

# Design of Autonomous Mobile Robot Navigation System Using Fuzzy Kohonen Network Method

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## Abstract

*Navigation is a technique for determining the position and the direction of an object to travel in the real environment. This navigation system is implemented on an autonomous mobile robot in order to determine the position of the robot on its environment and to determine the direction of the movement. In this project, Fuzzy Kohonen Network (FKN) method is applied as an autonomous mobile robot navigation system. This method is chosen because it has a fast response movement in avoiding obstacles on the several environmental conditions and able to recognize patterns of the surrounding environment, so that the robot can move freely and precisely by itself.*

*In this project, a hardware module that used to detect environmental patterns is 5 pieces of infrared proximity sensors which are placed at 5 directions. Hardware modules that use of the robot actuator are 2 pieces DC-motor that are placed on the left and right, and a free-wheel in front. In this project, reliability testing of robotic navigation system is conducted for 21 environmental classifications, simple environment, complex environment and unstructured environment that result compared with the Fuzzy Logic method.*

*As results of validation of proposed technique such as the percentage of success for pattern recognition is 86, 67 %and time processing of FKN method known 160 ms faster compared to Fuzzy Logic method. In the simple and complex environment, the data is obtained for the change angle of FKN is  $28,24^\circ \rightarrow 28,63^\circ \rightarrow 29,02^\circ \rightarrow 29,80^\circ$ , while the Fuzzy Logic is  $12,16^\circ \rightarrow 13,33^\circ \rightarrow 13,73^\circ \rightarrow 29,80^\circ$ . From these data the robot-based FKN known action movement by recognizing patterns encountered, while the Fuzzy Logic method action is slower because it is based on the calculated speed of the active rule. In unstructured environments, the robot navigation system with Fuzzy Logic stop at the position of time  $432 \times 32$  ms (unstructured environment 1) and at position  $288 \times 32$  ms time (unstructured environment 2), while in the robot navigation system using FKN successfully exploring the environment.*

**Keywords:** Robot Navigation System, Autonomous Mobile Robots, Fuzzy Kohonen Network, Pattern Recognition, Unstructured Environment.