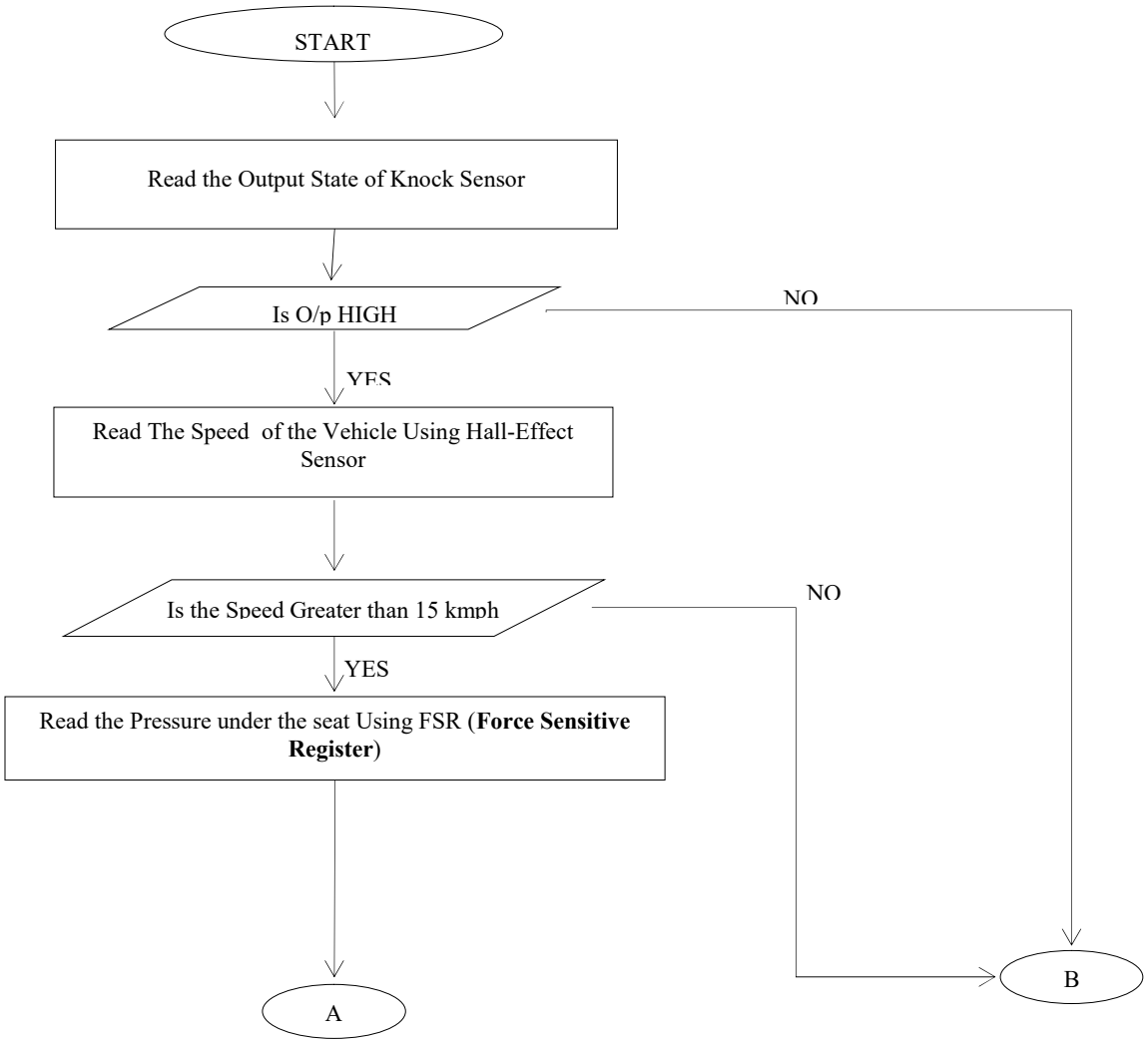
Pressure sensor FSR (Force Sensitive Register) will be placed below the seat of the rider.After that pressure sensor (Force Sensitive Register) will detect the pressure on the seat.If there is no rider on the bike after jerking,then the pressure sensor will make the 1st Arduino's 8th pin high .That pin is connected with second Arduino's 7th in. If the 7th pin is low,then the device does not follow the further process. If the 7th pin of the Arduino is high,then the accelerometer determine the tilt angle of the bike. If the tilt angle is lower than 60 degree,then the device do not follow the further process. If the tilt angle is greater 60 degree,then the Arduino will send the message to the concern person along with bike's location and turn on an alarm for 15 sec.

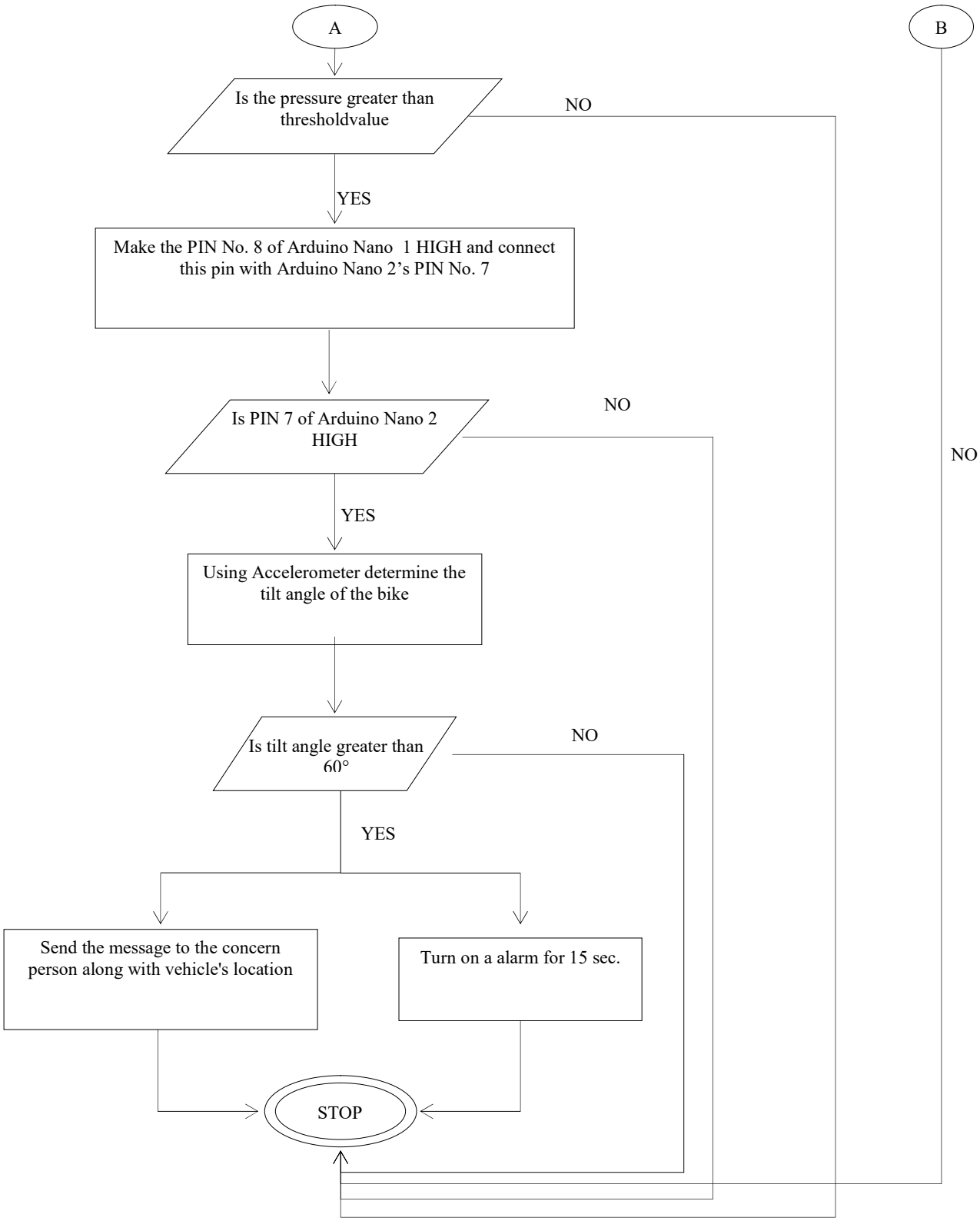
*2.3 WORKING OF HEART RATE SEANSOR WITH ESP8266:-*

We make another device for detecting heart rate for the rider.Basically heart rate sensor helps to gather the information of health condition about rider. And the data will be uploaded in web using ESP8266.

Heart rate sensor can send analog data as well as digital data.Heart sensor will be placed below the wrist to detect the pulse rate. Heart rate sensor always sent real time the value to ESP8266. So ESP8266 will upload heart rate continuously. Anyone can check rider's hear rate by checking the web address where it is uploaded. Along with that facilities there will be one panic button. Whenever the aforementioned system can detect the accident an alarm will be rang. Within 15 secs of this if the rider thought it is not a serious case, no need to inform any one then he/she can press the panic button simultaneously 3times within 15 sec. Then one message will be shown in web "There is no serious accident".

*2.4 FLOW CHART FOR ACCDENT DETECTION:*






## III. DISCUSSION

This is a theoretical case study. The actual results can be obtained by designing such type of system and doing some experiments on it. However, though, proposed system makes use of Two-wheeler but it can help in studying and monitoring other types of accidental cases of vehicles such as, car, truck,etc.

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