IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 5, Issue 12, December 2016

# Path Planning for Autonomous Robot using Fuzzy Logic

**Basavanna M[1], Dr M Shivakumar[2], Stafford Michahial[1]**

Asst Prof, Dept of E&IE, GSSSIETW, Mysuru[1]

Prof & Head, Dept of E&IE, GSSSIETW, Mysuru[2]

**Abstract:** Autonomous robots are those which move freely without explicit human control. Path planning is done for such robots in order to reach the destination in the shortest possible time. Path planning also helps in obstacle avoidance. Here we are using fuzzy logic algorithm, which is widely used in artificial intelligence to make human like decisions. Fuzzy logic gives an output in the form of degrees of truth rather than just true or false. In this paper we are taking an image and converting it into a bmp file. Image consists of different obstacles which is in black colour and the white colour represents the path. A line joining the source and destination will give us the shortest path. Two different pixel values are set as source and destination. Six inputs such as the distance from the obstacle in front, distance at the front left diagonal, distance at front right diagonal, angle between the heading direction of robot and the goal, distance of the robot from the goal and preferred turn are chosen. The fuzzy system provides single output that will be the motion of the robot towards the destination. We make use of MATLAB software for the execution.

**Keywords:** Path planning, fuzzy logic, artificial intelligence, image map.

## I. INTRODUCTION

A robot is a mechanical or virtual artificial agent, usually an electromechanical machine that is guided by a computer program or electronic circuitry, and thus a type of an embedded system. Robots can be autonomous or semi-autonomous. Robots tend to possess some or all of the following abilities and functions: accept electronic programming, process data or physical perceptions electronically, operate autonomously to some degree, move around, operate physical parts of itself or physical processes, sense and manipulate their environment, and exhibit intelligent behavior — especially behavior which mimics humans or other animals [1][2].

The mobile robots need a control system for navigating in an environment [10]. Autonomous robots are intelligent machines capable of performing tasks in the world by themselves, without explicit human control[11].A fully autonomous robot can gain information about the environment[3-6] and work for an extended period without human intervention. Path planning is one of the most important elements for mobile robot.

Path planning is the determination of a path that a robot must take in order to pass over each point in an environment and path is a plan of geometric locus of the points in a given space where the robot has to pass through [7]. The mobile robot reacts to the detected obstacle and changes its heading direction in real time to avoid the obstacle [13].Generally, the problem of path planning is about finding paths by connecting different locations in an environment such as graph, maze and road. When advanced autonomous robots navigate within indoor environments (industrial or civil buildings), they have to be endowed the ability to move through corridors, to follow walls, to turn corners and to enter open areas of the rooms [14]. Path planning enables mobile robots to see the obstacle and generate an optimum path so as to avoid them[8][9].

## II. PROPOSED METHODOLOGY

Assume that you have a robot arena with an overhead camera as shown in Fig.1. The camera can be easily calibrated and the image coming from the camera can be used to create a robot map, as shown in the same figure. This is a simplistic implementation of the real life scenarios where multiple cameras are used to capture different parts of the entire workspace, and their outputs are fused to create an overall map used by the motion planning algorithms.

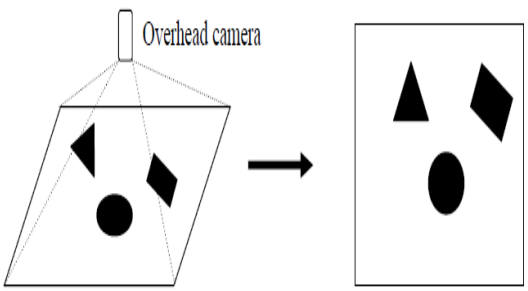


**Fig.1** Overhead camera system and creation of robot map

The same camera can also be used to capture the location of the robot at the start of the planning and also as the robot moves. This solves the problem of localization. An

IJARCCE
ISSN (Online) 2278-1021
ISSN (Print) 2319 5940
International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 5, Issue 12, December 2016

interesting looking region of interest becomes the goal of the robot to be used in the motion planning algorithms. The robot is not shown in the map in Fig.1.

We assume that the source and goal of the robot is explicitly supplied. Fuzzy based navigation is a reactive planning technique, where the immediate position and distances from obstacles is considered to compute the immediate move, without much bothering about the future[15].

In such a manner immediate actions lead to motion of the robot, ultimately leading to the goal. In order to solve the problem using fuzzy logic, we first need to select a few inputs which best represent the situation that the robot is currently placed in. The decision of motion is made purely on the basis of these inputs and not the actual scenario.

For this problem 6 inputs are selected. These are distance from the obstacle in front, distance from the obstacle at the front left diagonal, distance from the obstacle at the front right diagonal, angle between the heading direction of robot and the goal, distance of the robot from the goal and preferred turn. The different inputs are summarized in Fig.2.

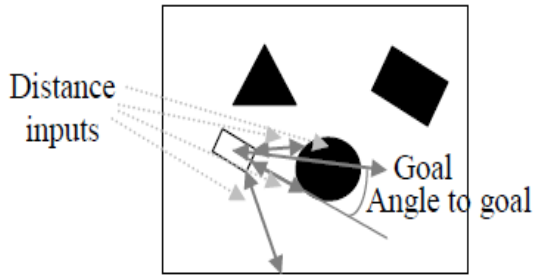


**Fig.2** Different inputs for the fuzzy planning

The last input, preferred turn indicates whether it would be beneficial to turn clockwise or anti-clockwise, all other inputs ignored. A simple rule is used to set the parameter. If the front obstacle is far away, turn is so as to more face the goal. If the front obstacle is close and a new front obstacle is encountered, turn using the side of the goal is preferred. If the front obstacle is close and the same obstacle as encountered in the previous step is found, the same turn as made previously is repeated. The fuzzy system produces a single output, which is the steering to make or the immediate angular speed. The fuzzy rules are written such that the robot avoids the obstacles and aligns itself towards the goal. The fuzzy system is a result of a lot of manual tuning of the rules and membership functions, over a wide variety of scenarios.

## III. RESULTS AND DISCUSSIONS

The paper discussed Fuzzy logic control technique for navigation and obstacle avoidance of a virtual robot using an image as a map.

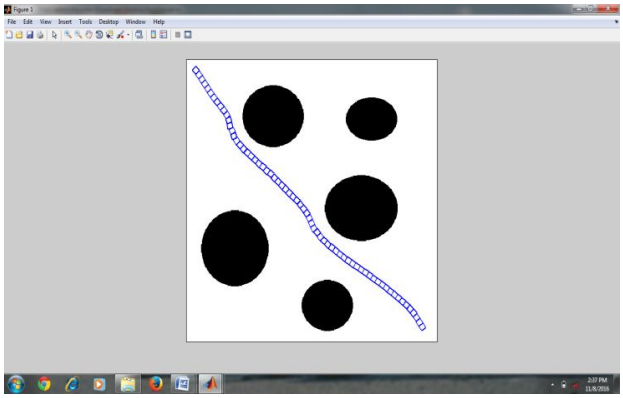

**Fig.3** Output image map.

## IV.CONCLUSION

The paper discussed Fuzzy logic control technique for navigation and obstacle avoidance of a virtual robot using an image as a map. Fuzzy logic is employed to conduct the path tracking behavior and obstacle avoidance behavior and to find a free path that helps the mobile robot to reach the target without hitting obstacles. It shows the effectiveness of the fuzzy logic algorithm for autonomous mobile robots and guarantee efficient and safe navigation of autonomous mobile robots.

## REFERENCES

[1] Polk, Igor, "RoboNexus 2005 robot exhibition virtual tour" 2005.
[2] Harris, Tom. "How Robots Work" How Stuff Works.
[3] Choset H,P. Pignon," Coverage Path Planning:The BoustrophedonDecomposition. in Int. Conf. on Field and Service Robotics", 1997.
[4] Sariff N, Buniyamin N, "An Overview of Autonomous Mobile Robot Path Planning Algorithms", 2006.
[5] Wan Ngah, W.A.J, Buniyamin N, Mohamad Z, "Point to Point Sensor Based Path Planning Algorithm for Mobile Robots", 2010.
[6] Vacariu L., Flaviu Roman, Mihai Timar,Tudor Stanciu, Radu Banabic, Octavian Cret, "Mobile Robot Path-planning Implementation in Software and Hardware ",2007.
[7] Haklıdır M, Taşdelen, "Modelıng And Sımulatıon Of An Anthropomorphıc Robot Arm By Usıng Dymola",2006.
[8] Bhushan Mahajan, Punam Marbate," Literature Review on Path planning in Dynamic lanning Environment" IJCSN International Journal of Computer Science and Network, Vol 2, Issue 1, 2013.
[9] Kusampudi Navyanth, Sanjeev Jacob "Navigation of Autonomous Firefighting Robots Using Fuzzy Logic Technique", International Journal of Engineering Science and Innovative Technology (IJESIT)Volume 4, Issue 6, November 2015.
[10] Rahul Kala, "Code for Robot Path Planning using Fuzzy Logic", 2014.
[11] Siegwart, R.,Nourbakhsh, IR. "Introduction to Autonomous Mobile Robots", The MIT Press, 2004.
[12] G.Bekey,"Autonomous robots",MIT press books,2005.
[13] Lim Chee Wangy, Lim Ser Yongy , Marcelo H. Ang Jr.z," Hybrid of Global Path Planning and Local Navigation implemented on a Mobile Robot in Indoor Environment ".
[14] Vamsi Mohan Peri," Fuzzy logic controller for autonomous mobile robot", 2002.
[15] Maulin M. JoshiMukesh A Zaveri,, "Reactive Navigation of Autonomous Mobile Robot Using NeuroFuzzy System", International Journal of Robotics and Automation (IJRA), Volume (2) : Issue (3), 2011.