Automated Obstacle Detection and Speed Controlling System

Group # 03

Section: C

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***Abstract*— Nowadays many road accidents are happened because of careless driving or any unwanted situations on the road. Sometimes the drivers cannot detect any obstacle near the vehicles and for this many unwanted accidents happen. So the key goal of this simulation-based project is to design a system that will detect any obstacle from some specifics distances automatically through a microcontroller. Besides that, it can control the speed of that system or vehicle to stop any unwanted accident. This will be achieved by designing a system where a sensor can detect any object from some distance and blink a light or a noise will be made by a notification buzzer to alert the users and also control the speed automatically. And the whole process of detect the obstacle to control seep is controlled via an Arduino Uno.**

Index Terms*—Grove *Ultrasonic sonar sensor, Arduino UNO, OLED display, 1N4001 Diode, TIP120 Transistor.

I. Introduction

Safety is an important topic for any transport system. All over the world every day many road accidents are happening for lack of safety. Obstacle detection is a crucial issue for driver assistance systems as well as for autonomous vehicle guidance function and it has to be performed with high reliability to avoid any potential collision with the front vehicle.

An automated obstacle detection system through a microcontroller can improve the safety on the road for any transport system. Where user can easily understand the environment near the vehicles or the system. This type of obstacle detection system can also use in train, smart robot, smart cycles etc. Also in this world so many people are blind and cannot move without blind stick. We can use this system in those smart blind stick to make their life more easier. In this obstacle detection system it will notify the user by LED or Buzzer or Display message to stop any unwanted accident.

This paper is structured as follows. In Section II we discussed the earlier researches that has been done on obstacle detection system. The basic working process of our proposed model are stated in Section III, the software simulation (Proteus) related to the model development are described in Section IV and results in section V. Society impacts are described in Section VI and the limitations in Section VII.

II. Literature Review

The obstacle detection systems in vehicles can inform the driver of the approaching obstacles and, if necessary, they can override the driver's braking or steering command.

In 2006 Kunsoo Huha, Jaehak Parkb, Junyeon Hwangc and Daegun Hongc designed such a system for any vehicles [2]. And this similar type of sensor system was also designed for automated train in 2003. Where this system was mainly working for track detection but it was failed. Later more advance, strong sensor and more devices were used [4]. Sylvain Cardin, Daniel Thalmann and Frederic Vexo also designed the wearable Obstacle Detection System for visually impaired People in 2016 via a stereoscopic sonar system and sends back vibro-tactile feedback to inform the user about its localization [3]. These type of systems used the ultrasonic sensor that is able to measure the distance from the ground of selected points of a motor vehicle. Alessio Carullo and Marco Parvis described more about this sensor in 2001 [1].

III. BASIC IDEA OF PROJECT

Here we are using a sonar sensor (HCS04) to detect the distance of an obstacle and will also glow the LED or a noise made by the notification Buzzer as soon as it detects the obstacle from some specific distances. HCSR04 is an Ultrasonic ranging module which consists of a transmitter, receiver and control circuit. It has four pins for VCC, GND, Trigger and Echo as showed in Figure 1.

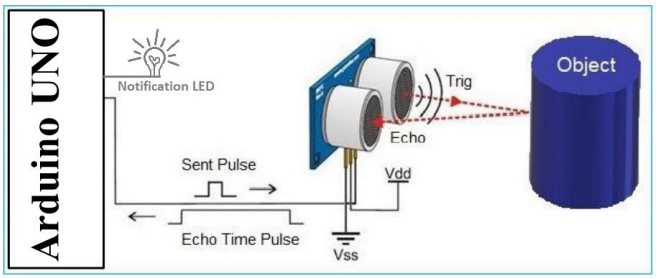

Figure 1: Object detection using Ultrasonic sonar sensor.

It can easily interface with Arduino boards. Using IO trigger for at least 10us high level signal, the Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.

The Trigger pin of the sensor is connected to a digital pin and the Echo pin at another digital pin of the Arduino Uno board with connecting wire. And LED and Buzzer is connected to show that an obstacle is detected and also control the system. Here LED, buzzer and motor control will act as output pins because trigger will be generated from Arduino and LED/buzzer state (HIGH/LOW) will also be changed by the Arduino board, showed in Figure 2. As the ping generated from the Arduino board travels out from the trigger and comes back to the echo, so to find the distance of the object we take half of the distance travelled. As we all know, the speed of sound is 340 m/s or 29 microseconds per centimeter or 74 microseconds per inch.

So, the distance covered in centimeter by the trigger will be calculated by the following equation:

distance_cm=microseconds/29/2 or,

distance_inch=microseconds / 74 /2;

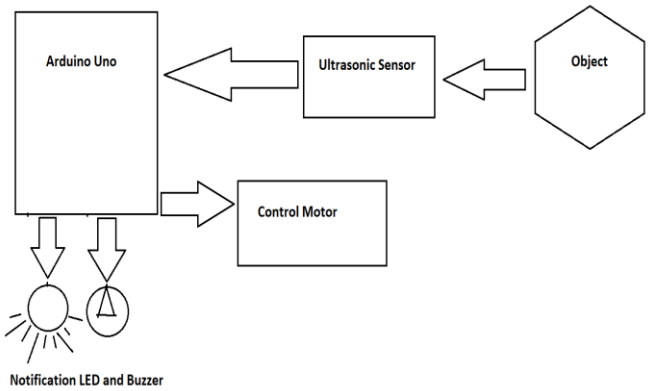

Figure 2: Block diagram of detect an object with notification led/buzzer and control the motor.

Here the motor is connected with a pulse with modulation (PWM) pin which can take value like analog pin to control the speed of the motor.

IV. SOFTWARE IMPLEMENTATION

For the simulation we use "Proteus Professional 8.9" software. There we create a flowchart project with Arduino Uno. At first, from the Visual Designer go to Peripherals and right click on it, then select Add peripheral and from Grove folder we add "Grove Ultrasonic Ranger" and "Grove 128x64 OLED display" one by one. After that from Schematic capture we go to File → Import project clip → Arduino and select "Arduino LED Green Breakout Board", "Arduino LED Red Breakout Board" and "Arduino Buzzer Breakout Board" one by one and add them to our Schematic capture. For the motor controlling part first we select component mode and click on "P" from where we select 10WATT1K Resistor, TIP120 Transistor, Simple DC Motor, 1N4001 Diode and Dc Voltage Source one by one. And from Terminal mode we select group and default for input (IO3) which is the Pulse with modulation pin. After that we connect all the components to complete the system In Schematic capture like Figure 3.

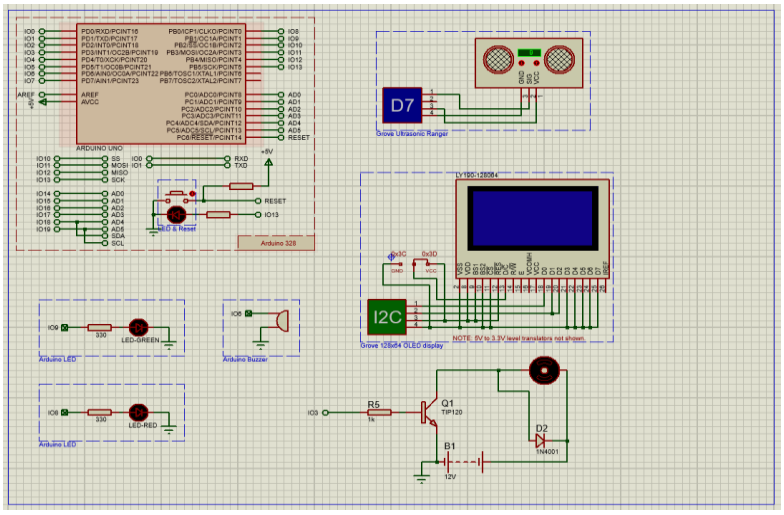

Figure 3: Schematic Capture for Software simulation.

Next we build the flowchart in Visual Designer according to some conditions:

- If distance_cm between 5 to 10 cm turn on the Buzzer, Motor Speed: 0 (Off).
- If distance_cm between 11 to 20 cm turn on Red LED, Motor Speed: 128 (Half speed)
- If distance_cm between 21 to 30 cm turn on Green LED, Motor Speed: 200 (Little bit slower).
- If distance_cm is above 30 cm turn off all the LED and Buzzer, Motor Speed: 255 (Full speed).

So in Visual Designer first we turn off all the led and buzzer in setup event. Next we create a new event "Display" and from oled display we take cleardisplay, set textcolor, set textsize, setcursor, print and display in that event. After that in Loop event fisrt we take readCentimeters from grove ultrasonic sensor then take the decision blocks for three different conditions and give all the conditions, if those given conditions are true then that specific led or buzzer will turn on otherwise remain off. Also we create a String type variable in Assignment block named "ShowMessage" and each time we define a message with the distance in that variable, then call the Display event to show that message in the OLED display. For motor controlling we take the "analogWrite" from cpu where we declare the pin 3 for pwm pin and also different value of speed for different conditions. We also give 2 seconds delay after led/buzzer turn on and off as showed in Figure 4.

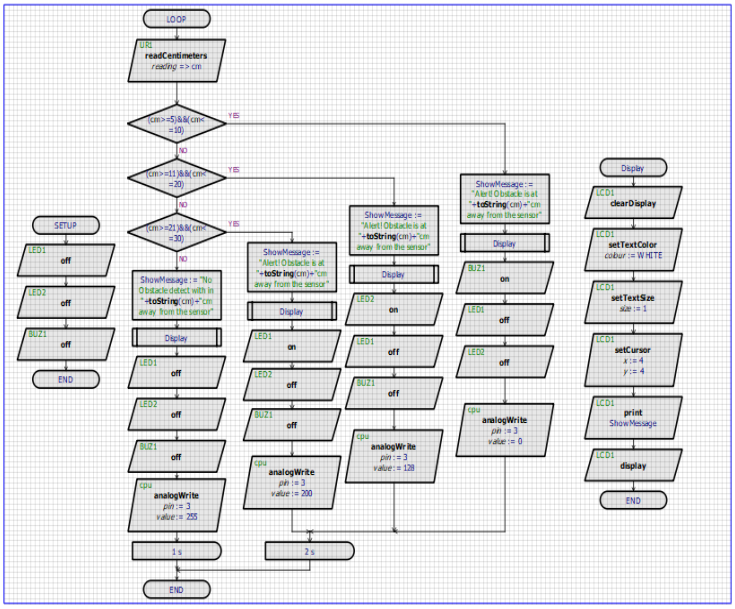

Figure 4: Visual Designer Flowchart.

Finally, after building the project we have seen the result in the Schematic Capture.

V. RESULTS AND DISCUSSION

After the simulation and run the project we can see the results for some specific distance and also it control the system motor for different conditions.

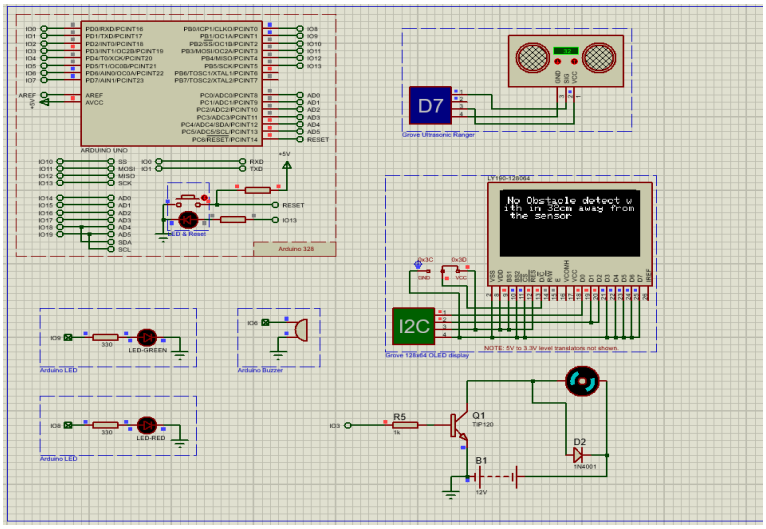

Figure 5: When the distance of an obstacle is above 30 cm.

In Figure 5, we can see that when any obstacle distance is above 30 cm then all the led/buzzer is turn off and the vehicle/system motor speed is full (255). Also the OLED display is show the message with the distance.

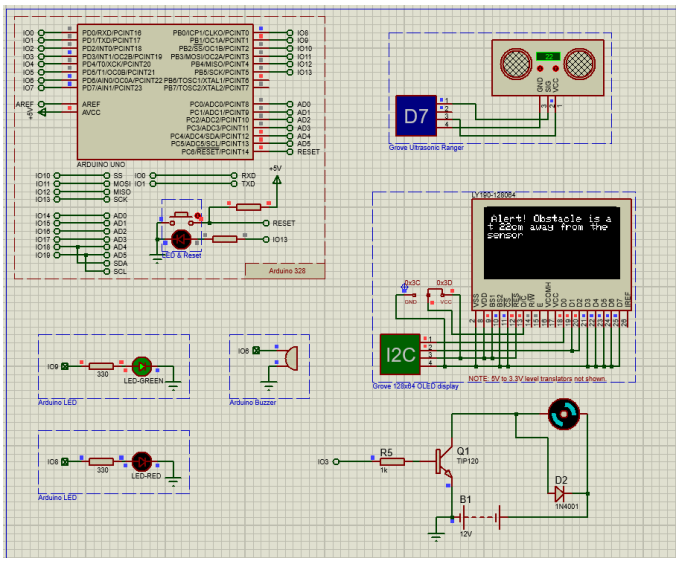

Figure 6: When the distance of an obstacle is between 21 to 30 cm.

In Figure 6, we can see that when any obstacle distance is between 21 to 30 cm then the green led is turn on and the vehicle/system motor speed is little bit slower (200). Also the OLED display is show the alert message with the distance.

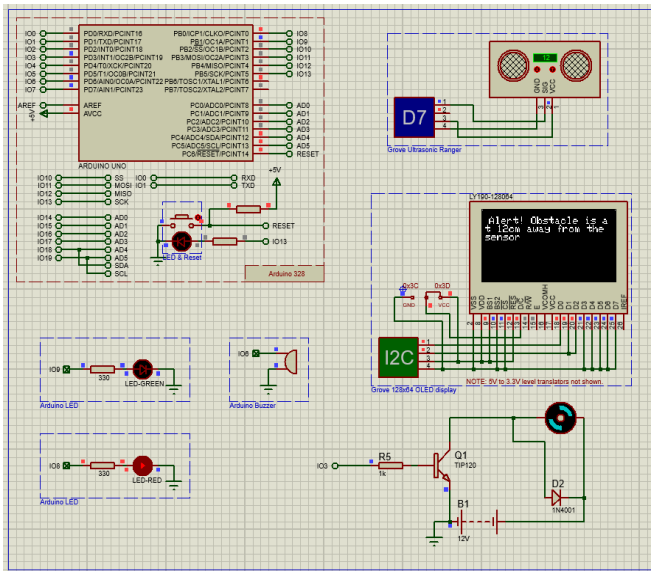

Figure 7: When the distance of an obstacle is between 11 to 20 cm.

In Figure 7, we can see that when any obstacle distance is between 11 to 20 cm then the red led is turn on and the vehicle/system motor speed is become half (128). Also the OLED display is show the alert message with the distance.

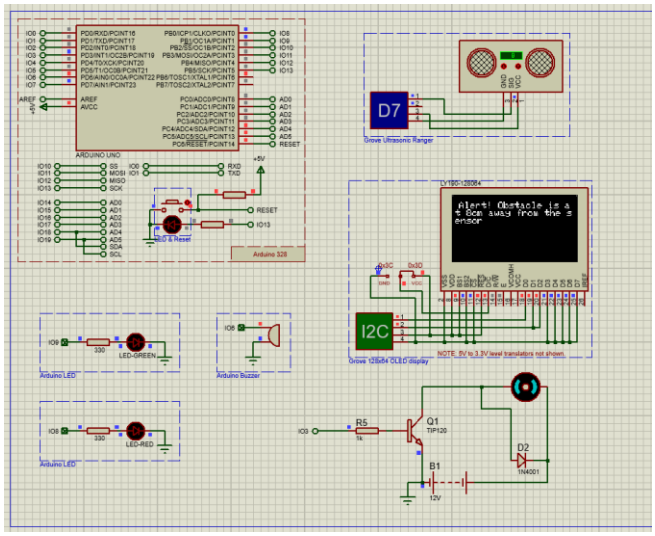

Figure 8: When the distance of an obstacle is between 5 to 10 cm.

In Figure 8, we can see that when any obstacle distance is between 5 to 10 cm which is very close to the system then the Buzzer is turn on and the vehicle/system motor speed is also turn off (0). Also the OLED display is show the alert message with the distance.

VI. FUTURE WORK / SOCIETY AND ENVIRONMENTAL IMPACT

We can use this system in automated speed control vehicles, robots, and smart blind sticks to stop any unwanted accidents on the road. Vehicles like cars, bikes and even smart bicycles can use this sensor to keep a safe distance it can show a visual representation, an audible representation, or a combination of both. Robots can use it to avoid any objects in real-time and for blind stickers this a very good option as it helps the person to know from a certain distance that there is an object by giving them a buzz or an audio signal. And it will help to avoid any unwanted accidents, so we can said that this project will be beneficial for man-kind.

VII. CONCLUSION/LIMITATIONS

In this project the system with Ultrasonic sensor is easy to implement with very low cost. But it has some limitations also, like its limited testing distance or limited detection range, sometimes inaccurate readings, and inflexible scanning methods. Unsuitable placement of any components can cause system failure. Also damage of sensor can provide faulty result which might be harmful for users.

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