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Internet of Car: Accident Sensing, Indication and Safety with Alert system

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Abstract: - Detecting an accident before occurring it can save human life. To do this, advance accurate human detection and accident detection capability is needed. Several researches are going on regarding pre-crash detection & avoidance system from obstacle. To implement this system, priorities crash is essential for human or animal compared to obstacle. How the system will operate when it faces a situation to between human and obstacle? Differentiating human or animals and obstacles is more important by detecting them. If the system is unable to detect human then there will be a possibility to hit human rather than obstacle. Driver when drive a car in high speed may bypass humans, animals, or any obstacle for a few inches and the measurement is done by his own eyes which may occur an accident. Moreover, risk increases in foggy weather to see further that any animals, human or any obstacle is present in front of the car or any car is coming from opposite direction. Giving the priorities to human or animal, this paper work is done. By this system, a car will try to avoid obstacle after avoiding human or animal if there is any. Driver will also be notified with red lights indicating that obstacles are in front. However, if the system would not be able to avoid accident then our system will automatically generate a tweet in tweeter. For further safety, this system also contains relay and buzzer where relay will protect the car from battery ignition and buzzer will make noise to inform people surrounded.

Keywords: - *Accident Avoidance, Accident detection, Obstacles detection, Wi-Fi, vehicle tracking.*

I. INTRODUCTION

According To The Who 2013 Global Status Report On Road Safety [1], Road Traffic Deaths Would Become The Fifth Leading Cause Of Death. The Report Showed That There Had Been No Overall Reduction In The Number Of People Killed On The World's Roads: About 1.24 Million Deaths Occur Annually. Among Them Cyclist, Motorcyclists, Car Occupants & Unspecified Road Users Are High. Number Of Animals Die In Road Accident Is Also Quite Good. Even In Several Countries The Number Is Pretty High. In Order To Reduce The Number Of Car Crash Charles Birdsong, Ph.D., Peter Schuster, Ph.D., John Carlin, Daniel Kawano, William Thompson Has Designed Pre-Crash Detection System Using Ultrasonic, Laser Range Finder And Radar Sensors [2]. Accident Avoidance And Detection On Highways Is Designed By S.P. Bhumkar, V.V. Deotare, R.V.Babar [3]. These Systems Have The Ability To Detect Obstacles But The Most Important To Detect Human Being Or Animals And Avoid Them Are Missing. This Sensing Technology Can Reduce A Large Number Of Bikers, Cyclist And Passerby Death. There Are Also Lots Of Research Work Is Available On Accident Avoidance, Crash Detection And Alarm System. Megalingam, Rajesh Kannan & Their Group Mate Have Developed "Wireless Vehicular Accident Detection And Reporting System" [4]. Automatic Accident Detection Via Embedded Gsm Message Interface With Sensor Technology Is Developed By C.Vidya Lakshmi, J.R.Balakrishnan [5]. These Methods Uses Break System, Windows Close, Seat Belt Stiffen To Save Life From The Accident But If The Obstacle Is Human Or Animal Then Our System Uses Avoidance System Also. It Also Indicates The Driver That Obstacles Are Ahead. So The Driver Can Turn Left Or Right According To The Indication. If Avoidance Is Not Possible And Accident Happens Then This System Detects The Accident. Beside That It Will Also Generate A Tweet To Tweeter Through Wi-Fi System. It Is Also Possible To Coordinate Location Through Gps System Which Is Not The Main Concern Of Our Project.

Fig. 1:- Human and obstacle detection before 5m distance

II. MAIN TECHNOLOGY USED

1.1 Obstacle detection & indication sensor

This is one of the photoelectric sensors which is a set of transmitter and receiver. Detection distance can be adjusted as it is required. The sensor can detect distance by visible light interference which is small, cheap, and easy to assemble, easy to use, and other characteristics are given bellow:-

1, output current DC / SCR / Relay Control output: 100mA/5V powered
2, DC current consumption < 25mA
3, response time < 2ms
4, point angle: 15 °, effective distance 3-50CM adjustable
5, detection of objects: transparent or opaque body
6, working environment temperature: 25 °C ~ 55 °C
7, standard sensing object: sunlight 10000LX The following incandescent 3000LX

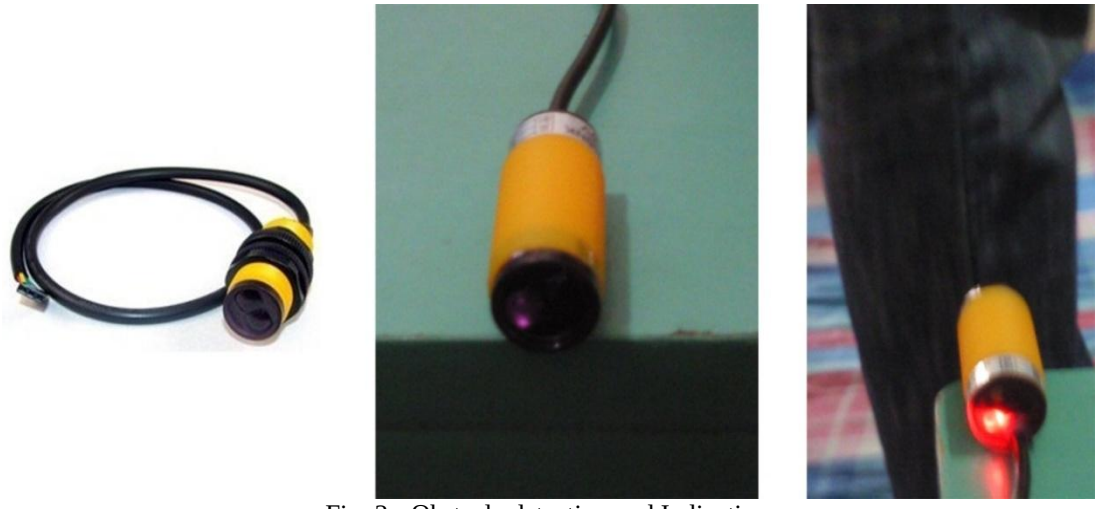

Fig. 2:- Obstacle detection and Indication

In both side of the car two IR obstacles sensors are placed. Anyone coming from the left side of the car or any obstacle found at the left side can be detected by left sensor and right sensor also work in same manner. The presence of an obstacle or human is indicated through red light when it detects human or obstacle. When human detection sensor detects human at the right side of the car and obstacle sensor detects an obstacle at the left side of the car then car will be moved toward left side to save human. As obstacles in both side of the car are detected thus both indication lights will be turned on.

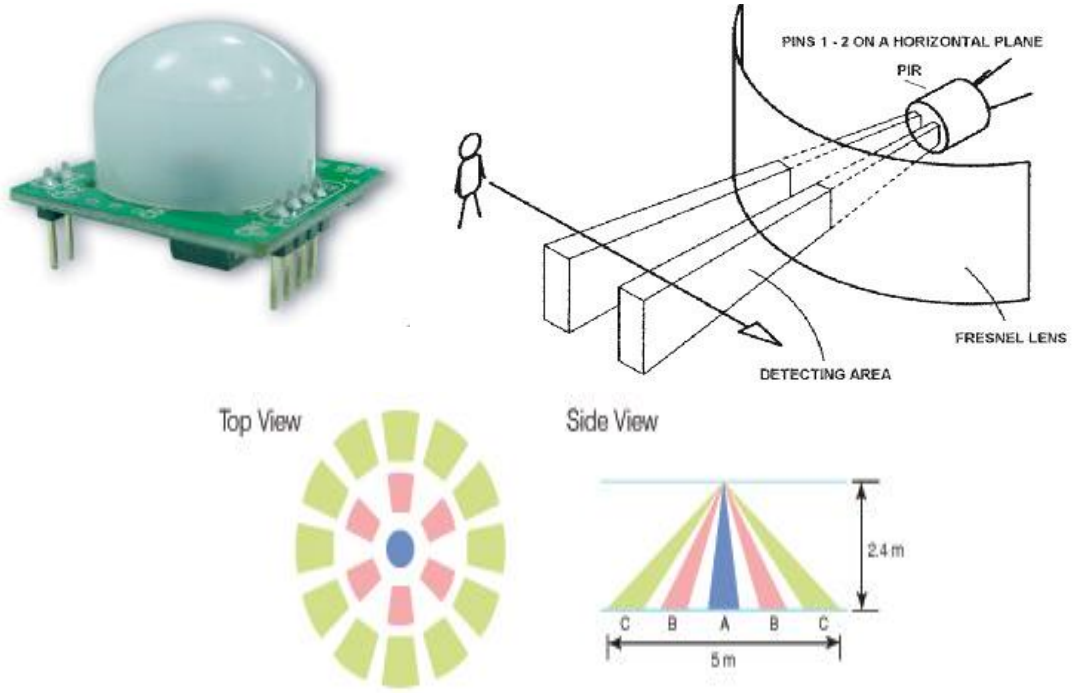

Fig. 3:- Fresnel lens, increase sensitivity and range of PIR sensor

1.2 Passive Infra Red sensor

The key of this project is Human sensing technology. In this project passive infra red sensor has been used to detect human. Infrared radiation exists in the electromagnetic spectrum at a wavelength which is longer than visible light. It can be detected though it cannot be seen. Objects that generate heat also generate infrared radiation and those objects include animals and the human body whose radiation is strongest at a wavelength of 9.4um [5]. PIR sensor is able to detect the change of radiation of this infra red radiation. A picture of working principle of PIR sensor is given below.

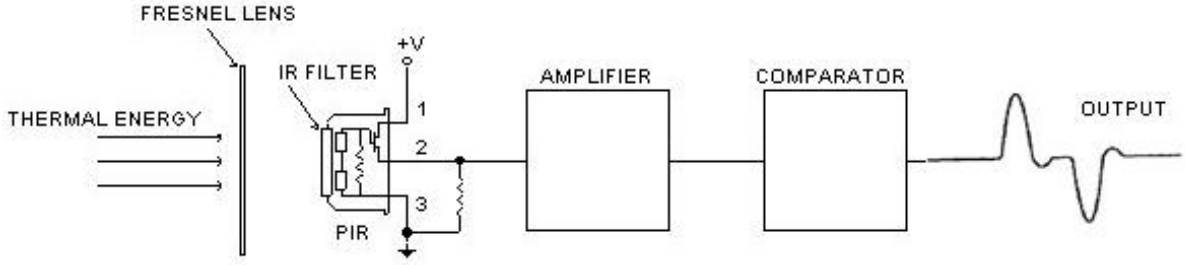

Fig. 4:- Typical configuration of PIR

PIR sensor generates +5v and -5v sine signal when any human or animal passes in front of the sensor or any movement is detected of human or animal in front of this. A breakout board is used to detect this signal and convert it into a longer digital signal. The output of PIR sensor can be adjusted. For max it can create an output signal for approximately 1.2 seconds [6]. This is more than enough to detect the signal.

2.3 Fresnel lenses

FL65 Fresnel lens is made of an infra red transmitting material that has an IR transmission range of 8 to 14um which is most sensitive to human body radiation. It is designed to have its grooves facing the IR sensing element so that a smooth surface is presented to the subject side of the lens which is usually the outside of an enclosure that houses the sensor. The lens element is round with a diameter of 1 inch and has a flange that is 1.5 inches square. This flange is used for mounting the lens in a suitable frame or enclosure. Mounting can best and most easily be done with strips of Scotch tape.

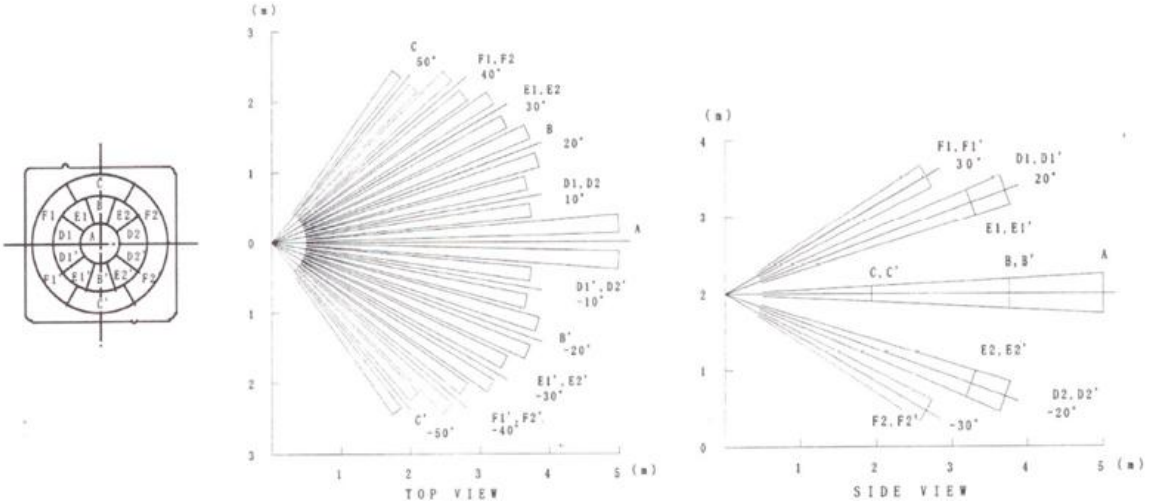

Fig. 5:- Reduced width of PIR sensor

Detection area of a PIR sensor is 3m in width, 5m in length & 3m in height. But on average the width of any car is around 1.5m. We have to detect humans or animals within this width. So, we have covered the lens area to reduce the width to 1.5m. Here is a picture below:-

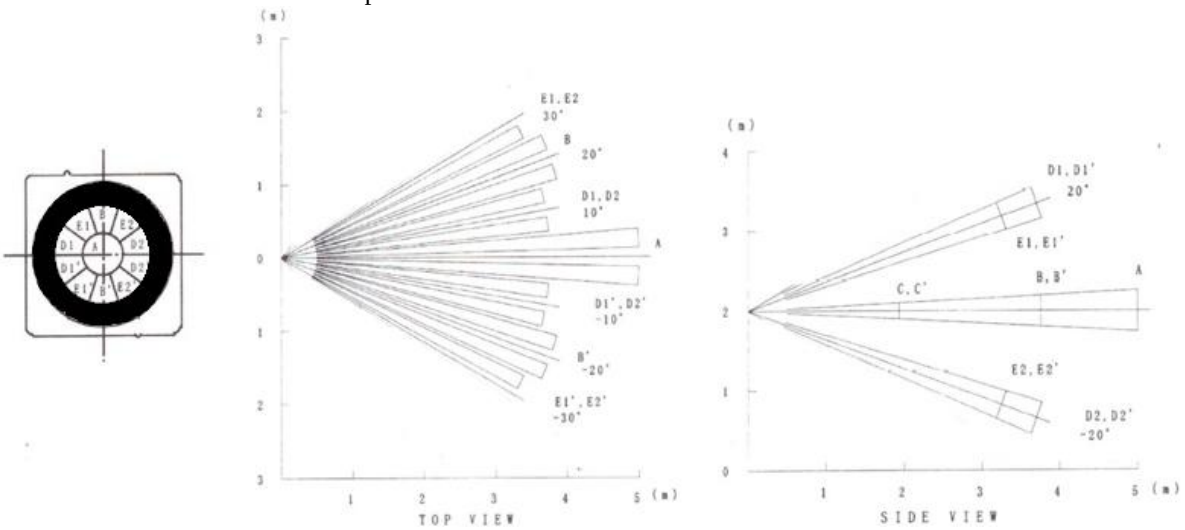

Fig. 6:- Reduced width of PIR sensor

In order to identify the position of the human being we need two sensors. Their detection area will overlap each other at the center. If both the sensor detect human means human is at the center. If left PIR only detect means the person is at the left side of the car and same for the right side. With the help of distance sensor this system [2] is also able to find out the distance of the human. Here is a figure describing the covered area.

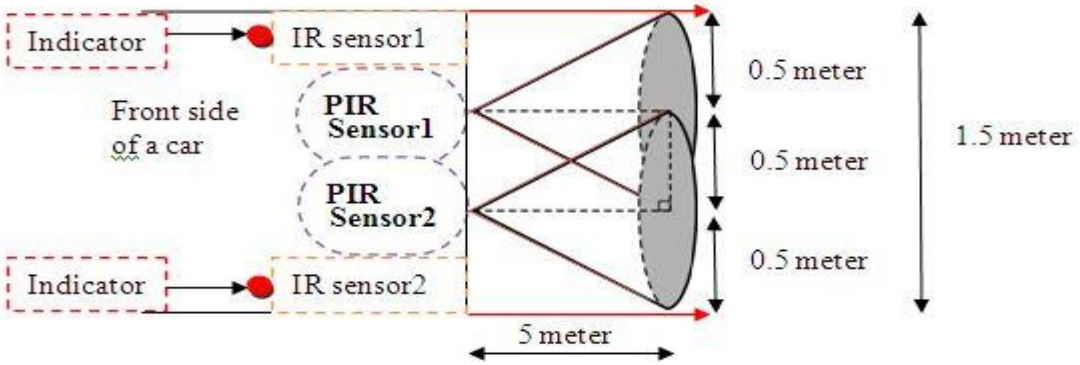

Fig. 7:- Area covered by PIR & IR sensors, human position detection & indication

2.4 Accident avoidance system

An advance pre-crash system is also capable to avoid accident by sensing human and their distance from vehicle. For example an automated braking force can be executed in this system. Moreover, the system can handle the steering by determining the position of human or obstacle. If driver forgets to press horn then the system can also generate an auto horn to indicate the person in front of the car.

2.5 Accident Detection

Most of the accident detection system uses complex 3 axis accelerometer, gravity sensor or costly android mobile phones with complex circuitry. In this system the accident detection method is also cheap and simple. We have used a tilt sensor to detect accident. Whenever any major accidents happens car jump or even flip over. We are detecting the amount of angle it rotated from ground. Tilt sensor can measure a rotation of minimum +15degree or -15 degree [7].

Fig. 8:- Accident Detection using tilt sensor

2.6 Wi-Fi shield

The RN-171 module has been used here as Wi-Fi shield which is a complete TCP/IP wireless networking module. This module is perfect for mobile wireless applications for mobile wireless applications for its small form factor and low power consumption. It incorporates a 2.4 GHz radio, 32-bit SPARC processor, TCP/IP stack, real time clock, crypto accelerator, power management and analog sensor interfaces. It also contains 8 Mbit flash memory and 128 KB RAM, UART and SPI slave hardware interfaces, 10 general purpose digital I/O and 8 analog inputs (14 bit,400mv). It accepts 3.3v regulated power supply or 3v battery.

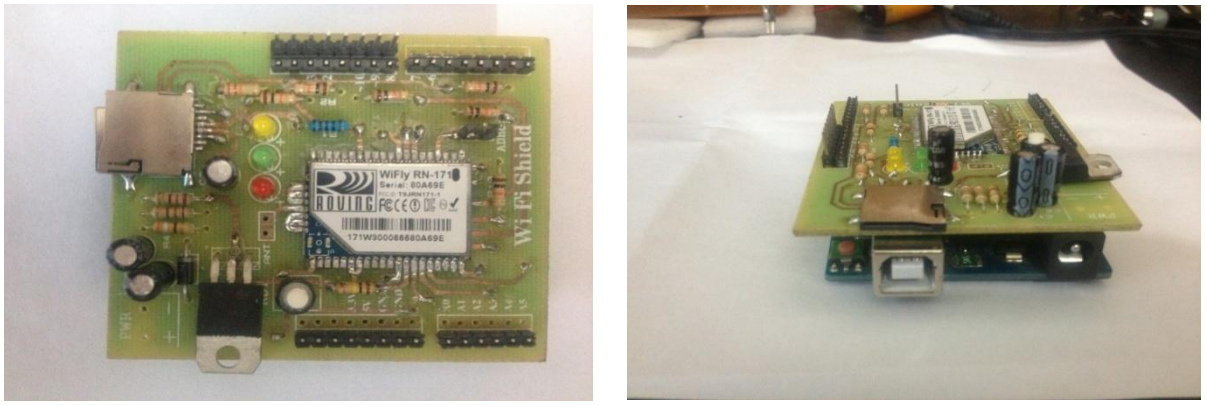

Fig. 9:- Wi-Fi Shield top and side view

2.7 Arduino

The Brain of this project is Arduino uno which is a microcontroller board based on the Atmega328. It has14 digital input/output pins, 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. To get started it is just needed to connect it to a computer with a USB or power it with an AC to DC adapter. The board can operate on an external supply 6 to 20v. The recommended voltage is 7-12v, otherwise 5v pin may supply less than 5v if supply is less than 7v and the voltage regulator may overheat and damage the board for supplying more than 12v.

Fig. 10:- Arduino uno board

2.8 Relay and Buzzer

In this project 12A/220vAC relay has been used to protect the car from battery ignition when an accident occurs. If any accident occurs then the relay will trip its coil to avoid battery sparking. Buzzer has been used to make noise thus it can inform peoples surrounded when any accident occurs.

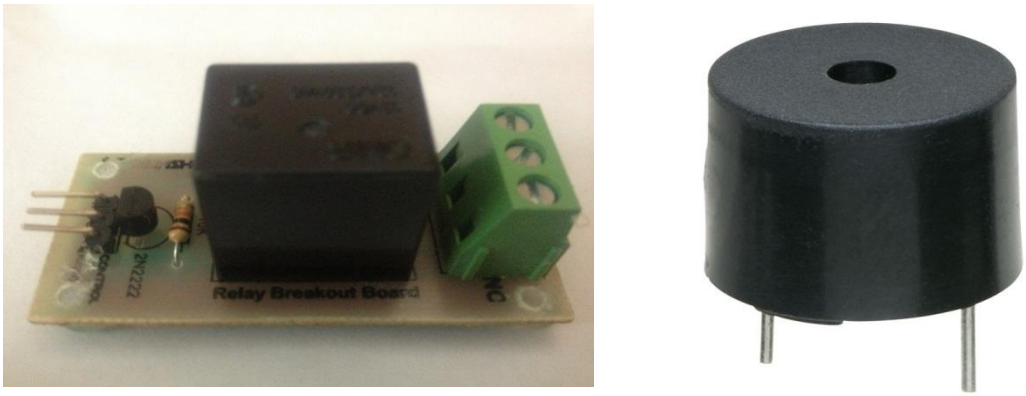

Fig. 11:- Relay and Buzzer

III. CIRCUIT DESCRIPTION

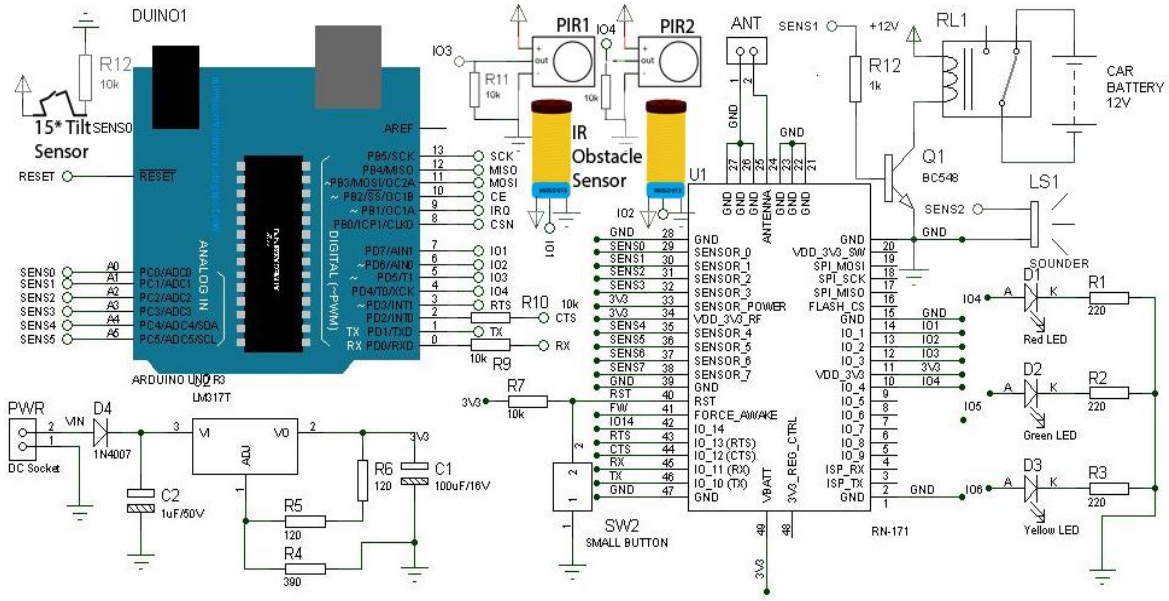

Fig. 12:- Schematic diagram

The controller used in this project is Arduino Uno. Two PIR sensors are connected to IO3 & IO4 bit. One tilt sensor is connected to sens0 bit. All these sensors give digital input that's why all these 3 pins are pulled down by 10K resistors. Here all the VCC are +5v. IR sensors also consume +5v and both sensors are connected to IO0, IO1 bit. Wi-Fi module communicates with microcontroller through serial communication. Other pins are used to control the Wi-Fi modem. Relay is connected to Sens1 no pin. And Buzzer is connected with sens2 no pin. Here LM317T IC is used to generate 3.3v which powers the Wi-Fi module. Power of Arduino comes from USB.

Circuit operation is simple. First step is to detect human. There are three possibilities, human is at left side of the car, at the middle of the car or at right side of the car. If human is at left side only PIR1 will generate a high signal, if human is at the center both the PIR will generate high signal & if the person is at right side only PIR2 will generate a signal. According to the PIR a signal will be sent to turn the staring to avoid the human. If avoidance of obstacle is not possible then the tilt sensor will be get shorted and a +5v will go through sens2 pin. When microcontroller gets this signal it initiates an alarm and sends a tweet to internet through Wi-Fi module. We did not included GPS module for location tracking as there are several Wi-Fi modules are available in market to know the pin point location of car. Relay is used to disconnect the battery of the car while accident occurs. Lots of time spark from batteries ignite fire and cause severe damage. To avoid spark from battery relay is used to disconnect the positive terminal of battery. And buzzer also continuously indicates that accident has occurred and need emergency help. Tilt sensor measure any angle rotation around +15degre of -15degree which confirms the indication of accident.

This module tweets to owners account. Owners tweet account is previously saved in Arduino and Also connecting IP of Wi-Fi module. There are others alert systems can be also implemented like mailing to GMAIL, post in facebook, etc. Bellow showing the output of tweet once accident occurred.

Fig. 13:- Tweet from car indication of accident

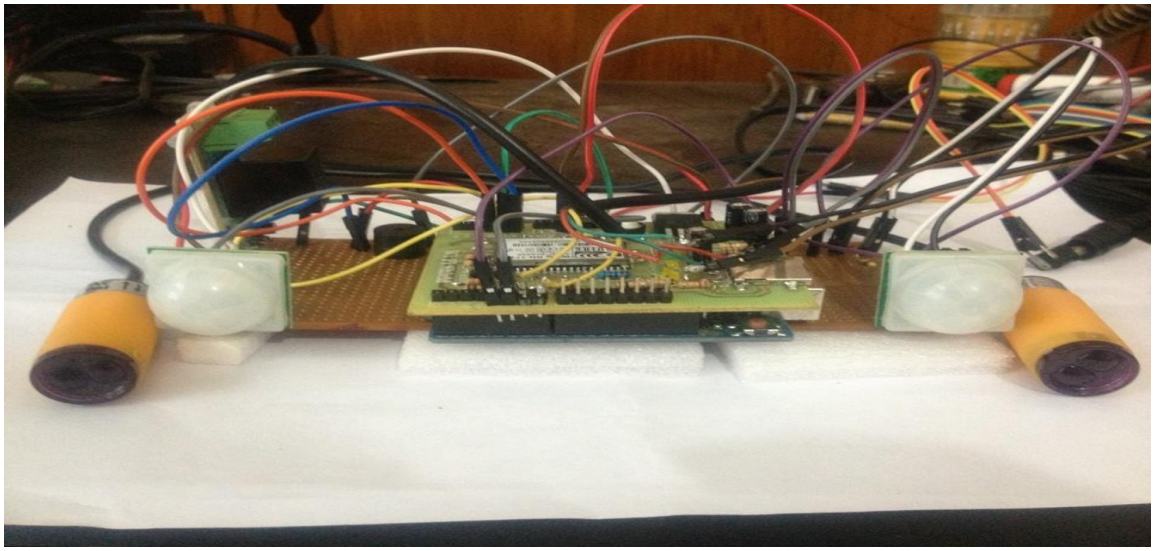

Fig. 14: - Front view of the hardware

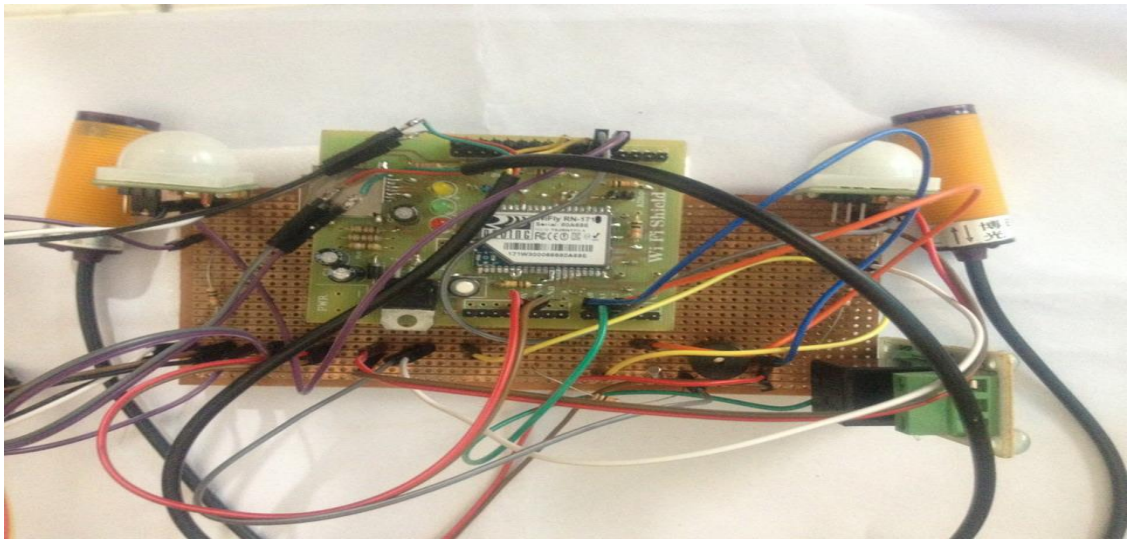

Fig. 15: - Top view of the hardware

IV. FURTHER APPLICATION

1. Avoiding Helicopter or Air plane collision with birds.
2. Robots will be able to identify humans & animals.
3. In NASA robot to detect presence of life using sensor.
4. Earthquake survival finding inside buildings.
5. Fire survival finding inside buildings.

V. CONCLUSION

Passive Infra red sensor is a reliable solution for detecting human or animals and this technique certainly can save lots of life. Human lives are most valuable. Pre-crash detection system must be equipped with combination of different sensors. Detecting humans or animals including obstacles will certainly give us a better solution to reduce the death of humans in road crash.

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