Obstacle Avoiding Robot Using Infrared and Ultrasonic Sensor

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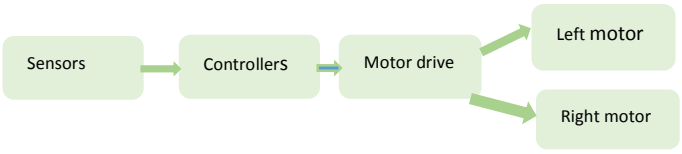
Abstract – Now a day's many industries are using robots due to their high level of performance and reliability and which is a great help for human beings. Proposed project robot will move in a particular direction in which Ultrasonic Sensors and Infrared sensor sense a signal while avoiding the obstacles in its path. Ultrasonic Sensor and Infrared Sensors are controlled by an Arduino Microcontroller. Ultrasonic and Infrared are less in cost and has high ranging capabilities. They can Navigate Robot in Unknown Environment By avoiding collisions and it is also used for blind people. It is used to stop accidents and reach our homes safely. We have programmed the Arduino Microcontroller so that it detects the obstacle and avoid the collision.

Keywords— Infrared Sensor, Ultrasonic Sensor, Arduino Microcontroller, Embedded Computing.

1. INTRODUCTION

Now a day's Robotics is part of the advancement of technology. Automatic navigation is developed in recent years like wall-following, edge-following, human following and obstacle avoiding robots. The project is designed to build an obstacle avoidance robotic vehicle using ultrasonic and infrared sensors for its movement Unmanned Aerial Vehicles (UAVs) are playing a vital role in defense as well as civilian applications.



The behavior of a robot is dictated by the interaction between the program running on the robot, the physical hardware of the robot and the terrain. A robotic vehicle is built, using an Arduino Uno. The robot gets the information from the surrounding area through mounted sensors on the robot the objective of having obstacle avoiding robot is to enable autonomous functioning without human supervision.

Dynamic steering algorithm which ensures that the robot does not have to stop in front of the obstacle which allows the robot to navigate by avoiding collisions.

It involves the controller which guides the robot in unknown environments. Microcontroller consists of memory, integrated core.IR sensors able to accurately measure distances with reduced response times. This robot uses an infrared sensor to detect obstacle n between the paths and then avoid them to complete in the objective. The IR transmitter continuously generates an IR signal of 38 KHz, when an obstacle comes in the path the infrared signal reflected back from the object and is received by the IR sensor. Introduces the solar operated low-cost obstacle avoidance robot in which the solar cells are constructed of materials that turn.

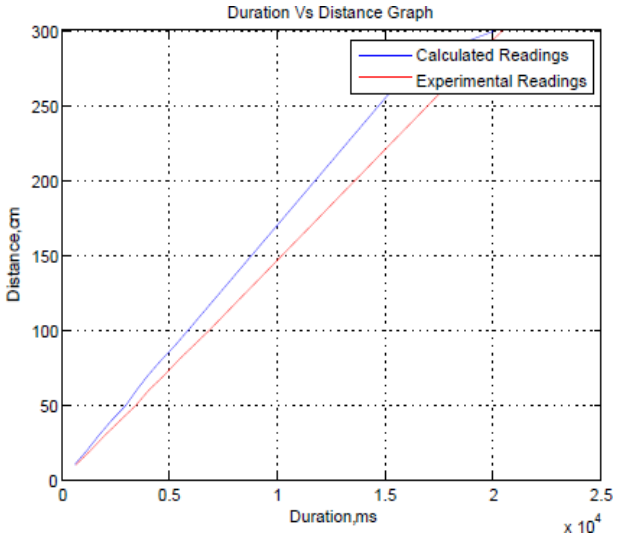
Solar energy converted into electrical current which can be collected for power generation. To increase the voltage of electricity generated, solar cells can be wired together in series to create larger arrays, known as solar panels. A solar panel is made of many solar cells wired together

2. RELATED WORK

In the existing system, a Robot was designed to detect the obstacle and move safely in an unknown environment. Robots need sensors to obtain information about the world around them. They help to detect position, velocity, acceleration, and range for the object in the robot's workspace. Mostly everyone uses Ultrasonic Sensor for this detection. This system is used for the blind people for vehicles to avoid collision automatic vacuum cleaner,.etc

The existing graph related to ultrasonic sensor

S. no.	Calculated t_{IN} (Duration)(ms)	Experimentalt_{IN} (Duration) (ms) by ultrasonic sensor	Actual distance of object (cm)
1	680	580	10
2	1360	1160	20
3	2040	1754	30
4	2720	2322	40
5	3400	2956	50
6	4080	3510	60
7	4760	4031	70
8	5440	4656	80
9	6120	5262	90
10	6800	5859	100
11	19040	16514	280
12	20400	20000	300



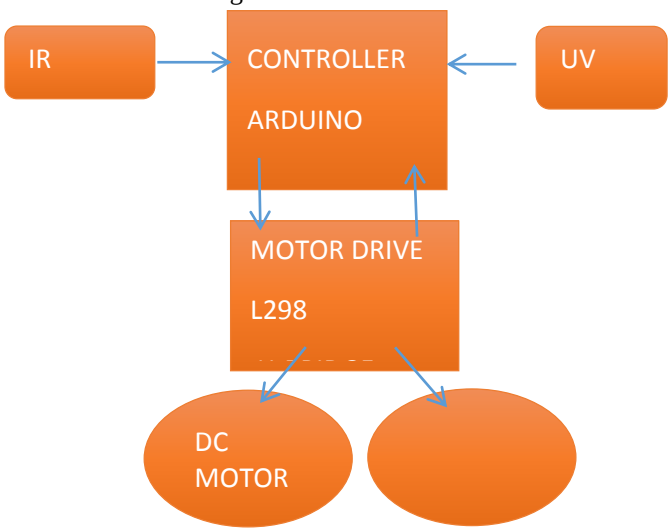
2.0. Literature Rivew

the system is used as a guidance device for blind and visually impaired people. It developed self-controlled robots for military purposes. They can navigate in Unknown Environment By avoiding collisions. This technology is used in the vehicle to drive safely. The problems in this existing system are mostly everyone uses ultrasonic sensor. Ultrasonic sensor has problems like Sensing accuracy affected by changes in temperature because the sensor requires medium to travel if medium is hot then it travels faster if medium is cold then it travels slowly, Sensing accuracy affected by soft materials because soft materials observe the sound wave, They Cannot work in a vacuum because sound needs medium to travel. Some of the others sensors affected by dust, dirt, or high-moisture environments. The existing system cannot detect pits in its path this is the most important drawback. Some of them work using a remote.

So we need to use two sensors to overcome these problems they are Infrared sensors and Ultrasonic sensor and we need to use one more Ultrasonic sensor to detect the pits in the path.IR used because it can work in the vacuum and at any temperature because it does not require medium to travel. Ultrasonic sensors these sensors are not affected by dust dirt or high moisture.

3.0. PORPOSED MODELLING

3.1. Architecture Diagram



3.2. Module Identification

3.2.1. Sensors

3.2.1.1. Ultrasonic Sensor

Ultrasonic Sensor Sends out an High Frequency sound pulse that reaches the object and returns back as an Echo .This sensor has two Openings one sends the sound wave and other receives the Sound wave. Ultrasonic sensor module is low cost, high performance sensor and provides stable and high ranging accuracy. Its ranging distance is 2cm to 350cm with 3mm accuracy. This module includes ultrasonic receiver, transmitter and control circuit. The module is low cost, accurate and easy to interface with a microcontroller, the HC-SR04 range makes it ideally suited for developing object

3.2.1.2. Infrared sensor

The infrared Sensor is a device which detects the changes in surrounding by infrared waves.It is also used to sense the Heat open-drain input which means it cannot be interfaced directly to the Arduino due to the maximum characteristics of the open

drain input which ranges from -0.3 to 3 voltages .These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor The output of this sensor is 8 bit serial measured.

3.2.2. Motor Drive Module

The L298H-Bridge motor is used to control the two DC Motor Wheel .They have a voltage Range between 5 and 35v and its peek current is 2 Ampere. It allows to control the speed and direction of DC motor wheel at the same time

3.2.3. The DC Motor Wheel

The DC motor wheel is controlled by L298 H-bridge .The direction of motor is controlled by sending a HIGH or LOW signal to the drive for each motor or channel.In the motion Procedure of the Robot

Stop: Both the wheels stop

Forward: Both the wheels move Forward

Right: Left motor rotates forward and right motor moves backward

Left: left motor moves backward and right motor move forward.

4.0. RESULTS AND DISCUSSIONS

4.1. Implementation

The implementation of obstacle avoiding robot involves program using Arduino board. An Arduino is a famous programmable board. In this board we write code in C++ due to its open source environment, we can able to easily write and upload codes to the I/O board. Sensors are connected with Arduino board and Microcontroller is able to sense the environment using input from sensors. It is able to control its surroundings by dc motors using H-Bridge module. The other Ultrasonic Sensor is placed in an angle towards the earth to detect the pits in the path. when this sensor placed towards the earth in certain angle then it calculates the gap between the earth and the robot when it increases then it is a pit in front of it then it stops movies in another determined direction. This system calculates the distance between the object and robot by using the time gap between the transmitted and received sound wave.

$$D = (T * V)/2$$

D = Distance between the robot and the object

T = the time gap between transmitted and received wave

V = Velocity of sound emitted by ultrasonic Sensor (344m/s)

The output graph shown below is very similar to the linear trend line and a change can be made and the relation between the distance and the volage is the following

$1 / (d+ K) = A * ADC+ B$

where

d - distance (cm)

K - constant (found using trial-and-error method)

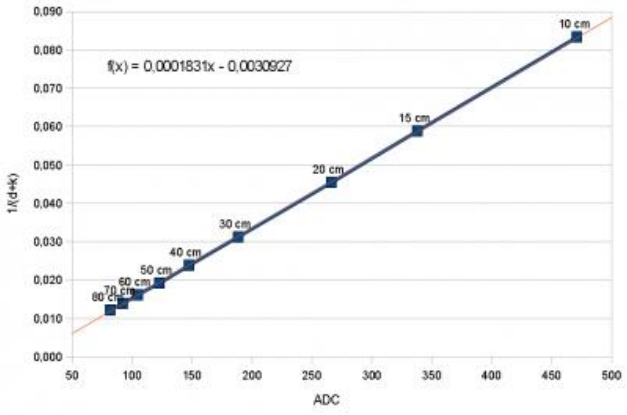
ADC- the digitalized value of voltage.

A- linear member (the trend line equation value is determined)

B - free member(the trend line equation value is determined)

Distance can be expressed from the formula:

$d = (1 / (A * ADC + B)) – K$



Comparing of Present Graph to Graph in Existing System

when we compare with the existing system to this System the Accuracy was changed it has the high accuracy compared to the existing system. In the proposed system, experimental value and calculated value are close to each other.

The Resultant Robot is capable of detecting pits in the path. The Accuracy of the robot was also increased. Finally resultant robot can detect the object with the minimum error

5.0. CONCLUSION

From this study, a robot that detects and avoids collisions is developed. The robot was very good in which it is easily capable to sense the obstacle and by processing the signal coming from the sensor it is perfectly avoiding the obstacle coming in between the path. The above Arduino controller and an ultrasonic sensor were studied and the HCSR-04 ultrasonic sensor and the infrared sensor was selected for obstacle detection Robot. Implementation of the obstacle avoidance algorithm was successful and it is carried out with minimal errors.

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