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DESIGN AND FABRICATION OF AN OBJECT AVOIDER ROBOT WITH PREDEFINED OBJECT GRIPPER

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Abstract*- The evolution of robotics seems in many ways to mirror the evolution of the computer. Today robots can be found in many businesses and practically every major research institution. However, the promise of the common robot envisioned by many prognosticators and authors to exist in the homes and lives of the average person has yet to be fully realized in the same way the personal computer has come to be as ubiquitous as the refrigerator. As such we believe that the next logical step in the evolution of robotics is to place robots in the hands of the hobbyists. Additionally, these robots must be powerful and flexible enough to spur this next step. Developing a robot that can grab required sized object and avoid other objects over or below the required size is the prime objective. It makes dexterous coordinated movements. It moves without direct human intervention. So, in an industry, this robot can automatically search a specific object in any direction. When it finds the object, it grips the object and places the object in a desired place. We used infrared led, photodiode, servo motor, motor driver, microcontroller (16f877A) .*

Keywords: Autonomous, Geared motor, Microcontroller, Photodiode, Servo Motor

1. INTRODUCTION

Bangladesh is a developing country. The industries in this country are not well embodied. Most of the ploy is done manually. So, the rate of production is exiguous. Embarkation of low cost Robot [1] in industry will cause opulent production and production will be more cost effective. The port management in Bangladesh is very inefficient and back dated. It takes exorbitant time in the sea-port of Bangladesh releasing goods. So, national and international investment is not being emboldened.

An object avoider robot with predefined object gripper can be used in industry and port to accelerate the momentum of work. The intension is to ameliorate a wheeled robot. It can move forward and backward, left and right by direct current (DC) motor. Servo motor is used to grip the object. A theoretical design is developed. A detailed design of each of the different constituents of the system is designed. The second task is to develop and build all the components of the robot and finally integrate. The third task is to test the operation of the built model and assess its performance and limitations which gives it a special suitability to use in remote places or domestically with less cost.

2. SYSTEM OVERVIEW

The object avoider robot [2] with predefined object gripper merges the mechanical & electrical design. The whole system is divided in three subsystems, electrical subsystem, mechanical subsystem, software and coding subsystem (fig. 1). Merging all these system the robot can perform its desired actions.

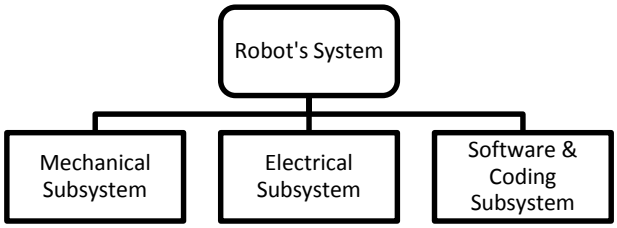

Fig.1: System analysis

3. WORKING PRINCIPLE

The mechanical design of the robot uses two geared dc motor, two wheels, one freewheeling ball is placed in the front of the robot and one servo motor to grip object. Infrared led and photo diode is used as sensor. Four sensors are used. Two is at the lower side and two is at the upper side. When the upper sensors and lower sensors get

activated, the robot moves forward & that time servo motor turn on then gripper gripes the object. If the lower two sensors get activate, the robot avoids the object. If only Left sensor finds the obstacle, the robot moves right to avoid collision by keeping right wheel stop and moving left wheel. Similar manner if only Right sensor finds the obstacle , the robot moves left to avoid collision by keeping left wheel stop and moving Right wheel. When the sensors do not sense, it moves forward to search object. It can detect an object from 12 cm distance [3].Different sensor arrangement of this Object Avoider Robot with Industrial Gripper is shown in the following blocks (fig. 2).

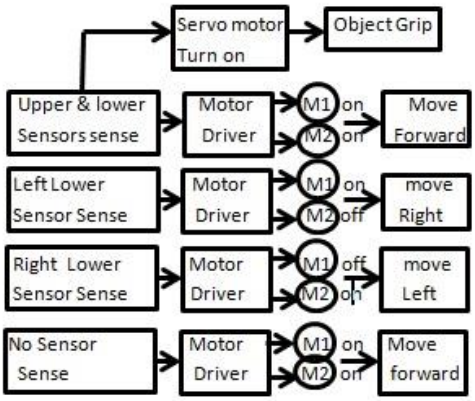

Fig.2: Block Diagram of working principle

3.1 Mechanical Subsystem

The hardware design of the robot includes motor-wheel placement, body setup, sensors arrangement and gripper mounting. The robot uses two dc geared motor & wheel in the back side and one freewheeling ball is on the front side for free movement of the robot. A aluminum gripper with a servo motor is mounted on the robot to grip object. The servo motor rotates 180˚ to grip the object freely. When signals are sent to the gripping control system it opens its grip up to 18cm (Fig. 3).

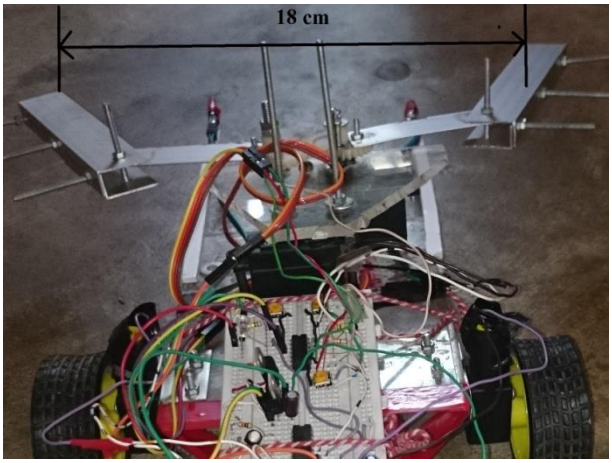

Fig. 3: Dimension of open grip

After taking the object it closes its grip and follows further steps. The gripper can withstand up to 4kg of weight. We can vary this weight limit by changing the servo motor in according to our need.

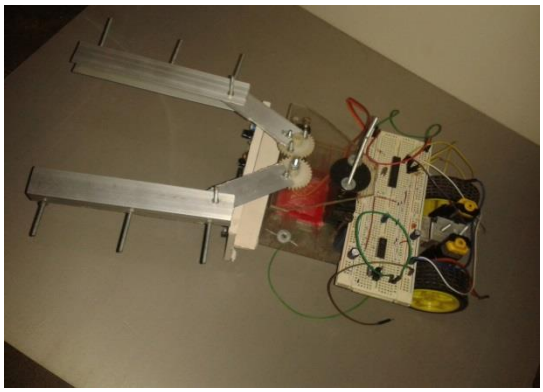

Fig. 4: Mechanical Subsystem

3.2 Electrical Subsystem

The sensor are infra-red LED and photo-diode. The infra-red LED is used of “always on type” that means it sends infra-red rays continuously and it is received by the photo-diode if only reflected by an object. Voltage drop of the photo-diode decreases and this drop can be detected by Op-amp (LM-358).The Op-amp LM-358 [4] is used as a comparator to generate a digital signal. This digital signal is send to the microcontroller (16f877a) and it performed its programmed operation. Motor driver L293D is used to run and stop the motor base on the digital signal from microcontroller (16f877a). When upper sensors finds object then servo motor starts its operation. It can rotates 180˚ freely and grip object firmly. After robot moves backward and placed the object in its desired place. Before circuit implementation [5], simulation was done in Proteus Simulation Software (fig. 5,6).

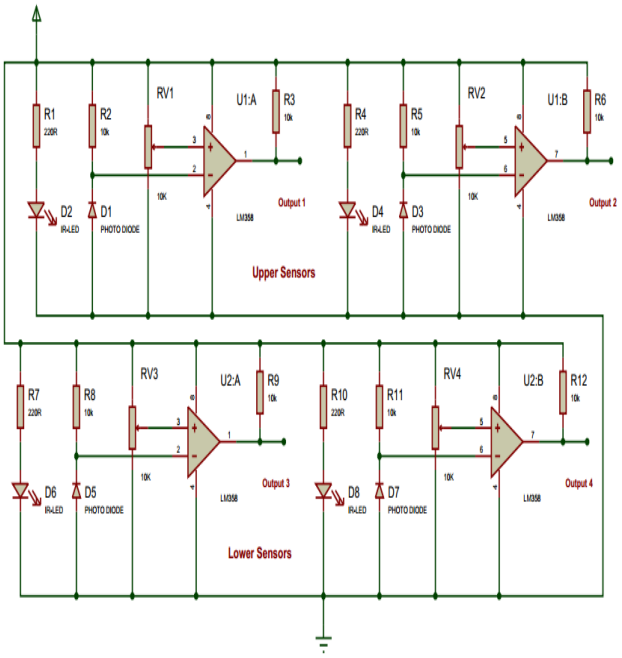

Fig. 5: Circuit diagram of sensor part.

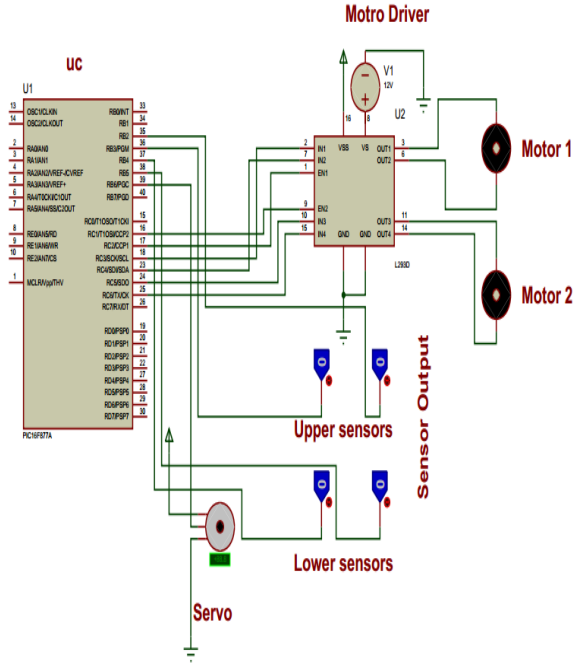

Fig.6: Circuit arrangement & simulation diagram on Proteus

3.3 Software and coding Subsystem

The software coding of this Object Avoider Robot with predefined object Gripper design is achieved by C Language. The program basically was written on MicroC for PIC and then process the data in MCU and perform it's desired operation. A brief overview of the software function and the system architecture is shown in Figure 5 to clarify the cyclic phase rotation for robot gripping system. From the flowchart, the calling sequence and the relationship between the functions are visualized. The algorithm and corresponding flowchart has been shown here (fig. 7).

1. Start
2. Check sensors if on or not.
3.If sensors are on then proceed to the next operation and if not then check again.
4. Check the upper sensors.
5. If upper sensors are not high then avoid the object and go back to step 2.
6. If upper sensors are high then send signal to the servo to grip the object.
7. And start the process again

4. RESULT

As the robot is switched ON, Then the robot continuously check any obstacle in path, if there is no obstacle then robot will go forward [6]. If lower left sensor will found obstacle in left side the controller send a command to the motor drive to stop the right motor & move the left motor and just opposite as obstacle found in right side. The other hand if both upper will found obstacle then robot grip the object and move backward and place it to the right place. The robot worked properly. Expected result was earned. In Summary when it found undersized object, it avoids it and continues to search. When the robot finds any object of desirable size, it grasps it and places it at right. The figure (fig. 8) is shown below when robot is gripped an object:

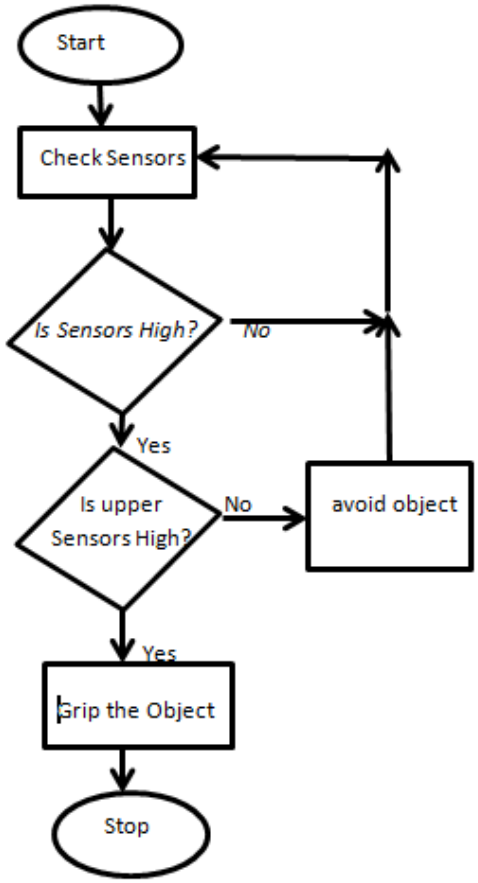

Fig. 7: Flowchart for the software and coding subsystem

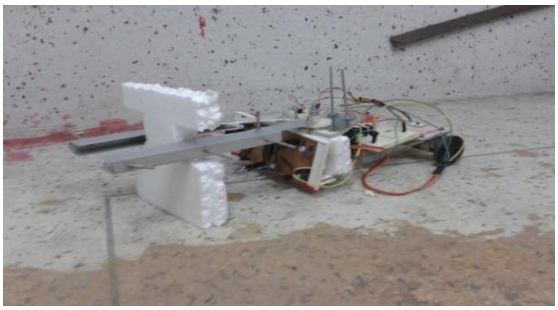

Fig. 8: Gripping an object

5. APPLICATION

Obstacle avoiding technique is very useful in real life, this technique can also use as a vision belt of blind people by changing the IR sensor by a kinetic sensor ,which is on type of microwave sensor whose sensing range is very high and the output of this sensor vary in according to the object position changes. This technique makes a blind people able to navigate the obstacle easily by placing three vibrato in left, right and the centre of a belt named as VISION BELT and makes a blind people able to walk anywhere. On top of obstacle avoiding robot temperature/pressure sensors can be added to monitor the

atmospheric conditions around. This is useful in places where the environment is not suitable for humans. Same technology can be used in various application by modifying the microcontroller program for example

1. Line/Path finder Robot.
2. As automatic vacuum cleaner.
3. With proper programming we can use it as a weight lifter.
4. In Mines

6. CONCLUSION

Obstacle avoiding technique is very useful in real life and it is used in numerous applications such as Line / Path finder Robot, automatic vacuum cleaner, weight lifter and mimes[7]. There some limitation of the robot. It has low sensing range, but we can improve this low sensing range by using ultrasonic sensor. The robot doesn't move quickly and stuck among densely cluttered obstacles. Further this can be improved by using Vector Field Histogram(VFH).

Robot is expensive in respect to the economic condition of Bangladesh. The initial cost is very high as the most of the robot is made of aluminum and expensive microcontroller. But if the robots are employed in the industry and port, the profit will engulf the cost. Robots save the time and labor. They make little mistake compared to human being.

7. REFERENCES

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