Implementation of Navigation Target Seeker Mobile Robot Based on Pattern Recognition with Fuzzy Kohonen Network (FKN) Methods

Aditya P. P. Prasetyo[1], Katjuk Astrowulan[1], and Ali Fatoni[1]

[1]Abstract-Navigation is a technique for determining the position and direction of travel in the actual environment. This navigation system can be implemented on a mobile robot to accomplish a specific task, in this paper is used in order to navigate the robot can move toward a specific target while avoiding obstacles exist. One of the control techniques used in mobile robot navigation is based on pattern recognition techniques. With a pattern that has been previously implanted in the "brains" of the robot, the mobile robot can take action in accordance with the movement of the pattern. This paper used method of Fuzzy Kohonen Network (FKN) in order to be able to navigate a mobile robot to recognize patterns in the environment. The target used is a specific point designated position using a camera support (GPS Ad-hoc). Based on test results using this method, the obtained results are satisfactory, precisely to the targets and fast search time targets.

Index Terms – Navigation of Seeker Target, Pattern Recognition, Fuzzy Kohonen Network, GPS Ad-hoc.

INTRODUCTION

Navigation on the mobile robot system has two main objectives, namely to avoid obstacles and steer the robot toward the target. To meet these two main objectives, then by using the method of FKN expected movement of the robot can take action in accordance with the pattern that has been implanted environment. In addition, with the help of the camera as GPS Ad-hoc [1], then the position of the robot and the target can be known.

DESIGN AND METHOD

In this section will discuss the design of target localization system architecture and control mechanism. It also describes the FKN method used for robot seeker target navigation.

I. Design of Target Localization System Architecture

Application of the target localization in the real world requires a definite architectural design to ease modularization. Modularization easier for researchers to try a new search algorithm without having to change much in the microcontroller on the robot. In this case the author designed the architecture of the localization of the source of gas by dividing into three major parts, namely: behavioral modules, camera modules and communication modules, as shown in Figure 1.

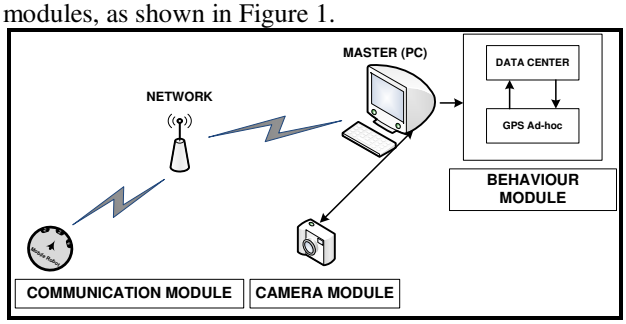

Figure 1. Target localization system architecture design.

II. Design of Control Mechanism

Control mechanism using the FKN broadly divided into two stages, namely the first stage by infrared sensor readings against obstruction and the environment, then through FKN as direct control method will move the robot to avoid obstacles and navigate to find targets. If the obstacle is not detected again, then in the second stage of this GPS Ad-hoc coordinate robot will move towards the target area detected with the help of a compass sensor to determine the degree of position. On this mechanism, DC motors act as actuators that control the movement of the robot toward a certain direction and position. In the Figure 2 shows mechanism controls used.

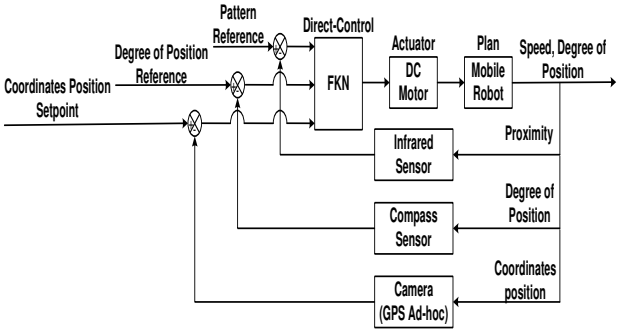

Figure 2. Control Mechanism.

[1]Aditya P. P. Prasetyo, Katjuk Astrowulan, and Ali Fatoni are with Departement of Electrical Engineering, Faculty of Industrial Technology, Institut Teknologi Sepuluh Nopember, Surabaya, 60111, Indonesia. E-mail: aditya.prasetyo13@mhs.ee.its.ac.id; katjuk@ee.its.ac.id; fatoni@ee.its.ac.id.

II. Fuzzy Kohonen Network

FKN is one type of Neuro-Fuzzy method which is the result of integration between fuzzy logic and neural network (Kohonen) [2].

FKN technique, the weighting is obtained from the prototype to the changing patterns of input patterns [3]. The pattern comes from experiments using some sample data and will ultimately obtained the corresponding weights. Each pattern prototype made interconnected with one rule in the rule table. The overall structure of FKN can be seen in Figure 3.

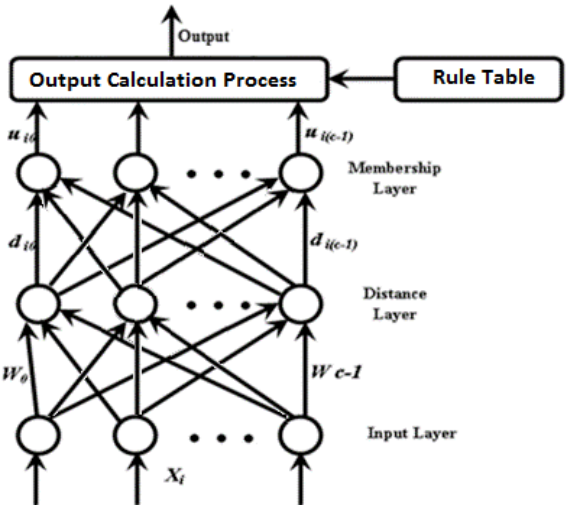

Figure 3. FKN Structure.

RESULT AND DISCUSSION

Once the program FKN has invested in mobile robot and visual program on the server computer that displays the robot movement data, curve DC motor, the trajectory and the camera has been made, then the Figure 4 is a view when the robot has successfully hit the target.

Tests performed 10 times by putting the robot at the starting point with the same pixel x = 38 and y = 25, whereas the target pixel point is the value of x = 240 and y = 100.

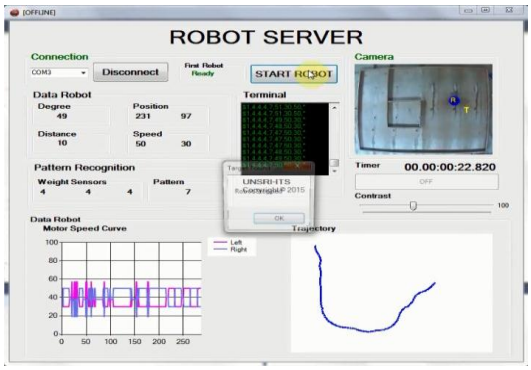

Figure 4. Robot Server Visual.

From these tests obtained average time search target of 23252 miliseconds and the average distance of the target was found in 8.92 pixel. Below is a table 1 which shows the results of the test.

TABLE 1. TABLES OF TEST RESULTS

Order Test	X Point (Pixel)	Y Point (Pixel)	Degree (°)	Distance (Pixel)	Time (ms)
1	228	102	53	8.54	23033
2	232	103	75	8.54	23469
3	232	99	50	8.06	23683
4	231	104	73	9.85	23694
5	232	104	63	8.94	23798
6	231	99	52	9.06	23680
7	232	98	49	8.25	23037
8	231	103	62	9.49	23251
9	232	96	59	8.94	22378
10	231	97	55	9.49	22492

CONCLUSION

Based on the test results are known FKN method has been successfully implemented as a navigation for target seeker mobile robot through pattern recognition. By using FKN method, the target can be found quickly and precisely.

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