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A Review on: Maze Solving Robot Using Arduino Uno

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Abstract—**Robots are entering into the life of human and making our life simpler. Maze is a network of the paths having different obstacle from entrance to exit. Maze solving is a important field of robotics. Solving a maze is fully depends upon decision making algorithms. Various algorithms are designed yet to solve maze. In this paper a maze solving robot using arduino uno is developed having two types of algorithms which will help the robot to solve the maze efficiently. And find the shortest path among the various possible paths.**

Keywords—*Arduino Uno,Ultrasonic sensor,Motor Driver,Wall following algorithm,Flood fill algorithm*

I. INTRODUCTION

Nowadays mobile robotics is an very important field, in which robot find path on its own. And also it can move independly from one point to another. In robotics era maze solving is an important field, in which various mathematicians made the various algorithms for maze solving and every algorithm have its own advantages and demerits.

This type of robot can be used in many aspects or in many research studies where man could not go. Rescue operations would be the major application of this robot.

In this paper we are describing the Wall following algorithm which is best suited algorithm for maze solving. Wall following contains its two types in which robot will move according to the right wall follower or left wall follower. Shortest path is very important concern for solving the maze efficiently. Flood fill algorithm is used for the same. Arduino Uno is very popular open source microcontroller based board. Ultrasonic sensor could be used to measure the distance to the obstacle. This can be done for the left, right, front for finding the distance to the obstacle in these three directions. Ultrasonic sensors array can be used to accomplish this.

For verifying the result 4*4 small maze is constructed.

II. LITERATURE SURVEY

In the year of the 20th century, Maze solving problems become an vital field of robotics.
In 1972, IEEE organizer Spectrum magazine came up with the concept of micro-mouse which is a small microprocessor controlled vehicle with self-intelligence and capability to navigate a critical maze. Then in May 1977, the fast US Micro mouse contest, called" Amazing Micromouse Maze Contest" was announced by IEEE Spectrum. After that this type of contest became more popular, and many type of maze solving robots are developed every year.
Late 1970s the analysis of the maze solving robots designs were used to have huge physical shapes that contain many blocks logic gates. Figure 1(A) and 1(B) show the example of early the maze solving robots (micro mouse). Due to technological development the physical size of the robot becomes smaller and the features of the robot becomes modern.[1]
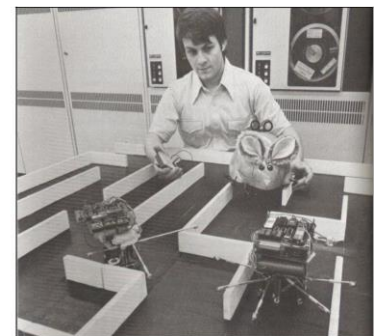

FIGURE 1 (A)   FIGURE 1 (B)

In 1999 Sonja Lenz, Michael Gims and Dirk Becker from University of East London developed a micro mouse. They apply a non-graph theory algorithm, **Wall Following Algorithm.** But their robot did not move intelligent in the map and it could not solve maze with loop.[2]
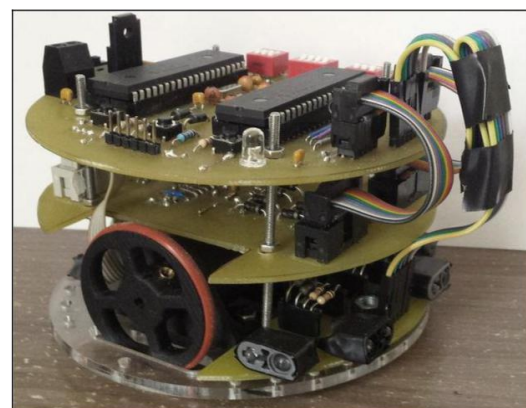

FIGURE 2

III. HARDWARE DESIGN OF MAZE SOLVING ROBOT

Main hardware of our project is Arduino uno board. Ultrasonic sensors are used for obstacle detection and motor driver are used to move wheels. For robotics we have used gear dc motors. Array of ultrasonic sensors are interfaced to the arduino board which will measure the distance from the wall to the robot. which makes easy for the arduino to make decision whether to move right ,left or front. This is mainly based on wall following algorithm that is right wall following

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or left wall following. This robot is autonomous it will move on its own way and it is based on battery.
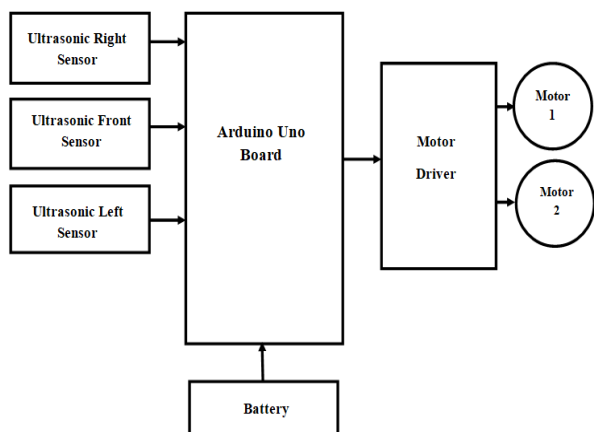
Figure 2 Block Diagram of Maze Solving Robot

Firstly robot will enter the maze. It will first detect the wall at the right side, left side and front side using ultrasonic sensors. According to the distance measured by the ultrasonic sensor arduino will decide whether the wall is present or not. Using wall following algorithm robot will turn to the left ,right or front. Once it is traverse the maze it will find the shortest path using flood fill algorithm.

IV. ALGORITHMS USED IN MAZE SOLVING ROBOT

A. Wall following algorithm

Right wall following algorithm
Ultrasonic sensors will measure the distance to the wall from the robot its depends upon the measured distance that where the robot will move.
1.If the distance to the right wall is greater than 5cm it will consider as it is null means no wall present it will turn to right side only.
2.If the distance to left wall is greater than 5cm it will turn around .
3.If there is no wall at straight keep straight.
Left wall following algorithm
1.If the distance to the left wall is greater than 5cm it will consider as it is null means no wall present it will turn to left side only.
2.If the distance to right wall is greater than 5cm it will turn around .
3.If there is no wall at straight keep straight.

B. Flood fill algorithm
Maze is path of consisting of entrance to exit which is divided into cells. flood fill algorithm will assign zero value to the exit cell. neighbouring to the exit cell it will assign one higher

value than exit cell and keep on assigning higher values to the neighbouring cells and after assigning all the cells it will travel from highest to lowest value cells only that will determine the shortest path for the maze.
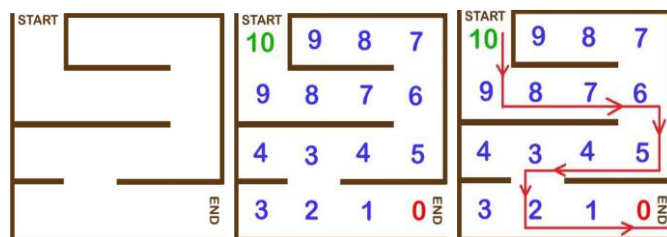

FIGURE 3   FIGURE 4   FIGURES 5

V. ADVANTAGES

1. Robot can easily find the shortest path.
2. Real time application is implemented.
3. Efficient way to solve maze.
4. Small size robot.
5. Arduino makes the project efficient.

VI. APPLICATIONS

Nowadays robots are widely used in different hard and harmful find. This project is based on decision making algorithms. So, it can be used in numerous intelligent fields. It can be used as a navigation problems, rescue operation, search operation, medical attention, military search and rescue, etc.

There are many caves that are like mazes where humans could not go. This robot can find its way on its own . It can also be used in too small area or dangerous cave where human can't enter.

Also in a big industries and shopping mall, it's possible that one can lose track of the paths. This robot can be used as a guide for finding or determine path.

VII. ACKNOWLEDMENT

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VIII. FUTURE SCOPE

1. Artificial Intelligence can be used to solve the maze very efficiently.

2. IOT(Internet Of Things) can be used to determine the live status of site.

3. Live video streaming and pick and place assembly can be used to lift up the object.

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