

An Autonomous Self- Propelled Robot Designed for Obstacle Avoidance and Fire Fighting

K. Prathyusha

Assistant professor, Department of ECE,
NRI Institute of Technology, Agiripalli Mandal,
Krishna District, INDIA.
Email ID: prathyushakuncha@gmail.com

M. Chaitanya Suman

Assistant professor, Department of ECE,
Vignan's Nirula Institute of Technology & Science
for Women, Guntur, INDIA.
Email ID: mogadatichaitanyasuman@gmail.com

Abstract: A self-propelled autonomous novel navigation mobile robot, reactive system for real time obstacle avoidance, compatible with low cost SONAR sensor. This paper is designed to achieve obstacle avoidance and detect fire, sprinkle water along with the buzzer indicator. As per the program, the robot starts moving forward, if any obstacle is detected, the robot will tilt at an angle to its left. Again it starts moving forward.

Microcontroller (AT89S52) is used to avoid the obstacle and fire detection with the help of ultrasonic sensor and temperature sensor. The microcontroller is used to drive sensors and the motors, which are needed for the robot to keep moving.

Ultrasonic sensor is mostly used for avoiding the obstacle. An ultrasonic sensor is used to obtain the distance measurement depending upon the transmitting and receiving time. An ultrasonic sensor is placed on the stepper motor, which makes the sensor to cover the front view of the robot. Ultrasonic sensors are used to scan the front view of the robot and the time is calculated and distances are found using sound velocity characteristics. The echo time is calculated by the ultrasonic sensor and the information is passed to microcontroller which makes the robot to move forward and if any obstacle is detected, tilt left for avoidance of obstacle. As the robot moves forward, if fire is detected, temperature sensor detects heat and sends data to the microcontroller and the microcontroller sends signal to the buzzer and it starts sounding. There by, water starts sprinkling with the help of sprinkler.

Keywords: Self-propelled robot, Obstacle avoidance, Microcontroller (AT89S52), Ultrasonic sensor, Temperature sensor.

I. INTRODUCTION

A robot is a mechanical and virtual intelligent agent that can perform tasks automatically or with guidance, typically by voice control or by getting response through sensors. Robot is capable of understanding and synthesizing human Command for communication and performs required functions.

In Autonomous operating conditions the user will have no control on the robot that is the robot cannot be operated via any external controls, it will only function as per the data received from the obstacle detection circuits to the microcontroller which will make the robot motors move accordingly as per the code written in it.[1]

Now –a-days, many industries are using robots due to their high level of performance and reliability and which is a great help for human beings. The obstacle avoidance robotics is

used for detecting obstacles and avoiding the collision. This is an autonomous robot. The design of obstacle avoidance robot requires the integration of many sensors according to their task.

The obstacle detection is primary requirement of this autonomous robot. The robot gets the information from surrounding area through mounted sensors on the robot. Some sensing devices are used for obstacle detection like Ultrasonic sensor. Ultrasonic sensor is most suitable for obstacle detection and it is of low cost and has high ranging capability. It is used to extinguish or control small fires, often in emergency situations. All mobile robots feature some kind of collision avoidance, ranging from primitive algorithms that detect an obstacle and stop the robot in order to avoid a collision, using some sophisticated algorithms, which enable the robot to detour obstacles. [7]

II. EXISTING SYSTEM

The existing system performs obstacle avoidance with the help of an IR sensor. It can sense the objects in the nearby range. The IR sensor is placed at the front side of the robot and it senses the object only in front of it. If there is any obstacle, the robot turns either left or right depending upon the microcontroller instruction and again checks for an obstacle. If there is no obstacle, it proceeds towards the destination.

III. DRAWBACKS OF EXISTING SYSTEM

- The existed system with IR sensor is a low range detection device and its range is between 4 cm and 30 cm.
- The IR sensor cannot be used outside in the sun.
- It is not suitable for accurate ranging.
- It does not have fire protection circuit.

IV. PROPOSED SYSTEM

The proposed system uses an ultrasonic sensor instead of IR sensor which is having a detection range of 2 cm to 1 m. Whenever the robot is moving in the desired area, the ultrasonic sensor transmits the ultrasonic waves continuously. The ultrasonic sensor continuously radiates the waves in the forward direction as per the stepper motor movement. When the ultrasonic waves hit an obstacle, they are reflected back and that information is passed to the microcontroller. Based on the microcontroller instruction, the motor rotates in the respective angle. When there is any fire, the temperature sensor detects it and indicates with the help of a buzzer. The sprinkler motor sprinkles water to control fire.

VI. SOFTWARE IMPLEMENTATION

Program is written in embedded C. stimulation is done by using Keil ARM Software; Top Win is used for dumping the program.

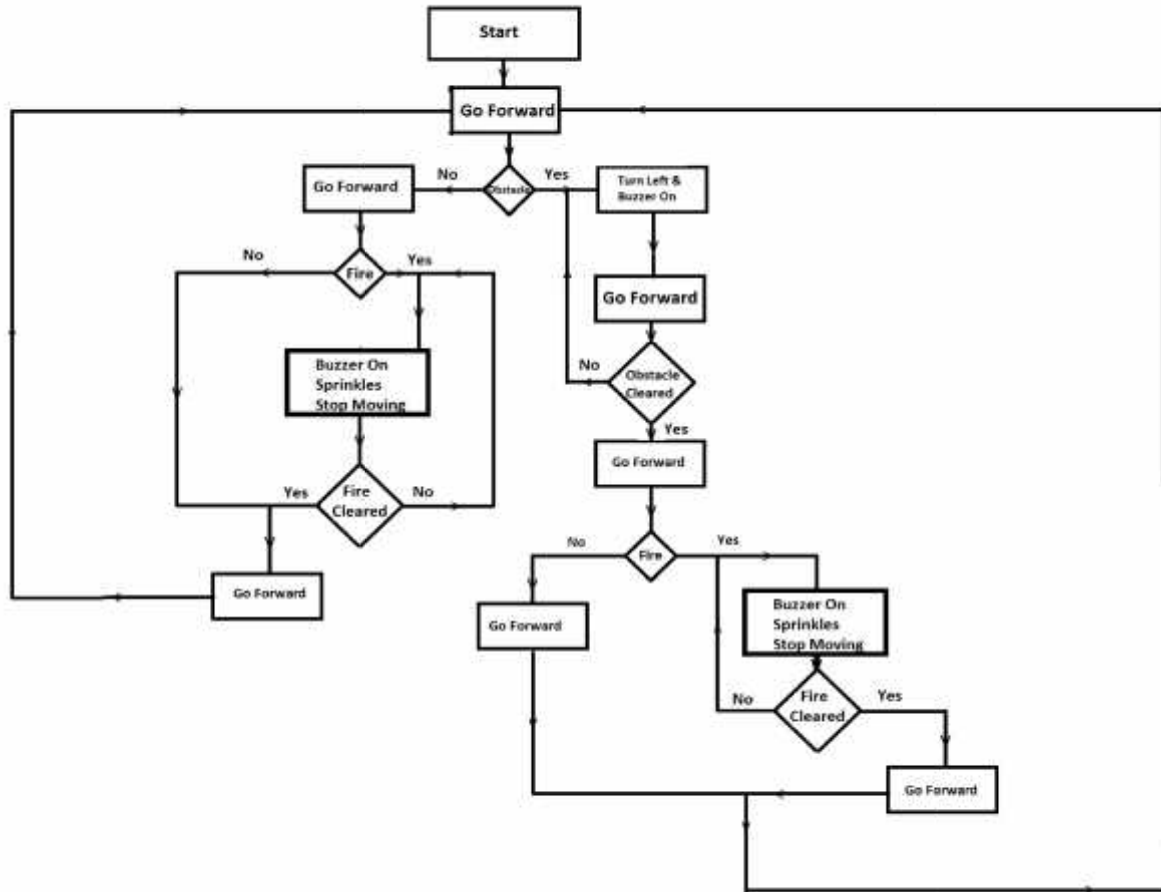


Fig 2: Flow chart of working of Robot

Algorithm

Step 1: As per the instruction written in Embedded C program initialize I/O ports

Step 2: Set Directions as Left/ Right. Checks if any obstacle is detected according to that change the motion of Robot .If any obstacles detects the robot tilts with some angle to the left side till the obstacle is cleared and then again moves forward.

Step 3: If no obstacle is detected in the middle or if the obstacle is cleared in its journey the robot moves forward.

Step 4: Wait for some time.

Step 5: go to step 2 to repeat the process

Step 6: Checks if any fire is detected as the Robot moves forward. If any fire is detected, the thermal sensor LM35 will give the data to the microcontroller and it starts buzzer, LED will glow and also water sprinkling will be on. After fire is stopped it again moves forward.

Step 7: Wait for some time

Step 8: go to step 6 to repeat the process

Step 9: End

VII. ADVANTAGES

- Whenever the robot senses any obstacle, it automatically diverts its position to left or right and follows the path without human guidance.
- It is cost effective.
- Reduces human effort.
- If fire occurs due to short circuit, the robot sprinkles water along with buzzer indication

VIII. DISADVANTAGES

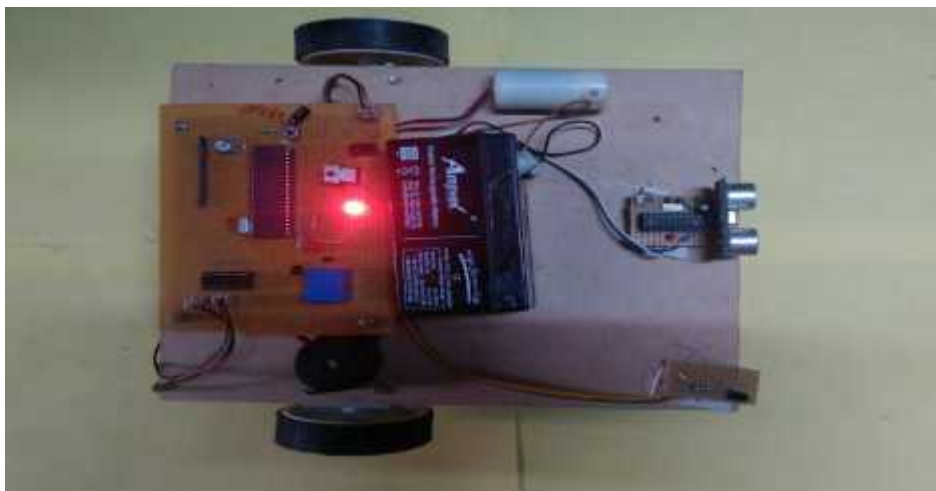
- It needs continuous power supply.
- Back EMF will be a problem when more circuits are connected.
- If correct commands are not given in the program, there is a chance for the robot to collide with obstacle.

IX. APPLICATIONS

- Obstacle avoidance robot is used in the machinery industries like automobiles manufacturing where loads can be shifted from one place to another place without any collision.
- It is also used in the same way in chemical industries for detection of fire and fumes and controlling them.
- It is used for military applications.
- It is an essential element of autonomous mining vehicle system.
- It is used in autonomous cleaning robots.
- It can be used at places where probability of explosion is high.

X. CONCLUSION

The purpose of “A Self Propelled Autonomous Novel Navigation Obstacle Avoidance Robot” is to create a cost effective and high efficient system for obstacle avoidance. This can be applied everywhere from industrial to household purposes. A lot of factors determined the accuracy of the robot we designed. These factors were the environmental phenomenon in which the robot was tested such as a well-lit or a dimly-lit environment. These factors majorly affected the sensors. Thus the nature of the sensor and its accuracy defined the accuracy of our robot. The obstacle avoidance robot not only just avoids the obstacle, this robot also senses the fire and indicates with the help of a buzzer and also sprinkles water to extinguish fire.



X1. FUTURE SCOPE

Camera can be added for exact monitoring. A metal detector circuit can be added for detection of antiquities. A transmitter and receiver can be added and the information can be known from distant places. Pre-defined path can be added in the program. This obstacle avoidance robot just avoids the obstacles, path holes detection can also be added and with proper programming it can also avoid concealed paths.

XII. REFERENCES

- [1] G. Bauzil, M. Briot, and P. Ribes, "A navigation sub-system using ultrasonic sensors for the mobile robot HILARE," in Proc. 1st Int. Conf. Robot Vision and Sensory Controls, Apr. 1981, Stratford-upon-Avon, UK, pp. 41-58 and pp. 681-698.
- [2] Subhranil Som, Arjun Shome, " Micro-Controller Based Obstacle Avoiding Autonomous Robot"; Int. Journal of Engineering Research and Applications ,Vol. 4, Issue 6, June 2014, pp.01-06.
- [3] LPC-ARM-Book, The Insider's Guide to the PHILIPS ARM &-Based Microcontroller AT Commands from wave-com.
- [4] ARM Research web site, <http://www.amrresearch.com/>
- [5] J. Borenstein, et.al. "A mobile platform for nursing robots," IEEE Trans. Ind. Electron., vol. IE-32, pp. 158-165, May 1985.
- [6] S. Ciarcia, "Home in the range, an ultrasonic ranging system," BYTE, Nov. 1980.
- [7] Kirti Bhagat et.al. "Obstacle Avoidance Robot", International Journal of Science, Engineering and Technology Research (IJSETR), Volume 5, Issue 2, February 2016.