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Vehicle Collision Detection and Lane Assist System Using RTOS

D. Sindhuja[1] **and M. Sivasubramanian**[2]

ABSTRACT

The largest areas of research and development in the automobile industry are road safety and accident prevention. Due to several accidents on roads there are several accidents are occurring. A person driving vehicle had to monitor the other vehicles coming behind through the rear view mirror. This lead to a major accidents while monitoring. There are many systems available such as Obstacle Detection and Lane assists namely Lane Departure Warning, Drift assist, Blind Spot Monitoring, Reverse Assist etc. This system which exist only present in the high end vehicle, which are sold for more cost. Is that driver driving a high end car has a life, which is precious and the driver driving a low end vehicles had no life, which one is not precious. So, an automatic detecting system with the controllershouldbe present in these vehicles so that they can take decision of their own and avoid themselves from accidents. In the proposed idea, implementing Ultra Wide Band (UWB) radar for detection of uncontrolled vehicle by using RTOS for moving and stationary object, under all environmental Condition. Infrared sensors used to detect the vehicle that are unintentionally departs from the lane. An alarm indication is given to the driver if there is any obstacle or lane crossing is detected. If the driver is not responding to the alarm then the vehicle will automatically stops when it is so close to other vehicle.

Keywords: Lane assist, UWB, infrared, RTOS

1. INTRODUCTION

Automobile industry challenging research is road safety. Due to the road accidents many deaths and injuries occurring, therefore a technology should exist in vehicles to prevent these accidents. Rear view mirrors are only option for the driver to monitor the vehicle coming behind. While monitoring, a very small mistake had done also lead to major accidents. There are many systems available for automatic detection Obstacle Detection using SONAR and assist are present namely Lane Departure Warning, Drift assist, Blind Spot Monitoring etc. But all these systems exist only in high end vehicles not in low end vehicles. So, an automatic detecting, warning and controlling system should be present in these vehicles to prevent accident. This concept is completely new. In this proposed idea, implementing UWB radar for detection of uncontrolled vehicle by using RTOS for moving and stationary object, under all-weather Condition.

The National Highway Authority of India (NHAI) says that, fortyone percentages of accidents are due to the lane crossing, this abnormal lane crossing done by driver unknowingly due to tiredness or intake of alcohol. Driving under toxicities, inattention, and tiredness etc. are among the common causes of abnormal lane departures. Thus, we are developing a method to keep the vehicles on the normal lane and path to avoid accidents.Shyr-Long Jeng, Wei-HuaChieng, and Hsiang-Pin Lu (2014), [1] estimated the speed of the vehicle by using radar. A side-looking single-beam microwavevehicle detector (VD) system for estimation of per-vehicle speed and length. The VD system produce a squint angle by using is a 2-D range Doppler frequency-modulated continuous-wave (FMCW) radar. An inverse synthetic aperture radar (ISAR) algorithm

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using Fourier processor to extract range and speed data of each vehicle. The simulation results gives an accurate estimations of vehicle speed and length. This system that has the excellent detection capability for small moving targets, such as bikes and pedestrians, at speeds down to 5 km/h. A signal processing modifications was used in the experiment with a commercial 10.6-GHZ radar.Niveditha.P.R1 and S.Gowri2 (2014), [2] had designed a method for detecting the collision by using ultrasonic sensor. In parallel to the development of braking technologies here a sensors used for detecting the obstacles, other vehicles or pedestrians around the vehicle. This technology prevents accidents of using Ultrasonic Sensors, Stereo Multi-Purpose cameras, Automated Emergency Braking Systems. The stereo multipurpose camera provides an intelligence up to 50 meters in front and there is environment recognition of 500 meters. Vehicles that brakes automatically, due to obstacles or any hindrance. After receiving signal from the sensors the braking circuit function to apply brake to the car automatically. Here they come across three principle of safety measurement for road accidents three, collision avoidance, collision mitigation braking systems and forward collision warning. Akhil Samnotra, Dr. Mahesh Kolte (2014), [3] had designed a method for vehicles crossing the lane. This system is mostly used at the time ofovertaking on highways. The vehicle coming behind is in our vicinity distance, and then our vehicle is notallowed to overtake the vehicle in front of us. They were calculated vehicle drift and avoid it from getting collided. Here he implemented the technology of road safety lane departure warning and obstacle detection, using ultrasonic sensor.

Ms. Kajal Nandaniya1, Mr. Viraj Choksi2, Dr. M B Potdar3 (2014), [4] has proposed about an automatic collision detection and warning system relying on a GSM Modem and a GPS module. In the case of an accident, the system detects deceleration of vehicle. The acceleration of the vehicle is monitored by a accelerometer sensor and check the decelerations value greater than threshold value and it gives the signal to the microcontroller via an ADC. There is a comparison in microcontroller between threshold value and deceleration value and immediately send an SOS message to preset numbers. Along with the message the microcontroller send the GPS location of the vehicle which one is continuously obtained from the GPS module.Yusnita Rahayu1, TharekAbd. Rahman1, Razali Ngah1, P.S. Hall (2008) [5] has proposed about the various applications and advantages of Ultra Wide Band (UWB). Ultra wideband (UWB) technology had narrow pulses on the order of nanoseconds, covers a very wide bandwidth in the frequency domain. UWB is a wireless technology transfer the data at high rates over very short distances at very low power densities and with numerous potential applications. The author describe about the presents current UWB technology and its potential applications. By implementing this technology there wills no interference with other existing Communication is discussed. He detailed with various advantages and disadvantages of this technology.

2. PROPOSED WORK

In the proposed idea, implementing Ultra Wide Band (UWB) radar for detection of uncontrolled vehicle by using RTOS for moving and stationary object, under all-weather environmental Condition. An infrared sensor used to detect the vehicle that is unintentionally departs from the lane. An alarm Indication is given to the driver if there is any obstacle or lane crossing is detected. If the driver is not responding to the alarm then the vehicle will automatically stops when it is so close to other vehicle.Hindrance detection and Lane departure warning system.Here we are combining of two technologies. Lane assists and Object detection. By implementing these two technologies in one vehicle, we can avoid the accident due to collision, and abnormal lane crossing. We are designing a system that will help you to avoid the collision on high speeds and abnormal driving. The project is divided into two modules that are joined together to achieve the desired goal of avoiding road accidents. They are as follows:

1. Lane Departure Warning: If the vehicle is departs from the lane for several times then the driver is alerted, even though for thealarmalso driver had not responded means, then the vehicle automatically stops. We had designed the system with certain number of lane count crossing, if it exceeds above that then the system alert driver. If the lane crossing beyond above the limit, then the vehicle stops.[3]

2. Obstacle Detection: The main aim to detect the object nearby and automatically stops the vehicle. This is done by a UWB RADAR that detects the stationary and moving object nearby. This system had the mechanism of detecting the vehicle and the object before a certain limit. It monitors the frequency and the speed of the object approaching the, when speed crosses certain limit then the vehicle stops.[2]

Our system is based on AURDINO controller and UWB, IR sensors that will work together in real time environment and acquire the information from the surrounding and providesthe information to the controller for processing and decision making.

3. SIMULATION RESULTS

Three kinds of software are used here. They are SIG-VIEW, MATLAB, and PROTEUS software. Analysed the signal through the SIG-VIEW software. The wave from the UWB RADAR is placed under different condition of No Object, Object Coming near to the Vehicle, Object Moving away from the Vehicle, under the Dense Traffic and object moving in front and each of the signal is analyzed in Time Domain, Spectrogram of Signal, Amplitude Spectrum of the Signal, Probability Distribution of the Signal, and Autocorrelation of the Signal through MATLAB. The lane crossing is detected by an IR sensor is simulated via PROTEUS software.

SIG-VIEW ANALYSES

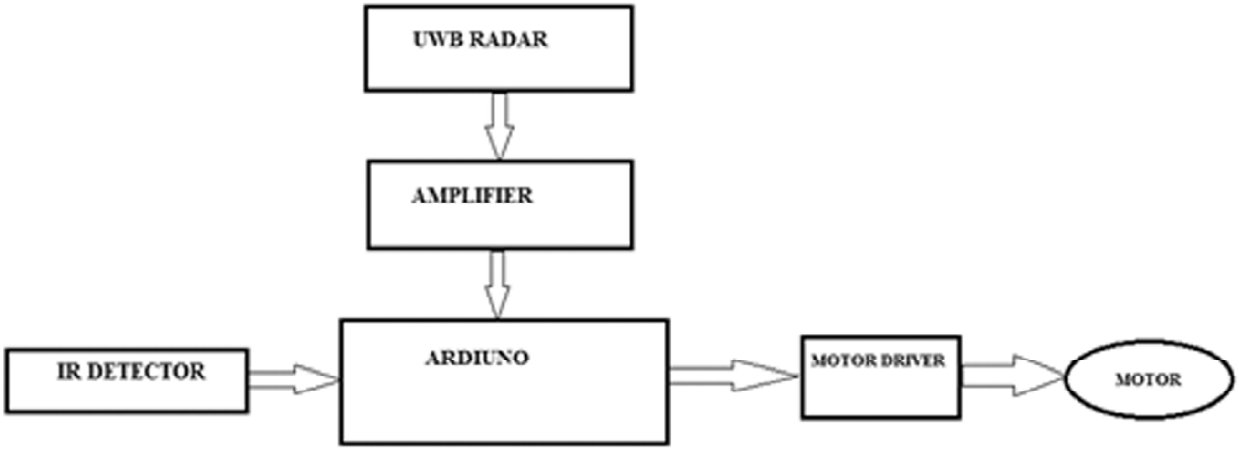

Figure 2.1: proposed block diagram

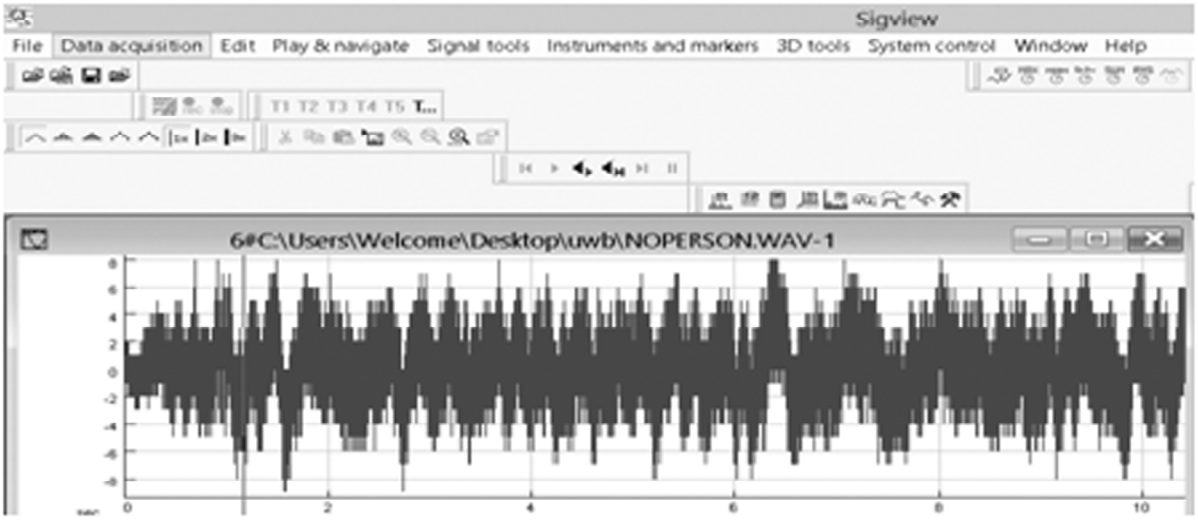

Figure 3.1: Sigview-No Object

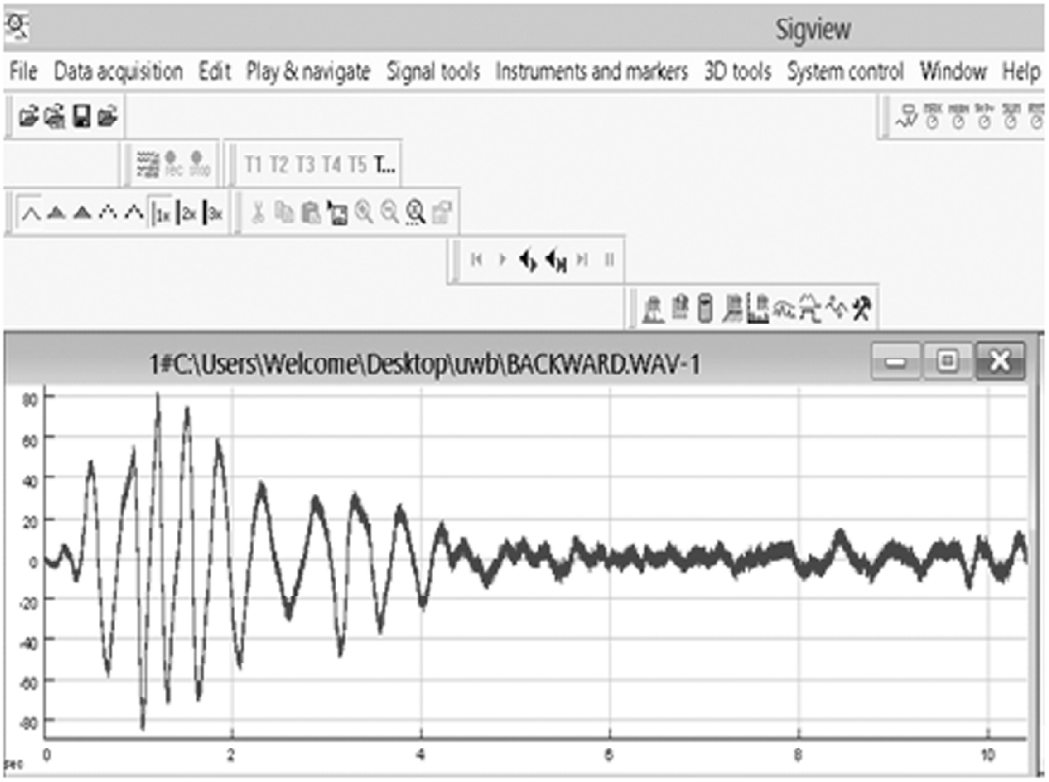

Figure 3.2: Sigview-Object Near To Vehicle

MATLAB ANALYSIS

Fig: 3.1 Mat lab Analysis-Object Near To Vehicle

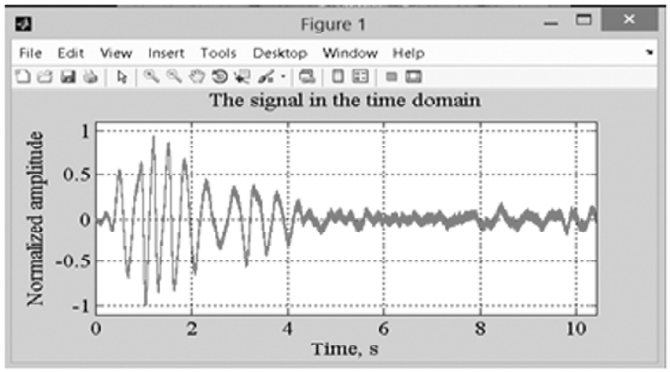

Figure 3.1.1: Signal in Time Domain

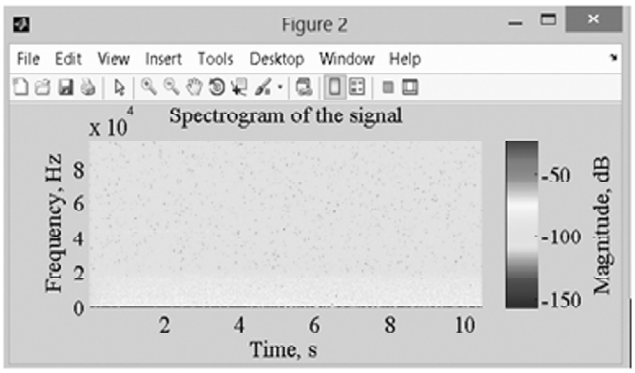

Figure 3.1.2: Spectrogram of the signal

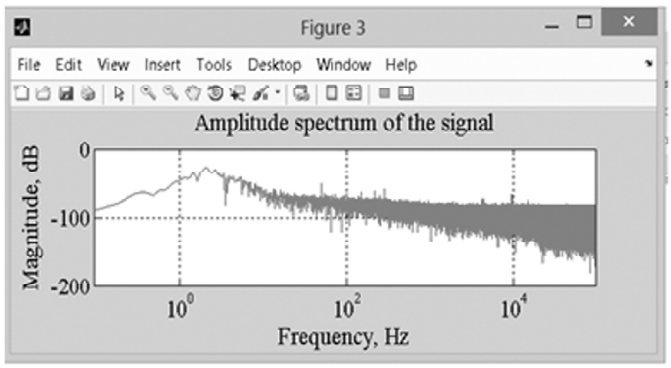

Figure 3.1.3: Amplitude Spectrum of Signal

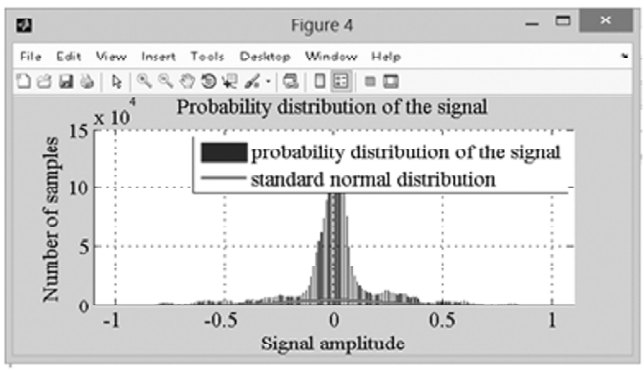

Figure 3.1.4: Probability Distribution of Principle

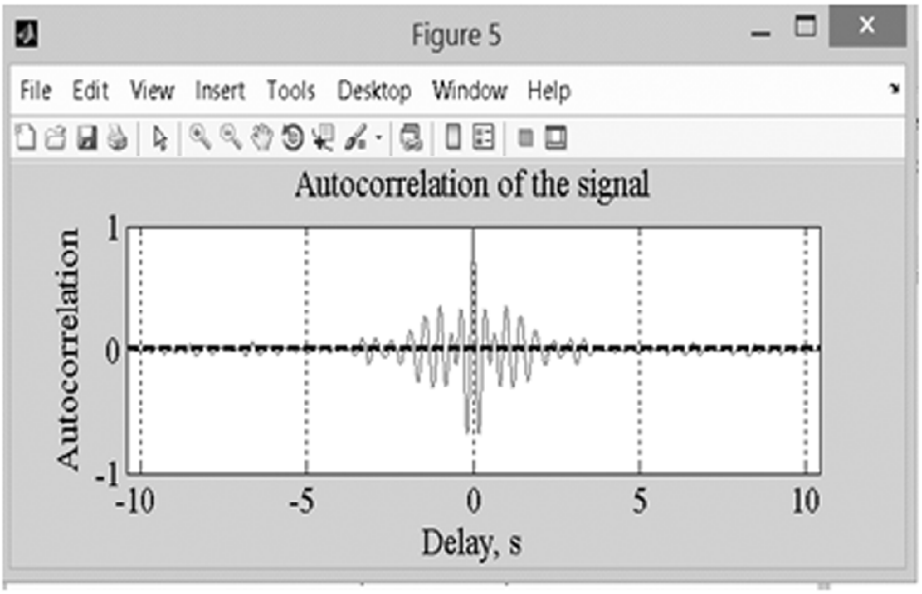

Figure 3.1.5: Auto Correlation of Signal

3.6 PROTEUS RESULT

The result shown in Figure 4.6 clarifies that when the sensor detects the white lane crossing then the LED will blink constantly to notify that the wheel moving away from the lane. This information will be displayed as "VEHICLE CROSSING THE LANE" on the LCD display. If the lane crossing is road for several times then the vehicle speed is controlled. If this continues after speed controlling also, then the vehicle automatically stops. The figure 3.6.1 shows a simple diagram of lane detector circuit in PROTEUS model.

The figure 3.6.2 is vehicle crossing the lane, there will be display on the screen of the driver indicating "VEHICLE CROSSING THE LANE" when the driver crossing the road. If crossing continues for several times then the alarm indication is provided to driver. When the vehicle crosses the reference limit, then the vehicle engine stops, shows in the figure 3.6.3.

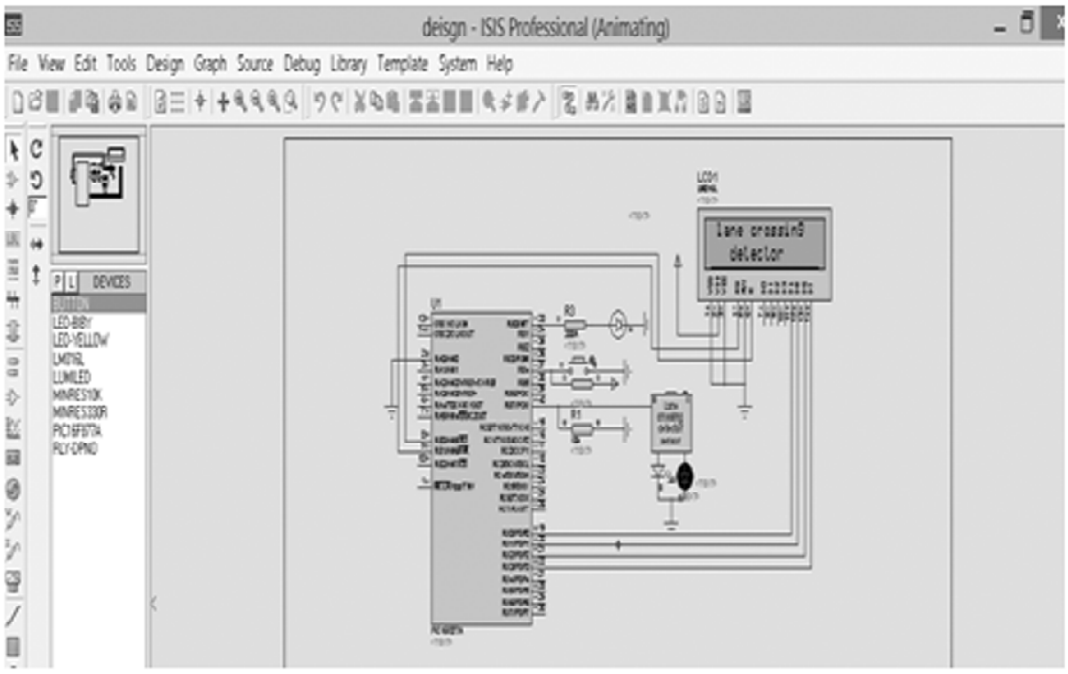

Figure 3.6.1: Lane Crossing Detector

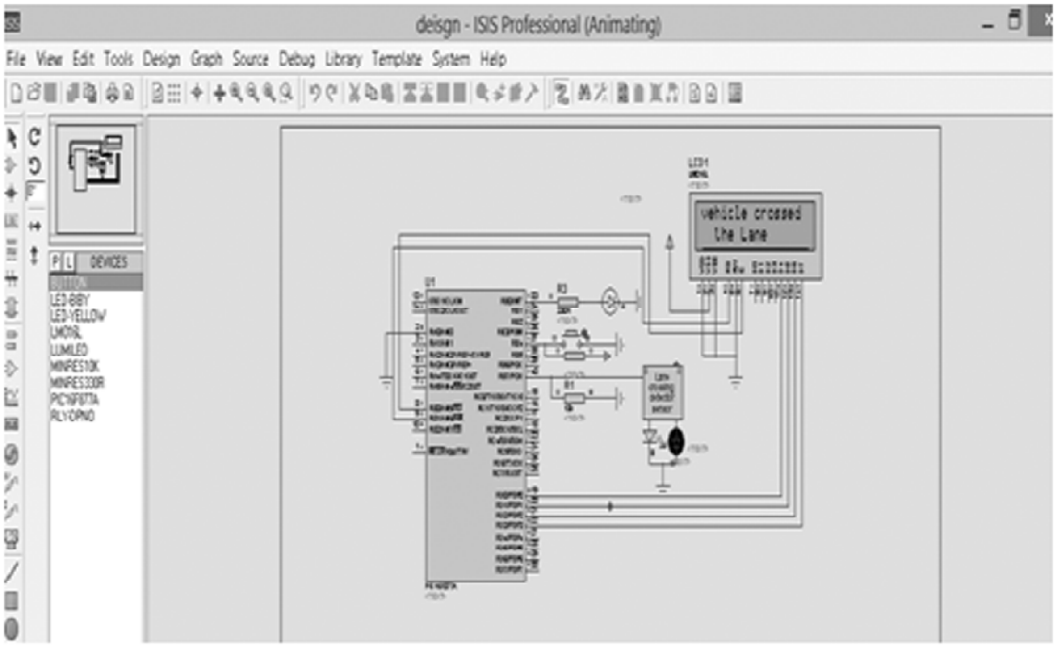

Figure 3.6.2: Vehicle Crossing the Lane

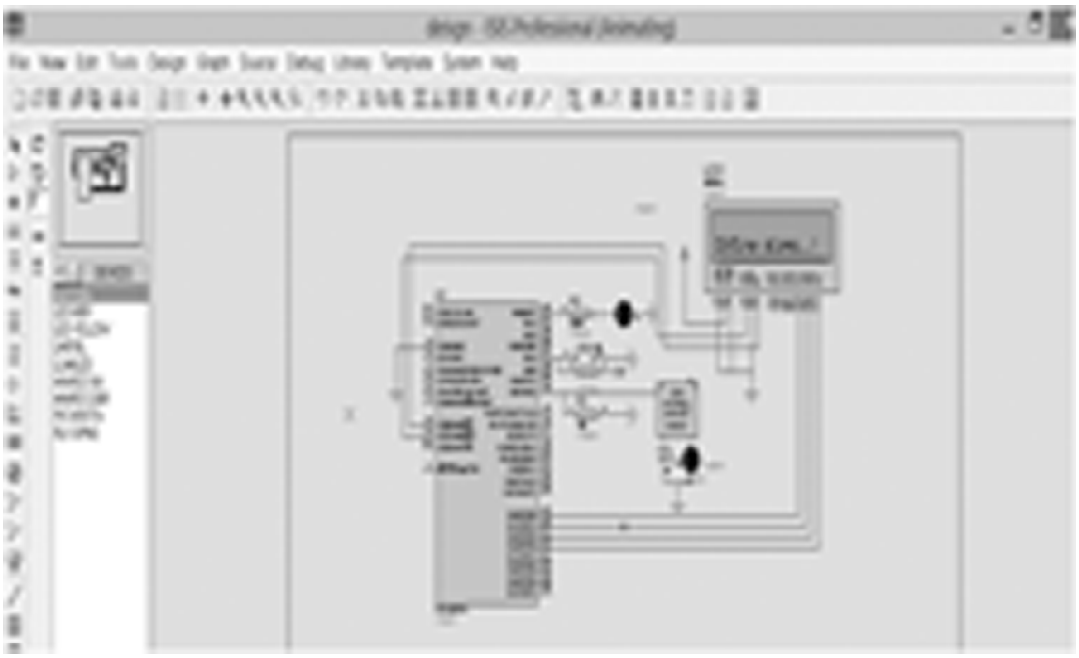

Figure 3.6.3: Vehicle Engine Stops

4. HARDWARE

4.1. UWB Radar

UWB RADAR is used to detect stationary and moving object. It does not depend upon the weather condition. Obstacles are detected by the sensor, when the obstacle comes very closer to the vehicle, then the controller takes the decision of stopping the vehicle and the UWBHB100 that has been used for detection.

HB Series of microwave motion sensor module are X-Band Mono-static DRO Doppler transceiver front-end module. These modules are designed for movement detection, like intruder alarms, occupancy modules and other innovative ideas. The module consists of Dielectric Resonator Oscillator (DRO), microwave mixer and patch antenna.[5]

4.2. IR sensor

IR SENSOR used to detect the vehicle when it crosses the lane on the road. It detects the white and black color of the lane and the road respectively. The information from the sensor is given to the ardiuno control board, when the vehicle crosses the lane for more than 5 count, then the vehicle stops automatically.

6.3. Hardware Experimental Setup

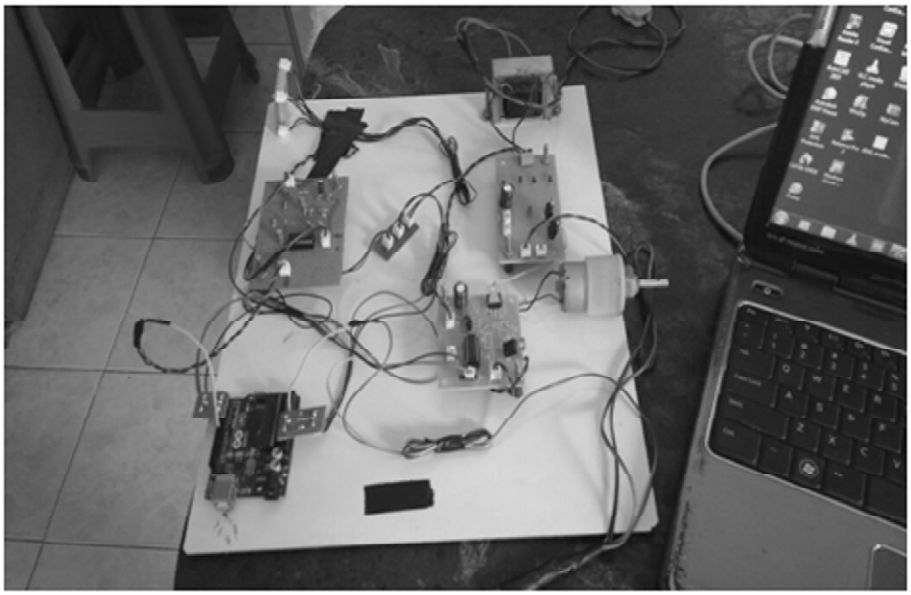

Figure 1 Hardware Prototype

5. OUTPUT RESULTS

Displaying theoutput with frequency and speed of the vehicle, it automatically reduces the speed when the object comes closer. When it is so nearer then the vehicle that automatically stops.

The below diagram shows the number of Lane counts, frequency and speed, if the vehicle crosses the limit of crossing the Lane, then there is a emergency braking system of stopping the vehicle

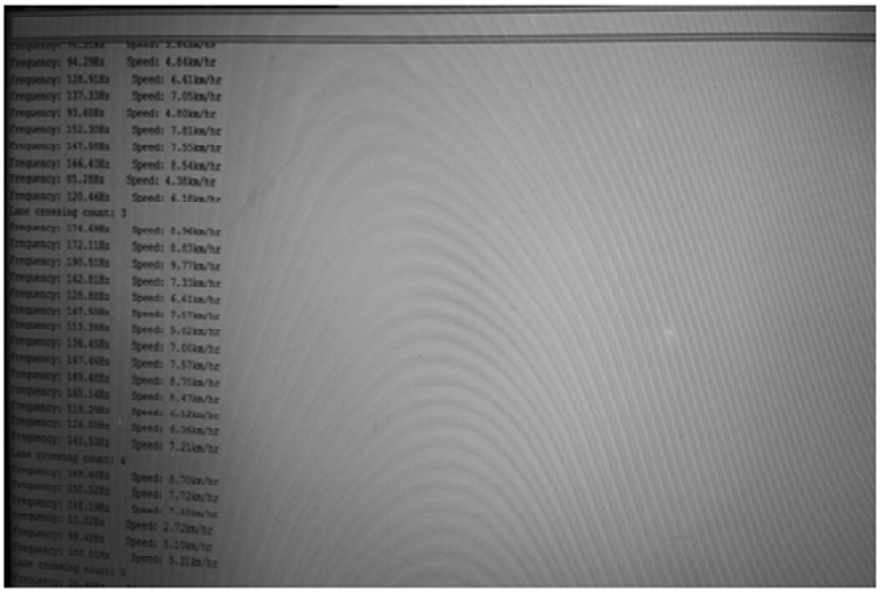

Figure 6.4.1: UWB RADAR detection of frequency and speed.

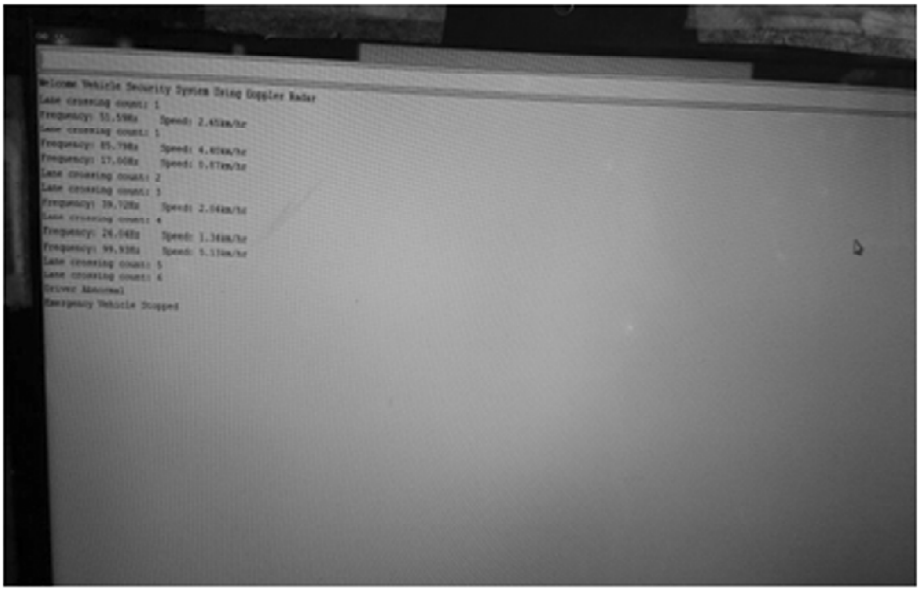

Figure 6.4.2: IR SENSOR detecting lane count

6. FUTURE WORK AND CONCLUSION

The framework of the proposed system is developed for a safety vehicular braking system using Ultra wide band (UWB), lane departure prevention and to design an automobile with less human intervention. This technology could be further enhanced and developed by using UWB with location tracking. The same can be implemented in submarines and aircraft.

This system can be extended by using ARM processors instead of using controller for fast operations. The Stereo multipurpose cameras can also be interfaced with this system to find the exact scene of an accident.

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