UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FACULTY OF ELECTRICAL ENGINEERING

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FINAL YEAR PROJECT

AUTOMATED GUIDED VEHICLE

(AGV)

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AUTOMATED GUIDED VEHICLE (AGV)

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A report submitted in partial fulfillment of the requirement for the degree of Bachelor of Engineering

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

JUNE 2012

I declare that this report entitle "*Automated Guided Vehicle (AGV)*" is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : ……

Name : JULIE AIDAH BINTI JUSIN

Date : ……

To my beloved mother and father

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ABSTRACT

The construction of Automated Guided Vehicle (AGV) model has been created all over the world. It gives many advantages in our lives and work just as a robot. It can done it task without complaint. AGV is a system that moves following a line from one point to another point regarding to it given task. This kind of technology can be found appliance at factories, offices, hospitals and even houses. The aim of this project is enhance a simplest circuit of AGV system that comes with low prices and user friendly. PIC16F877A microcontroller is use to control all navigation during the operation of AGV system. The advantage of this prototype is it has an ability to follow line on and can be further developed to do more complicated task in real life. The microcontroller is attached to a sensor that continuously reflecting to the surface condition. Therefore, this project involves of designing and fabrication of the hardware and circuitry. The main importance in this project is the algorithm to assembly language, embedded in the microcontroller. Then, the H-bridge will be use as the DC motor drive. At the end of this project, the AGV can move following the line regarding to the task that will be given.

ABSTRAK

Pembinaan model AGV telah dicipta di seluruh dunia. Ia telah memberikan banyak manfaat dalam kehidupan seharian kita dan bekerja sebagai robot. Ia boleh melakukan tugas tanpa sebarang rungutan. AGV adalah satu sistem yang bergerak mengikut garisan dari satu tempat ke tempat yang lain berikutan dengan tugas yang telah ditetapkan. Teknologi ini boleh dilihat diaplikasikan di kilang-kilang, pejabat, hospital dan tidak terkecuali di rumah. Matlamat utama projek ini adalah untuk menambah baik pulih litar yang ringkas bagi sistem AGV yang telah sedia ada. Pengawal PIC16F877A digunakan untuk mengawal semua pergerakan sistem AGV. Kelebihan sistem ini adalah ia bergerak mengikuti garisan berpandukan pengesan dan mampu melakukan kerja yang rumit dalam kehidupan sebenar. Pengesan akan disambungkan pada pengawal untuk mendapatkan bacaan dan membolehkan AGV bergerak. Oleh itu, projek ini melibatkan penyambungan litar dan pembinaan bahasa himpunan dan dimasukkan ke dalam sistem pengawal. H-jambatan akan digunakan sebagai pemacu DC-motor. Pada akhir projek ini, AGV boleh bergerak mengikut garisan berpandukan pengesan untuk melakukan tugas yang akan diberikan.

TABLE OF CONTENT

LIST OF FIGURE

LIST OF TABLE

LIST OF APPENDIX

CHAPTER 1

INTRODUCTION

This chapter will give a brief explanation about this project including the problem statement, objectives also the scopes of the project. This project is to develop automated guided vehicle (AGV) by using microcontroller.

1.1 Problem Statement

Automatic Guided Vehicles (AGV) has been using since the 1950's. First AGV developed in 1954 by A.M.Barrett,Jr. The AGV used an overhead wire to guide a modified towing truck pulling a trailer in a grocery warehouse. Then, commercial AGV were introduced by Barrett. In 1973 Volvo developed automated guided vehicles to serve assembly platforms for moving car bodies through its final assembly plants. Later, Volvo marketed their unit load AGVs to other car companies. [5] Several important aspects of AGV system problem should be acknowledged and need an in-depth research in order to understand the problems. Nowadays, industries already used complicated control system of AGV which it's comes with high cost. So, by enhance and design a simplest AGV circuit it will automatically comes with low prices. Then, in the industries, human workers will take more movement to do their work. With the application of AGV system can ease the strain on human workers by performing tiring task such as lifting and carrying heavy material. In handle the heavy work, AGV is more effectively with no signs of creeping. Therefore, the valuable knowledge on AGV construction is very significant to be studied

and be further implemented from the result of this project. It will come with many benefits to our live and technologies.

1.2 Objective

The main objective of this project is:

i. To find information about circuit of AGV system and PIC programming
ii. To design and enhance a simplest circuit for AGV application by using PIC microcontroller.
iii. To construct and develop the prototype of the circuit design.

1.3 Project Scopes

The scopes of this project are:

i. Design and development of AGV system.
ii. PIC microcontroller control all the navigation of the AGV operation
iii. Produce one complete system that can be user friendly.

CHAPTER 2

LITERATURE REVIEW

In this chapter will explain about the literature reviews that been reviewed. In order to design and construct of AGV system, research in AGV need to be performed. This chapter would discuss the previous studies of AGV that have been developed. This literature review section will also provide knowledge and understanding the application of the AGV system.

2.1 Control and path prediction of an Automated Guided Vehicle Control (AGV)

This journal discuss about the development of an AGV. The navigation of the AGV will be control by Programmable Logic Control (PLC) module as shown in the figure below.

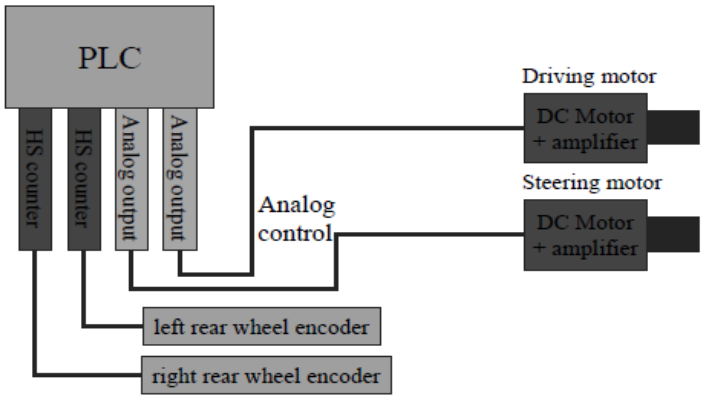

Figure 2.1: AGV command architecture

The position and orientation of the AGV will determined by the parameters of the motion are driving speed and steering angle. The input from both left and right rear wheel and analog output signal are interfaced with PLC module. Then, the steering and driving command signal can be calculated. The PLC convert the digital output to analog signal to drive amplifier of the driving motor and steering motor as shown in figure 4.1. The DC motor are been using in this project. [1]

The developed algorithm is based on memorised path and kinematics determination of the movement. The vehicle position and deviation are calculated from rear wheels rotation measurement. The steering and driving command are determined from this deviation. Localization of AGV by Kaman filtering algorithm is presented. Overall structure of designing AGV is described. Control of AGV motion is implemented by using PID control scheme. Displacement axis and steering axis are separated to implement the motion control. [1]

From this review that has been examined can be concluding that this kind of AGV has an ability to estimate and adjust the error sources during it position and orientation along the defined path. However, there is no safety that has been developing for this kind of technology in this project such as to detect any obstacle.

2.2 Makespan Minimization of Machines and Automated Guided Vehicles (AGV) Schedule using Binary Particle Swarm Optimization

This paper discuss about the implementation of Flexible Manufacturing System (FMS) to the AGV task. FMS is a high automated machine cell that controlled by a computer system. At the factory, the AGV need to do more than one task. So, this study is based on minimizing the total completion time of the AGV by using Binary Particle Swarm Optimization (BPSO). The algorithm is developing to control the navigation of the

AGV by using MATLAB software. Among the elements in the implementation of AGV is task scheduling. The efficient of scheduling will reduce the cost of delivery. [2]

As the conclusion, the schedule of AGV can be minimizing by using BPSO. The BPSO managed to provide a better optimization solution particularly for simultaneous scheduling of machines and automated vehicles in production environment. This kind of method can be implementing in the simple development of AGV's project.

2.3 Automated Guided Vehicle (AGV) using 68HC11 Microcontroller

This project is about an AGV prototype can move on a flat surface with its two driving wheels and a free wheel. The prototype will be control by M68HC11 microcontroller which it acts as main brain that will control all the navigation and responses to the environment. This project just develops for line follower. The ability to follow line on floor was an advantage of this prototype as it can be further developed to do more complicated task in real life. It using voltage sensor to detect the line. [4]

Therefore, this project involves both of designing and fabrication of the hardware and circuitry. The key study in this project is the algorithm designed in assembly language, embedded in the microcontroller. This prototype is able to move on a flat surface and move along black line on a white surface, depending on how much of the darkness and brightness of the surface as well as the width of the line.

The microcontroller MC68HC11 can be use to control all the navigation of this prototype. The microcontroller is the important part that makes this prototype has quite a simple circuitry, as it already has complete internal circuitry in the chip. The line follower sensor and the DC motors are very reliable and suitable for the prototype. As the sensors gives continuous input to the microcontroller about the surface physical variables. There is no safety for the prototype of this project that has been installed.

2.4 Development of control system for Automated Guided Vehicle (AGV)

This project was focused on development of the control system for Automated Guided Vehicle (AGV). It concentrates on developing the control system for the AGV operation, movement and loading & unloading mechanism. The objectives of this project are to develop the control system parts involving by using the electronic circuit system and computer programming. The wired guided navigation will communicate with the computer to the AGV to ensure the AGV work proper according to its operation. Subsequently, this kind of project needs to be fabricating each of the electronic com9ponents to become one complete circuit. All the computer programmings are building by using Code Blocks software, the compiler which is compatible with electronic components and Visual Basic software. Afterwards, Visual Basic 6 is used in this project to create user friendly interface which is better than C interface (Command Prompt). [6]

2.5 Carrying Robot (C-Bot)

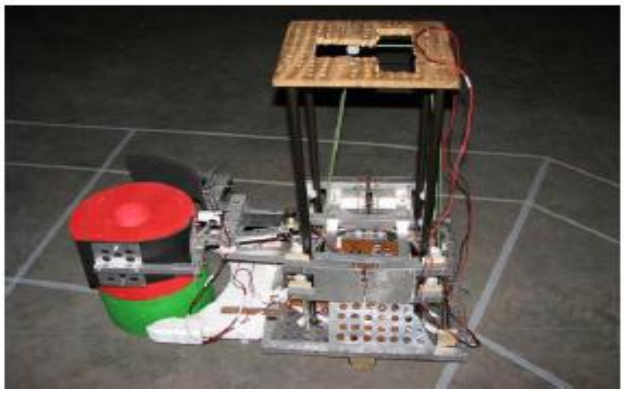

Figure 2.2: C-Bot

This kind of robot is was one of type of AGV application. It was designed to move in linear or curved route. C-Bot has a gripper tat function as gripping the work piece. It uses a high torque of servo motor for both function of gripping and vertical movement.

Then, it also uses dual motor drive system where both of the motor were coupled directly to the wheel. The safety bumper is use to detect any obstacle that come in front of its way. In the prototype, there were three wheels with two independently controllable wheels at the front and a free unpowered caster at the back. [3]

2.6 Microelectronic (MicroC)

MikroC is a powerful, attribute rich growth tool for PIC microcontroller. It is designed to present the programmer with the easiest possible solution for developing applications for fixed systems, without compromising performance or control. This kind of software is easy to built programming compare to the other software. While develop the programming, this software will show if there is any error. The operation of the AVG is design in the C language and imbedded in the PIC microcontroller. PIC and C fit together well which PIC is the most popular 8-bit chip in the world, used in a wide variety of applications, and C prized for its efficiency, is the natural choice for developing embedded systems. [7]

MikroC allows quickly developing and deploying complex applications. First, write C source code using the built-in Code Editor (Code and Parameter Assistants, Syntax Highlighting, Auto Correct, Code Templates, and more. Then, use the included mikroC libraries to considerably speed up the development: data acquisition, memory, displays, conversions, communication. Practically all P12, P16, and P18 chips are supported. After that, monitor the program structure, variables, and functions in the Code Explorer. Generate commented, human-readable assembly, and standard HEX compatible with all programmers. The program flow should be tnspect and debug executable logic with the integrated Debugger and get detailed reports and graphs: RAM and ROM map, code statistics, assembly listing, calling tree, and more. [7]

2.7 7 professional

Proteus is a zero-power research operated at the Paul Scherrer Institute, Switzerland. High degree of flexibility in study about the wide range of a different system is one of its main characteristics. At present, it is being used to provide an extended integral database for the validation of modern light water reactor fuel designs. [8]

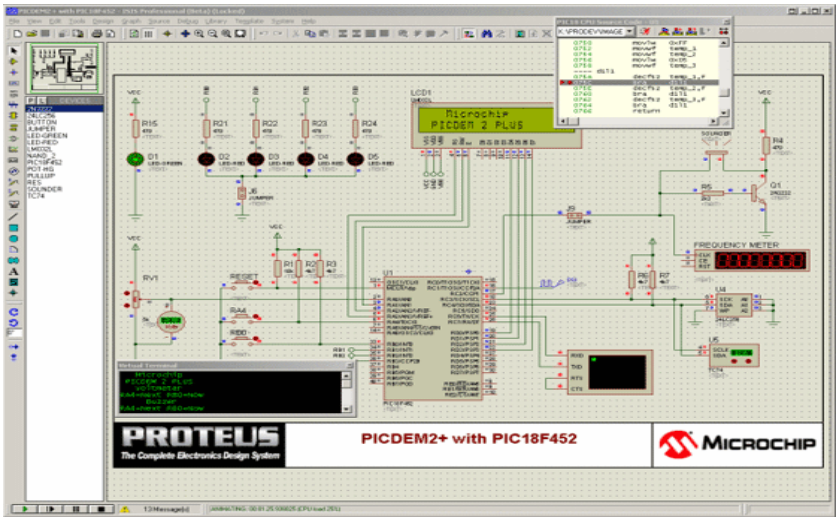

Figure 2.3: Proteus Virtual System Modelling

Figure 2.3 shows one the Proteus Virtual System Modelling (VSM) application. VSM combines mixed mode SPICE circuit simulation, animated components and microprocessor models to facilitate co-simulation of complete microcontroller based designs. The most exciting and important feature of Proteus VSM is its ability to simulate the interaction between software running on a microcontroller and any analog or digital electronics connected to it. The micro-controller model sits on the schematic along with the other elements of the product design. It simulates the execution of the object code (machine code), just like a real chip. [8]

CHAPTER 3

METHODOLOGY

In order to complete the final year project, a methodology has been organized to ensure the progress of the project running well and as a strategy to overcome problems. Project methodology also describes the procedures and methods been used to achieve the objectives of the project. Methodologies of this project are title understanding, literature review, comparisons, development programming, development of AGV operation, development for hardware and testing. Figure 3.1 show the flow chart of the methodology of the project.

The most highlighted method in this methodology is programming and hardware development. For software part are focus on circuit design, simulation and programming. Circuit designs consist of PIC circuit and power supply circuit. The circuit is design in Proteus 7.7 professional. MicroC software is to write a programming by using c language and compile it with PIC16F877A in the Proteus. Other than that, this project also using LCD to display the movement of the AGV prototype. Thus, the software part should be solve first before proceed to next step where the hardware part to generate the value of power.

Then, in hardware part Hardware part are focus on distribution board circuit, component assemble and circuit soldering. The main component used to construct this project is PIC 16F877A, Line follower (IR transmitter and receiver) sensor, analog distance sensor and LCD.