Human Detection Robotics System

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Abstract— The main purpose of this project is to design human detector robot which can find human in hazardous areas where rescue teams fail to reach. It is quite impossible to find human in collapsed buildings when natural disaster like earthquake occurs. This is why this robot is designed to work in disaster environments and help the rescue team. This proposed model is controlled through PC and navigates around the disaster areas to find human. It uses PIR sensor to sense passive infrared rays to come across the human and ultrasonic sensor to measure the distance between human and robot. When the robot will detect human, LCD display will show the output and the rescue team will reach that place immediately. This robot structure is designed in such a way so that it can move in the roughest conditions to detect human quickly.

Keywords— Body detection, PIR sensor, Rescue robot

I. INTRODUCTION

In Bangladesh usually destructive natural calamities lead to a large number of people buried in the ruins. Therefore, searching and rescuing these people become an important task. But for human this is very difficult to find people in a trapped area. The efficiency of search in ruins directly determines the success rate of the rescue, an important factor in improving the survival rate of trapped people. However, following a strong earthquake or a massive fire accident, there are usually many aftershocks, making the ruins more and more dangerous and complex, and bring many difficulties to the rescue team and threaten their lives. But the more important thing is detecting people who are trapped inside. That is why we have built such a robot that can find humans in trapped areas and give us signal so that we can easily define the place where should we approach to rescue trapped people. We have used one ultrasonic sensor for navigation, one PIR sensor to detect motion and DC motor as actuator for linear movement. We can check if there are any signal through LCD display also.

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II. OBJECTIVES

In Bangladesh the roads are not spacious enough. That is why most of the time in ruins most trapped people die because of the late arrival of help and not defining the location of victims in time. Our robot can detect human in short time and give us exact location of victims. So that rescuing them will be less time consuming and we can increase the rate of their survival.

III. LITARATURE REVIEW

Technology is inevitable in our everyday lives. This is because life without technology is pointless in today's dynamic world. On the other hand, natural calamities are unstoppable and there exists man made destructions. So in this world of technology we cannot sit quietly and let people be buried in ruins and die just because of not being able to detect their locations. A timely rescue can save more lives, keeping this in mind we have worked on our project. We have gone through some previous and recent works to find motivation. Some of them used so many components in the robot and made it complex and some of them did really well. A. Shobika and his team did well in their project Human Detection System Using Drone for Earthquake Rescue Operation. They placed the PIR sensor on a moving all direction quad-copter that can fly in the earthquake prone areas. On the other hand, Zia Uddin and Mojaharul Islam used gas sensor to detection excess gas in the affected area in their project Search and Rescue System for Alive Human Detection by Semi-Autonomous Mobile Rescue Robot. But we made something simple in design and cheap in price. Since our robot is small in size so it can go anywhere and we can use many in number. There is one major drawback which is not being able to use transmitter and receiver for communication, which we aim to upgrade by using RF transmitter and receiver in the future.

IV. METHODOLOGY

A.Product Description

3D Model: In this 3D model, we used 3 components outside. They are ultrasonic sensor, LCD and 2 wheels which are connected with 2 DC motors which are discussed in the product architecture.

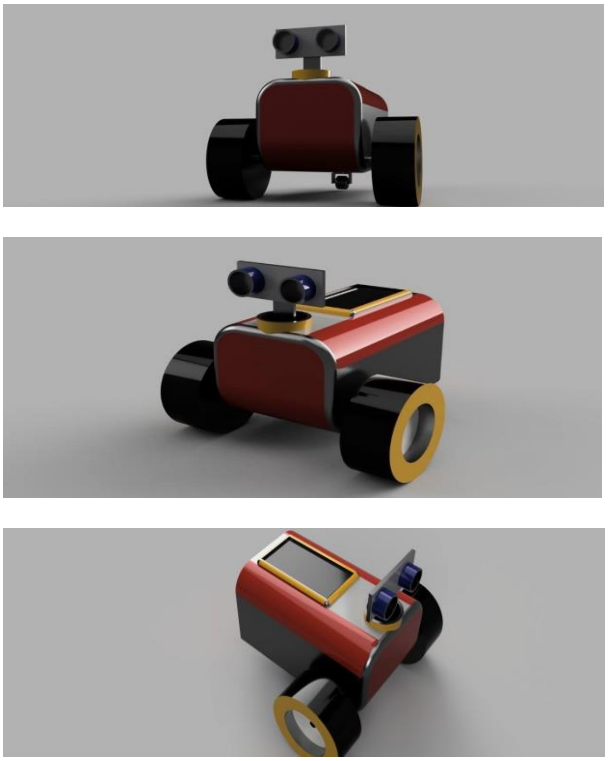
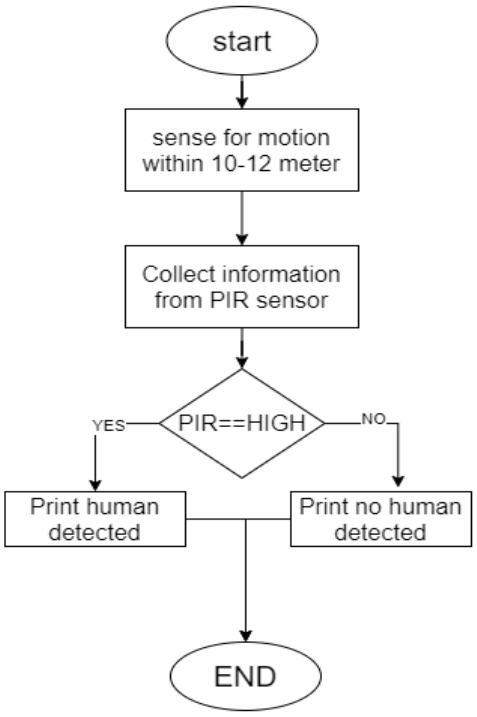


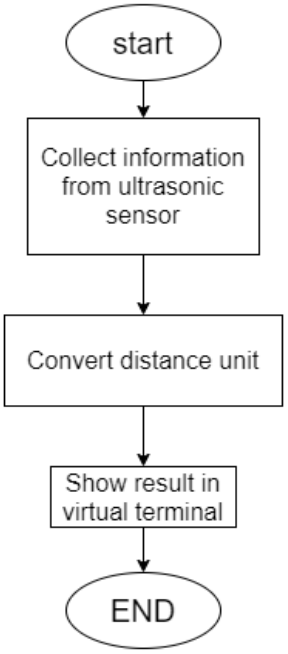
Figure: 3d Model

B.Workflow

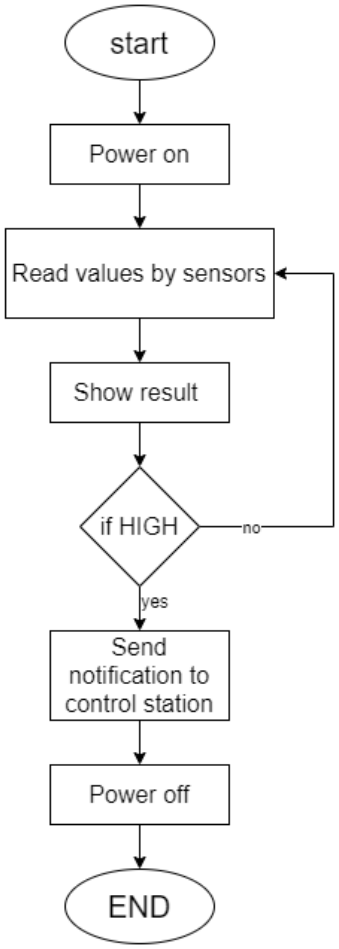
The functions of PIR sensor, Ultrasonic Sensor and the whole projects is shown in flowcharts below.



Pir Sensor Flowchart



Ultrasonic Sensor flowchart



Overall System flowchart

C.Product Architecture

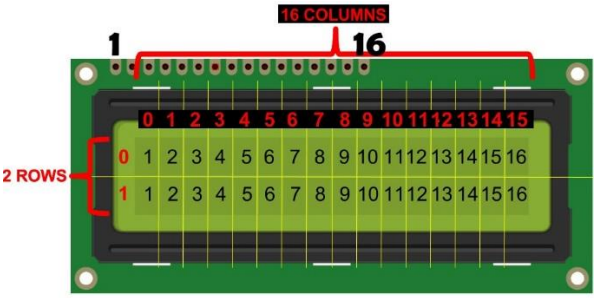
Arduino uno:

Arduino Uno is a microcontroller board based on the ATmega328P . It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno board is the first in a series of USB Arduino boards.

Ultrasonic Sensor:

Ultrasonic sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception.

LCD:

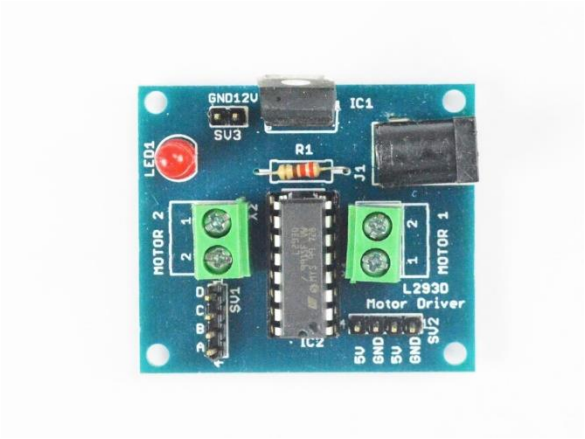


LCD stand for Liquid crystal display. It is an electronic display module. It has a wider application in many fields. LCD displays are used in robots also to display any message for the user. If we want to display value of sensors or any other data, these displays work a lot there. In short, it helps in debugging hardware and software components of Robots. For displaying text, we need to use software. We can represent a single character through an array of pixels. We need eight bytes to update one character on the screen. The two starting command bytes tell us the two locations and the other six bytes are used for the character.

DC Motor:

A DC motor is used to move the robot in left, right and

forward and backward directions. L293D motor drive module controls the DC motor to move in the direction. The direction of the movement is decided from the signals given by the human. Human can be detected using a IR sensor. An IR sensor is a sensor that produces passive infrared signals, these signals can detect heat. Human being produces heat which is detected using this sensor. Human being produces 9 to 10 microns of heat. A IR sensor's angle of detection is restricted to 180o i.e. except the area below the robot it can sense in all the other directions. The distance up to which IR sensor can detect is restricted within 12 ft.



these input pins. A 5v power is supplied at the 16th pin to operate the IC and 8th pin is applied to 12 Volts power supply. For this reason, that voltage L293D can bear is 36V, we can supply a voltage range of 2.4V – 36V to the 8th pin of IC. One of the easiest and inexpensive way to control DC motors is to interface L293D Motor Driver IC with Arduino. It can control both speed and spinning direction of two DC motors.

PIR Sensor:

Passive Infrared (PIR) sensor plays a primary role in the circuit that is detecting the human being. PIR sensors work on the principle that they every human being emits infra-red radiations of very low wave length. Thus, this sensor senses these radiations and outputs a logic high value. This sensor can sense the human within the range of 20 feet. PIR sensor can be connected to the Port1 of the micro controller. It's operational range is 2.2V – 5V.

L293D Motor Driver:

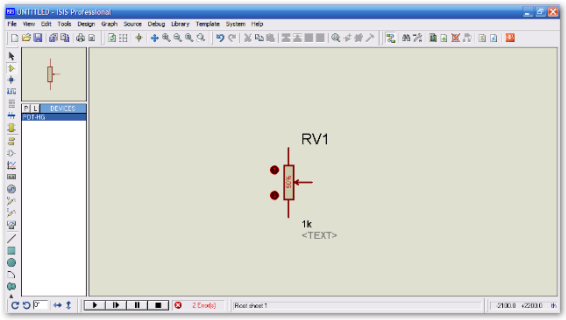
L293D is a motor drive IC. This IC is required to drive the motor and also eliminates back EMF generated. This IC internally has H-bridge circuit. The IC has 16 pins out of which 4 input pins drive the motor. Enables are used to enable

PCF8574 I/O expander for i2c bus:

The PCF8574 IO Expansion Board is used as remote 8-bit I/O expander for I2C-bus. Up to 8 PCF8574 IO Expansion Board can be connected to the I2C-bus, providing up to 64 I/O ports which is designed for 2.5-V to 6-V VCC operation. The PCF8574 device provides general-purpose remote I/O expansion for most microcontroller families by way of the I2C interface (serial clock (SCL), serial data (SDA)). The device features an 8-bit quasi-bidirectional I/O port (P0–P7), including latched outputs with high current drive capability for directly driving LEDs. Each quasi-bidirectional I/O can be used as an input or output without the use of a data-direction control signal. At power on, the I/Os are high. In this mode, only a current source to VCC is active. The PCF8574 IO Expansion Board features I2C pinheader on one side, and I2C connector on the opposite side. Hence, it's more flexible to connect the board to your development system. The board also supports I2C cascading, allowing the

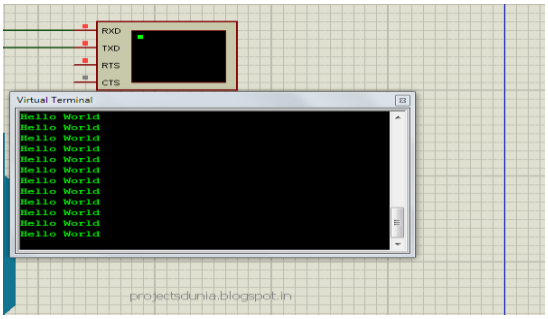
use of multi module connected to the I2C bus at the same time by connecting the pinheader and connector.

Pot-HG:



POT-HG is the only active variable resistor that allows you to change the resistance during simulation run-time.

Virtual Terminal:



Virtual Terminal is a tool in Proteus, which is used to view data coming from Serial Port (DB9) and also used to send the data to Serial Port. Virtual Terminal in Proteus is used to send or receive data to or from a serial port. Serial port is a 9 pin port which is mostly find on the computers and is used in Embedded System Projects for data communication. Normally in student projects, data is sent from hardware to computer via serial port and then user design some application on their computer to view that data in some represent-able form.

D. Software Part

In this proposed system we are using Arduino Software (IDE) which runs on Windows, Macintosh OSX and Linux operating systems. In this IDE, we import the utilities and libraries based on controllers. Arduino IDE is an open source software where user can use the software according to their own accords. Moreover, we are using Proteus 8 professional to build and simulate the project. Proteus 8 professional is a software which can be used to draw schematics, PCB layout, code and simulate the schematic. Many of the components in Proteus can be simulated. The proposed model will be controlled through Arduino IDE and simulated in Proteus. The robot is small in size for which it can be used easily for industrial purposes. Because of the scalability, it has the biggest growth potential. Also, the mass production is possible as it is cheap and budget-friendly.

E. Modular Development

Navigation: For navigation we used ultrasonic sensor which will be used for measuring distance between the robot and an object. A POT-HG(High granularity potentiometer) is connected with the ultrasonic sensor to simulate the distance by increasing/decreasing the cursor in proteus simulation. A virtual terminal is being used in Proteus to show the readings of the ultrasonic sensor.

Actuator: We used DC motor or Direct Current for the wheels which is most commonly used actuator for producing continuous movement and whose speed of rotation can be easily controlled. An L293D motor driver was used which is operated on 5v and 12v power for controlling the DC motors this is why we used a 12v and 5v power source. For small size, 2 DC motors are being used here for 2 wheels.

Detection: For detecting human PIR sensor is being used. Every human radiates the infrared energy of specific wavelength range. PIR can detect this and thus detect human movement. The result is shown on a LM016L LCD. Here, a remote 8 bit I/O expander for i2C bus is used to connect the display to the Arduino Uno, making the best use of input pins in Arduino Uno.

V. Result

PIR Sensor: In proteus, logic toggle is used for simulating PIR sensor. When logictoggle is 0, there is 0, there is no motion and when logictoggle is 1, there is motion which is detected is the PIR sensor and shown on the LCD.

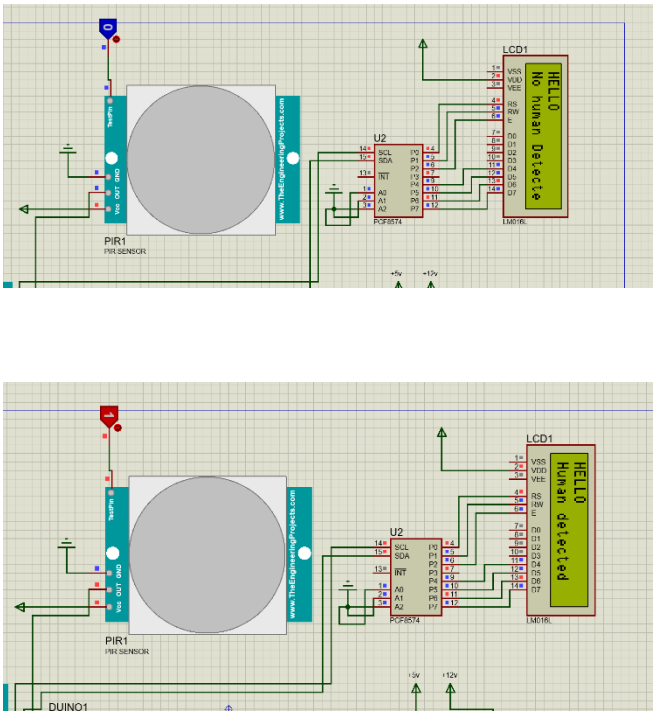
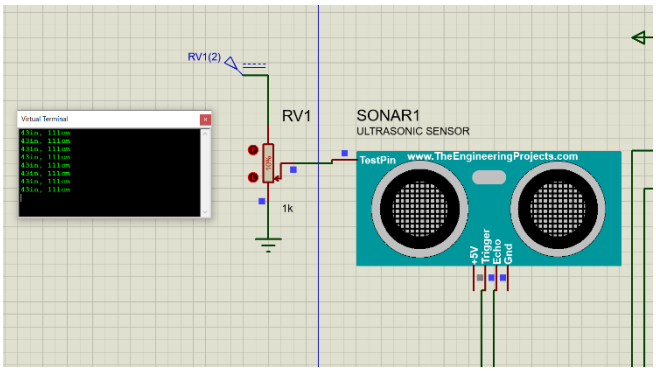


Fig: PIR sensor Reading

Ultrasonic Sensor: We used a POT-HG in Proteus to generate various results and show them in the virtual terminal. Distance is shown in the virtual terminal.



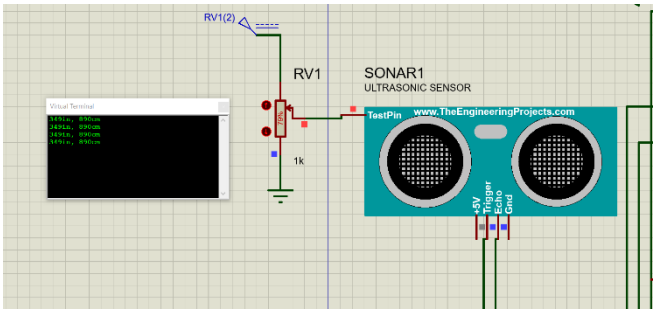
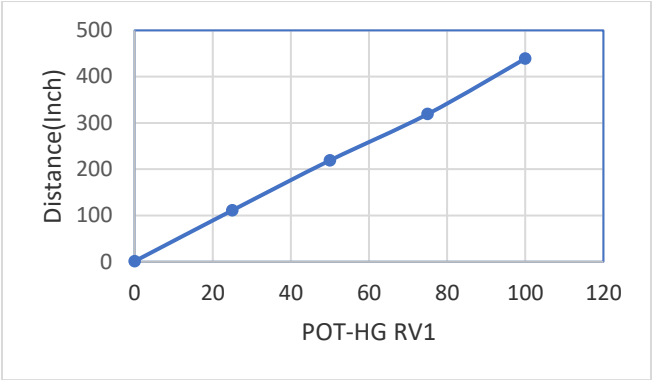


Fig: Ultrasonic sensor Reading



We can see the readings and accuracy of measuring distance of ultrasonic sensor from this graph.

VI. Conclusion

In this report, we have discussed about the proposed model of human detection robot to rescue human using PIR sensor and Ultrasonic sensor. The goal of this model is to detect victims in the disaster environments. When the robot finds humans, it notifies users by showing the output on LCD display. Hence many lives can be saved in a short period of time. Our proposed model is user-friendly and efficient device to detect humans. Because of the simple structure of this robot, it can perform operation in hazardous and rough areas efficiently.

This model will be a great requirement for rescuing operation and will be advanced in technology. It will detect victims in quicker times thus the rescue operation will be there to help victims instantly. However, it can be modified further by attaching a camera to locate positions accurately

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