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Obstacle Detection System for vehicles in Foggy Environment Minimizing Road Accidents

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Abstract: ***Obstacle detection for vehicles is important for the safety of human life. If there is any obstacle in the road it may cause accidents as well as this affects the traffic flow of vehicles. To prevent such accidents, it is important to detect the obstacles in real-time. But it is difficult to analyze due to factors related to shadow or sudden changes in the environment and obstacles ahead of the vehicle. Fog is one of the important factor that can cause vehicles not to identify the nearby objects. This paper aims to design a new approach for obstacle detection which is based on moving objects. This approach is more useful for identifying the minute obstacles in which becomes invisible due to fog, so assistance to the driver is provided and this ensures more safety. The main focus of this project is to find the find the distance, the driver can see nearer vehicle or obstacle and under each type of fog the maximum distance of visibility. The visibility distance measurement between two vehicles and an obstacle to vehicle distance measurement can be calculated using visual aids.***

Keywords – FPGA, LIDAR, Ultrasonic Sensor, Microwave Sensor

1. Introduction

Driving in bad weather conditions seems to be an impossible task as it reduces visibility and Fog is one of the most difficult weather conditions that drivers many people face. Fog has the potential to reduce visibility significantly, so drivers must stay focused on the road to stay safe. Sadly, Fog- related accidents cause more than 500 fatalities each year. Poor visibility of objects or vehicles in Fog conditions May leads to accidents, so identifying a vehicle in Fog seems to be a very important task to save many lives. The visibility range thereby describes the longest distance at which a black object of adequate size can be observed towards the horizon. In France 2011 it was estimated that 47% of total fatalities were caused due to night driving. Moreover, the accident rate at night is increased by a scaling factor of 1.7 as it is compared with daytime. The main reasons for this are poor visibility, speed, and drowsiness. To avoid this problem intensity of high beam headlights is kept low in Fog, as Fog causes dispersion of light. So advancement has to be seen in this regard to automate the system and as well as to increase or maximize the visibility in bad weather.

The Adverse effect of sensors weakness, particularly cameras made a bad effect on the vision applications of the vehicle thus failing ADAS. In particularly unfavorable conditions like fog or rain are major considerations. Firstly, they affect the safety of the driver by reducing his visibility. Secondly, they reduce the efficiency of the camera-based system as they change image quality thus making it inefficient. To ensure the self-sufficiency of the vehicles with more security the vehicle should have to find and maintain a distance from the vehicle in any ranges, during day and night.

This project's major focus will be on making vehicle driving safer and self-governing. This framework is utilizing LIDAR for object detection and ranging using laser light pulses, Ultrasonic sensor and Microwave sensor's which uses Doppler effect to produce velocity data about objects at a distance and to detect the motion of body movements. All of these sensors and FPGA are grouped for better performance.

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2. METHODOLOGY

The methodology for this project contains the flow chart and diagram that explains the methodology taken during the project. Besides that, this additionally introduces software development and hardware development. Designing the system concludes characteristically with the acceptable component. In any case, the element has been listed, the next step is to make up all elements. This can specialize in coding mistreatment IDE software system. The program is going to end and complete once the system had been organized. The FPGA is the main part of the system that is connected to all sensors. All the sensors of the system are unit connected to the input of the FPGA. The FPGA is additionally connected to the Voltage Converter. All the collected knowledge of sensors is going to be sent to the FPGA through wired connection.

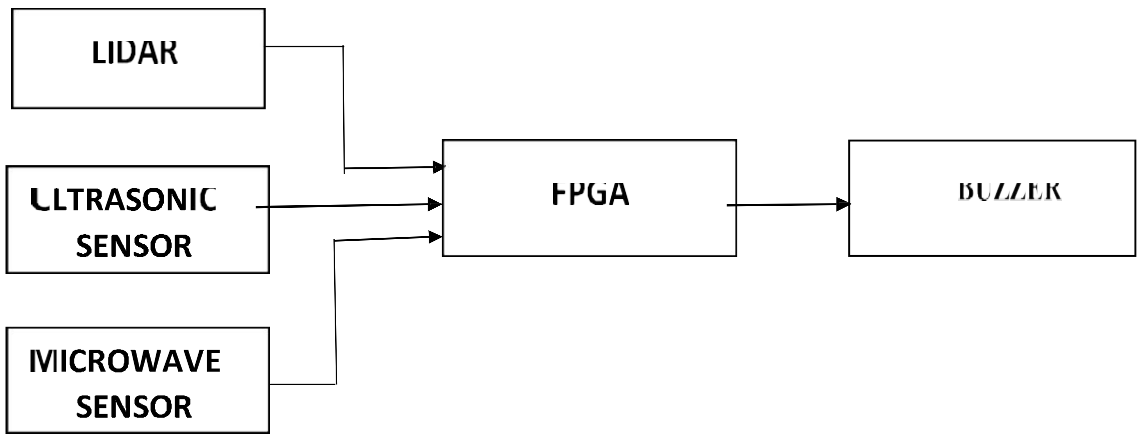

Fig1: Block Diagram of Obstacle Detection System of Vehicles under

3. HARDWARE DEVELOPMENT

This framework is utilizing LIDAR for object detection and ranging using laser light pulses, Ultrasonic sensor and Microwave sensor's which uses Doppler effect to produce velocity data about objects at a distance and to detect the motion of body movements. All of these sensors and FPGA are grouped for better performance.
LIDAR utilizes laser light to quantify separations. The working principle of the Light Detection and Ranging system is quite simple. It generates a Laser pulse train, which is sent to the surface/target to measure the time and it takes to return to its source. The actual calculation for measuring how far a returning light photon has traveled to and from an object is calculated by

$$\text{Distance} = (\text{Speed of Light} \times \text{Time of returning of light pulse}) / 2$$

Ultrasonic sensors regularly transmit a short burst of ultrasonic sound to the target, which in turn reflects the sound to the sensor as an input. The system then measures the time taken for the echo to return to the sensor and computes this distance to the target using the speed of sound within the given medium. It is the amount of time taken for the sound to travel through the medium and amplitude of the received signal. Based on velocity and time, the thickness can be calculated. Time taken by the pulse is actually for to and from the travel of ultrasonic signals, while we need only half of this. Therefore time is taken as time/2.

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The thickness of material = Material sound velocity X Time of Fight

Distance = Speed * Time/2

Microwave sensors, also known as Radar, RF or Doppler detectors, descry walking, running or crawling mortal targets in an out-of-door terrain. Fryer detectors induce an electromagnetic (RF) field between transmitter and receiver, creating an unnoticeable volumetric discovery zone. When a meddler enters the discovery zone, changes to the field are registered and an alarm occurs. Our fryer detectors are easy to install, give high probability of discovery, low nuisance admonitions and resistance to rain, fog, wind, dust, falling snow and temperature axes. Utmost operate at K-Band frequency, maximizing discovery performance and minimizing hindrance from external radar sources.

A field-programmable gate array (FPGA) is an intertwined circuit designed to be configured by a client or a developer after manufacturing – hence the term" field-programmable". The FPGA configuration in this design is using Verilog language, analogous to that used for an operation-specific intertwined circuit (ASIC). Circuit plates were preliminarily used to specify the configuration, but this is decreasingly rare due to the arrival of electronic design robotization tools. FPGAs contain an array of programmable sense blocks, and a scale of "reconfigurable interconnects" that allow the blocks to be "wired together", like numerous sense gates that can be inter-wired in different configurations. Sense blocks can be configured to perform complex combinational functions or simply simple sense gates like AND and XOR.

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm bias, timekeepers, and evidence of stoner input similar as a mouse click or keystroke. A voltage motor is an electric power motor which changes the voltage of an electrical power source. It may be combined with other factors to produce a power force.

4. CIRCUIT DIAGRAM

Here in this circuit diagram red wire is connected to VCC or high voltage, Green wire is connected to ground and the blue wires work as transmitter and receiver medium for sensors in which wire is connected from FPGA to Logical level converter and from logic level converter to Microwave sensor, Ultrasonic sensor and LIDAR.

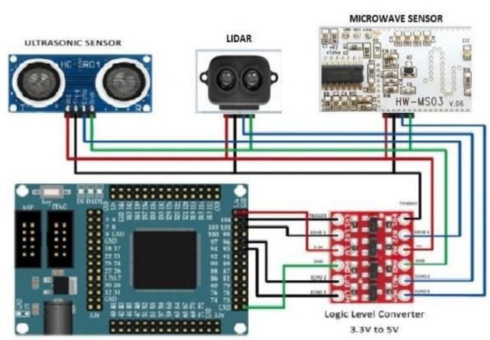

Fig 2: Circuit diagram of Obstacle Detection System

5. RESULT ANALYSIS

All the tackle outfit is being assembled and anatomized to insure that the performance of the systems is stable and in the asked condition. Supported the result and data analysis of the system will grease druggies to dissect the performance of the detectors. Therefore, it ready to cover the object in different parameters within the eschewal of doors terrain. In this result, the QuestaSim operation is used for simulation and verification purpose, and delivering the redounded at their affair waveform window and at Paraphrase window. All the detectors are displaying acceptable values in the QuestaSim app. Whenever, any object is in the range of detectors, Buzzer will throw an

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alert to the stoner.

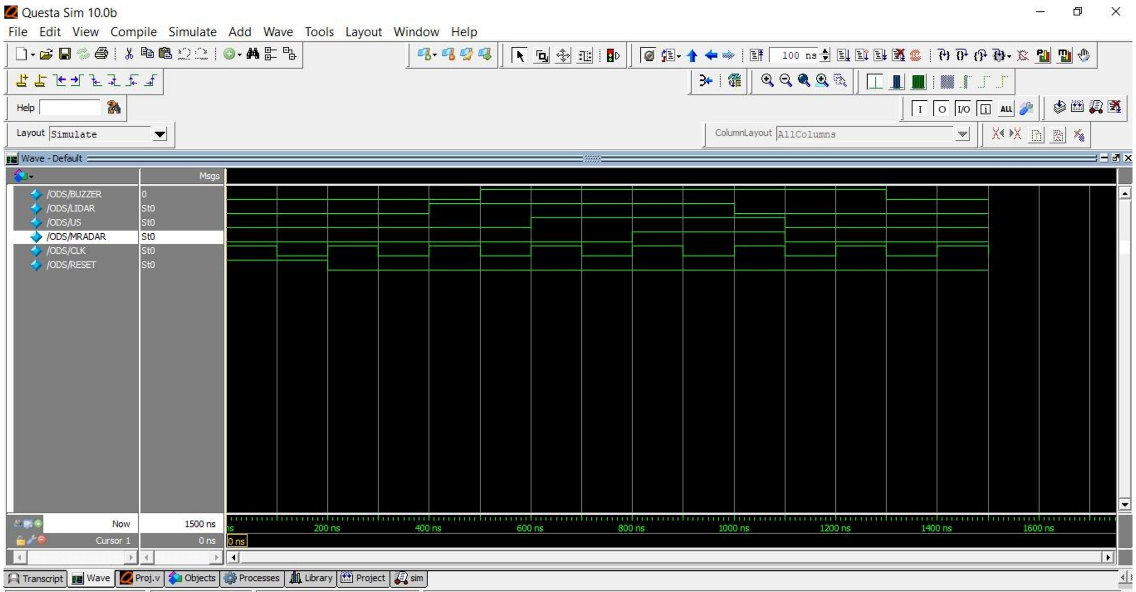

Fig 3: Simulated output waveform of object detection system

6. CONCLUSION

In bad rainfall conditions, especially in foggy condition, it's a great challenge to descry an object. The vehicles running on roads may get detracted by numerous environmental realities similar as structures, altitudinous trees and climbers frequently prone to diverge the attained results from factual results. RADARs are used to descry the presence of the object and LIDAR are generally used as Range finders to determine the distance of an object. Still, when used solely some are lacking in the quality of results similar as LIDAR can't descry objects that are too close but can descry far objects. Due to which Ultrasonic detectors are used to give accurate reading in short- range. So they're frequently used together to overcome the disadvantage of the other. In comparison with other approaches, the benefit of this approach is to use multiple detector data to descry the object or vehicle in advance and for safe driving. By using different detectors contemporaneously the stoner can be suitable to come apprehensive of the object's presence and take relative conduct and can avoid accidents or collisions in fog. This model, we're achieving this by using effective RADARs with the combination of low- cost Ultrasonic detectors and LIDAR.

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