OBSTACLE DETECTING ROBOT USING ARDUINO AND SENSOR

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Abstract— This paper describes about an obstacle detecting robot which is controlled over IR Sensor .The robot is made using IR Sensor, wheel encoder and it is controlled by Arduino microcontroller . IR sensors in the front portion of the robot which senses the obstacle and deviate its path to choose an obstacle free path. The data from the sensor is compared with Controller to decide the movement of the robot Wheel. It is mainly based on H-Bridges and Wheel encoder output. The H-bridge helps to find the rotation of the motor. The direction of the motor will be based on the sensing of the IR sensor and also using a wheel encoder.

Keywords—Arduino; IR Sensors; style; Obstacle; Robot.

I. INTRODUCTION

An obstacle detection robot is an electronic device which is used for detection of obstacle in a free path. Generally these kind of robots are made with either PIR Sensors or ultrasonic sensors .In this project we have made the robot using PIR Sensors and a serial camera which is used for capturing the image of the obstacle and sending it to the PC over which we are controlling the robot. Using of camera helps in detecting the type of obstacle which the robot is detecting. An Arduino due is used for making this robot. Also the speed of the robot has to be controlled using the wheel encoder chip. To control the robot sing internet a data base has to be created. The navigation of the robot is controlled by the PIR Sensors fixed on it.

II. INTERFACING INFRA-RED RANGE SENSOR TO ARDUINO

The infra-red range sensor uses an 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. Hence, a diode is used only to enable the current to flow when I/O pin is low. The sensor requires two lines from the Arduino in order to be controlled. One provides the signal to begin a measurement and also is used to provide clock pluses, this line is called Vin and the other line is called Vout which is used to transmit the measurement back to the Arduino. The output of this sensor is 8 bit serial measured. The serial camera will be connected to the I/O ports of the board, and the captured image will be transferred using the GSM module.

The GSM module we here going to use is Sim900 which is capable of connecting to GPRS and through which we can send and receive commands.

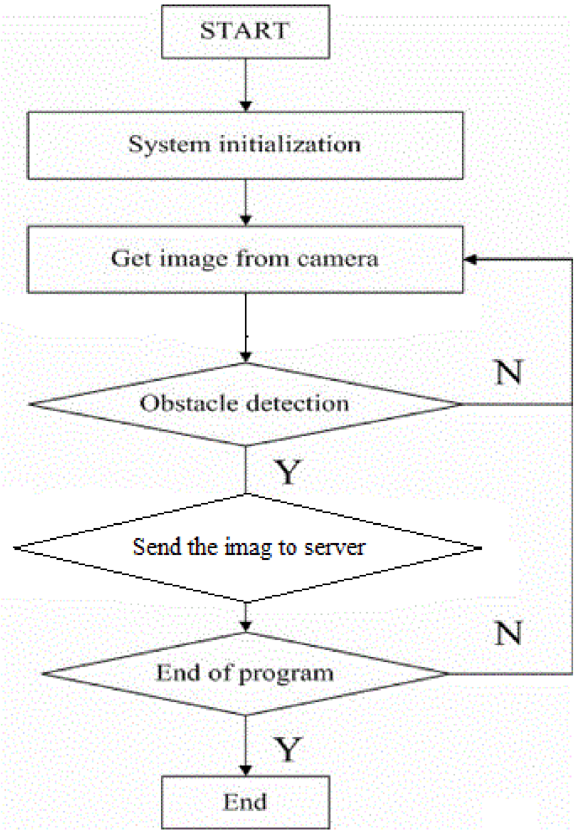
III. RANGE ESTIMATION AND AVOIDANCE OF OBSTACLE

In the robot there will be three PIR Sensors will be affixed. When the robot starts moving the PIR Sensor will help it to detect the obstacle in its path. As mentioned earlier the three sensors will be placed one in left, one in right and one in center portion of the front part of the robot. The range of the PIR Sensors is from 10 centimeter to 80 centimeter.
Together with the serial camera parameters from software calibration real-world distances can be retrieved. The maximum range at which the serial camera can be used for detecting obstacles depends on the image and depth resolution of the camera we are using.

IV. PROPOSED OBSTACLE DETECTION METHOD

The proposed obstacle detection system uses three infra-red range sensors that are mounted in front of the mobile robot cross over each other in order to provide coverage for a large area The sensors can measure a distance to an object by emitting infra-red pulses and then receives back the reflected signal. It can measure distances in the range 10cm - 80cm.

The implementation of detection system is divided in three stages: The first stage covers the hardware implementation, the second covers the software implementation and the third one is capturing the image and sending it to the server. In the hardware implementation, three infra-red range sensors are used to implement the hardware part of the proposed detection system. In the Arduino the pins are selected on the basis of pin numbers mentioned in the program. In the PIR Sensors there will be three pins for data, ground and Vcc.



Initial function of the robot

The initial function of the robot is to move as per commands given by the server. To move the robot, the Arduino should be programmed and should get sufficient power supply to operate. Apart from the power given to the Arduino the driver circuit must also get separate power. After the movement of the robot the speed of the motors should be controlled in avoidance to power drain out and other damages. For controlling the speed of the motors we are using a SpakFun wheel encoder SEN-12617.
The encoder counts the number of rotations by the wheels of the robot. The counts will then be sent to Arduino and the speed will be controlled.

- Read byte from PIR Sensor

The aim of this function is to read the distance information from the sensors. This information is serial bits and it is converted into a distance of centimeters. The sensors are calibrated using a linearization formula. The sensors output has an inverse relationship to the distance of an object. That is the further the object, the output values of the sensor will be small. The output values of the sensors are converted into distances.

$D= Kg/(X-Xo)$- (1)

Where D is distance in centimeters (cm) X is sensor output, Kg is the gain and Ko is an offset. The values of Kg and Ko can be determined as follows: Let D and X be the distance and output, respectively of the first measurement. Let D' and X' be the distance and output, respectively, of the second measurement.

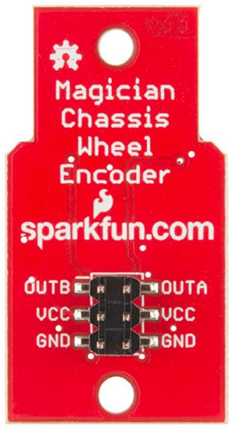
Interrupt function

This function deals with the timer 0 interrupt by generating the required waveform on the input pin of the PIR Sensor in order to initiate and read a byte from the output of the PIR Sensors also after the eight bits output from the PIR Sensors are read, it will generate the reset pulse to initiate the sensors to be ready for next measurement.

Motor Controlling Using the server

When the obstacle detection part informs the robot of the objects position in, the obstacle avoidance function guides the robot away from the objects and navigates it through a collision-free path. This part controls the robot's action by sending commands to the left and right motors. For now the obstacle avoidance part of the robot is very simple in which it just tries to avoid collision while performing a duty, but in the future we aim to implement a dynamic path planning for the robot and propose intelligent obstacle avoidance. The movement of the motors are controlled by the commands given through the web server. The database is created using MySQL and is connected to the robot using GSM module affixed on it.

The Wheel Encoder



The Wheel Encoder allows you to track the number of revolutions each wheel has made. This sensor works by detecting the movement of small teeth connected to a motor through the reflection of infrared light. By measuring the amount of reflected infrared light you can tell not only how far each wheel has traveled but how fast the wheels are turning.
The encoder has a 6-pin header which connects directly to the RedBot Mainboard via female to female jumper wires. Use the included RedBot library to start detecting wheel measurments. Two mounting holes lets you easily connect this sensor to your robot chassis.

Distance Estimation

The displacement distance presented between the left and the right cameras are projected as pixel values in disparity map image. The objects closer to the camera show more displacement distance between left and right images. These objects are demonstrated by higher value in disparity which result that lighter colour in the disparity map. On the other hand, further objects are shown by darker colours. Thus, by finding an equation between the pixel density value in the disparity map and distance, we can define the coordination of each object in the field. In this stage, the result of the stereo matching function is ready, so by using a mathematics formula we estimate the distance between the robot cameras and other objects. Figure 5 shows the relation between distance in cm and the disparity map pixel density values. With the help of this diagram, we extract a mathematics equation to convert the disparity values.

CONCLUSION

A new mobile robot detection system based on three infrared range sensors is presented. To detect an object in front of the mobile robot, the proposed detection system is implemented using three sensors cross each other in order to cover all the area in front of the mobile robot. The experimental results show that the best angle for mounting the position of the Sharp sensors should be 5 degree. Moreover, experimental results show that the proposed detection system is able to detect any object placed in front of the mobile robot. This work demonstrates that by using a proposed stereo matching method we could achieve better speed in executing a stereo matching function of the robot obstacle avoidance. By increasing the depth detection range of stereo vision, the need of using a combination of sensors to detect the closer objects in mobile robots is resolved. In our future work we will add some new features to our stereo vision based-robot to heighten its flexibility to operate in various workplaces.

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