DE LA SALLE UNIVERSITY

DEVELOPMENT OF AN INTELLIGENT (NEURAL NETWORK)
NAVIGATION SYSTEM FOR AN AUTOMATED GUIDED VEHICLE

A THESIS PRESENTED TO THE FACULTY OF THE GRADUATE SCHOOL
DE LA SALLE UNIVERSITY

IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE
MASTER OF SCIENCE IN ELECTRONICS AND COMMUNICATIONS ENGINEERING

SUBMITTED BY :

EDWARD T. ONG

DECEMBER 13 , 1993

ABSTRACT

With automation now spreading throughout factories automated guided vehicles have found their way into the shop floor and have become important ingredients in modern manufacturing systems. They are essentially mobile carriers which can automatically route or position itself. The navigation system developed can maneuver a mobile vehicle intelligently (based upon previous training) toward the final destination. This system will not depend upon external cables, rails or painted lines as was used by the existing automated guided vehicles.

The navigation system will have machine intelligence as implemented by two Neural Networks. The first Neural Network was implemented in hardware (analog blocks), to provide the basic instinct behavior of the system. A set of work sheets were developed to provide off-circuit training through the use of PC. After the training sessions, the proper weights can be placed in the hardware implementation of the Neural Network.

The hardware implemented Neural Network will implement a form of charge particle method of navigation. The system will be repelled by obstacles and attracted to the destination. Obstacle sensing will be implemented through ultrasonic circuits. The advantage of hardware implementation is fast response, and this is appropriate for the basic instinct of the system. The basic instinct control always has the highest priority,this implements the safety considerations of the vehicle. The first part of the thesis document discusses how the hardware can control the vehicle alone. As can be seen this provides the navigation system a limited capability.

Due to the disadvantages of using the hardware neural network alone,a better approach was considered. The behavior of the first Neural Network has undergone some minor changes, and another Neural Network was developed. Eventually we have two Neural Networks taking their corresponding turn in navigating the vehicle. The second Neural Network will be implemented as a computer program to provide flexibility. The control priority for the second network has a lower priority than the first. This second network will be trained to model learned behavior. This learned behavior can come from two sources. One source can come from an initial training on the environment path condition, another will be from feedback provided by the first network. Eventually we will have a sort of hierarchical control. The highest level will model learned behavior (Neural Network 2) which has the lowest priority. The lowest level will model instinct behavior (Neural Network 1 H.ware) which has the highest priority.

The development of such a system requires research on two major fields, Neural Network technology and Robotics engineering. The research targets to integrate the two technology together forming the foundation technology.

APPENDICES