Multilayer ProcessingArchitecture
of RAM Based Neural Network with
Memory Optimization for Navigation System

AhmadZarkasi[#1], Aciek Ida Wuryandari[*2]

[#]*Study Program Computer System, Faculty of Computer Science, Sriwijaya University,*

Jalan Palembang-Prabumulih Km. 32, Indralaya, OI, South Sumatera 30662, Indonesia

[1]zarkasi98@gmail.com

[*]*School of Electrical Engineering and Informatics*

Bandung Institute of Technology, Ganesa Street 10, Bandung 40132, Indonesia

[2]aciek@lskk.ee.itb.ac.id

Abstract—**Robots also have been trusted to help human to complete difficult jobs, for example, finding for the earthquake, a fire, or a sinking ship victims. The robot must be reliable, clever and moving automatically. The aim of this study is to develop and apply the application of artificial RAM-based neural networks (WNNs) on a mobile robot using a multilayer processing architecture with memory optimizations on to address and input pattern, so that producing smart navigation model which it has a simpler computational load and faster execution time. The gained result from the first study was the percentage of memory optimization in the amount of 50%. This result obtained from the formerly RAM using 8 bit data width has been optimized to 4 bits. Both of the percentage of data optimization pattern is 93.75%. This percentage is obtained from the optimization pattern (pattern taken is 4 bits MSB), each 1 bit data can handle 15 unseen patterns**

Keywords—**RAM based neural network, mobile robot, multilayer processing, memory optimization.**

I. INTRODUCTION

Robots also have been trusted to help human to complete difficult jobs, for example, finding for the earthquake, a fire, or a sinking ship victims. The robot must be reliable, clever and moving automatically. It is very important if a robot has a high level of smart navigation to avoid the bad things that might happen.One of application of smart navigation model is using RAM-based neural networks technique[5]. The neuron model used in the great majority of work involving neural networks related to variations of the McCulloch-Pitts (1943) neuron, which be called the weighted-sum-and-threshold neuron, or weightless neural networks [2].

Theimplementation of the network operation requires the use of multiplier unit, whichcan be problematic for embedded application due to the large size of resourcebecause the training the generalized data required both the forward propagationphase and backward (back error) propagation phase. A typical weighted neuronspecifies a linear weighted sum of the inputs, followed by some non-lineartransfer function [3]. The complexity of the training algorithm has limited its implementation in dedicated hardware. In contrast, the ANNs investigated are based on artificialneurons which often have binary inputs and outputs, and no adjustable weightsbetween nodes

Application ofmultilayerprocessingarchitectureisgoodforthedesign ofintelligentmobilerobotnavigation system, whichusesalot ofinputpatterns(2^n). Mechanisms which is conducted on this study is by grouping of input patterns (a number of 2^n) and output patterns into a few small groups, each group data will be processed to a certain extent, until produce expected output data. Memory optimization is done by using the strategy that only processing data 4 bits of most significant bit (MSB). On the other hand the algorithm will help solving data processing problems in each group of data in certain level.

Thistechniquewasexpectedtoimprovethe performance ofsystemsthathave been studiedpreviously.Techniquewas choosing because ithasa highspeedwhen processingthe input data, can tolerate inaccuracies in the environment,and couldbeen tracedto maphis surroundings. Performance of system that measured was percentage of memory optimization (memory bandwidth), percentage of patterns optimization (unseen pattern), successin recognizingthe environmentandspeed of mobilerobotto reachthe target.