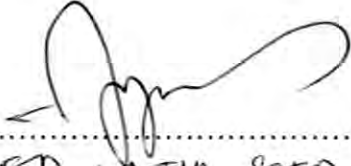


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Signature



.....

Supervisor Name

.....  
SYED NAJIB SYED SAUIM

Date

.....  
7/3/2005

**AUTOMATED GUIDED VEHICLE**

**LEE TAIN SANG**


**This Report Is Submitted In Partial Fulfillment Of Requirements For  
The Degree of Bachelor In Electrical Engineering (Industrial Power)**

**Fakulti Kejuruteraan Elektrik  
Kolej Universiti Teknikal Kebangsaan Malaysia**

**March 2005**

## ADMISSION

“I admit this report is written by me except the summary and extraction for each I have been clearly presented.”

Signature :  .....

Writer Name : LEE TAIN SANG .....

Date : 7-3-2005 .....

## DEDICATION

*A venture of this sort does not come without its pain.*

*The pain is usually felt by other people. But I really want to dedicate this report to*

*My beloved for providing moral support and encourage.*

## ACKNOWLEDGMENTS

Projek Sarjana Muda (PSM) is compulsory for a KUTKM student before being awarded the degree. This PSM report was being accomplished with the generous help of many people, who contributed ideas, time, reviews, suggestions, and encouragements.

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Last but not the least, I would like to thank my fellow friend for their kind and highly valuable advices directly or indirectly involved with my project.

## ABSTRACT

The main objective to develop Automated Guided Vehicle, AGV, for PSM is to construct a prototype of vehicle that can direct itself by following the program. The microcontroller 8051 model is used as AGV main controller which has variety of input devices and output devices. This prototype has two back wheel driven by a DC motor as main drive motor and two front wheels driven by a DC motor as steering motor. Both of the motor can change their direction by using the motor driver called H-bridge. In AGV operation system, the AGV loading goods and follow the track from one station to another station inspected by photomicrosensors. The photomicrosensor will generate the signal proportional to the strength of the image that the sensor detected and the image would become input signal to microcontroller. The microcontroller processed the signal and send information to the DC motors as an output. For collision avoidance, ultrasonic sensor will used to detect the obstacle. With this ultrasonic sensor, the AGV will stop automatically if there is any obstacle appeared in front of vehicle. In case of emergency, the radio frequency remote control is used to stop the vehicle.

## ABSTRAK

Objektif utama dalam membina kenderaan terpacu automatik untuk Projek Saujana Muda ini adalah melibatkan pembinaan prototaip sebuah kenderaan untuk tujuan penghantaran yang mana ianya mempunyai kawalan sendiri mengikut arahan yang telah diaturcarakan. Pengawal mikro model 8051 digunakan sebagai kawalan utama AGV yang mana ianya terdiri daripada pelbagai bahagian masukan dan keluaran. Prototaip ini mempunyai dua roda belakang yang dipandu oleh sebuah motor arus terus sebagai motor pandu utama dan dua roda hadapan dipandu oleh sebuah motor arus terus sebagai motor stering. Kedua-dua motor ini boleh menukar arah pusingan dengan mudah menggunakan pemacu motor yang dipanggil 'H-bridge'. Merujuk kepada sistem operasi AGV itu sendiri, ia menghantar barang yang diletakkan di atasnya ke stesen yang lain mengikut landasan yang mana landasan tersebut dikesan menggunakan pengesan mikrofoto. Pengesan mikrofoto ini akan menjana isyarat yang dikesan berkadaran dengan kekuatan imej yang dikesan yang mana ianya menjadi isyarat masukan ke pengawal mikro. Pengawal mikro akan memproses isyarat tersebut dan menghantar maklumat ke motor arus terus yang bertindak sebagai satu keluaran. Untuk mengelakkan perlanggaran, pengesan ultrasonik digunakan untuk memastikan segala halangan yang dapat dikesan. Dengan adanya pengesan ultrasonik ini, AGV tersebut akan berhenti secara automatik sekiranya terdapat halangan di hadapan. Untuk kes kecemasan, alat kawalan radio frekuensi digunakan untuk memberhentikan kenderaan.



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## **CHAPTER 1**

### **INTRODUCTION**

This chapter will discuss the introduction of automated guided vehicle, the project objectives, problem statement and scope of the project. The end of this chapter will list the dissertation outline.

#### **1.1 Introduction**

In a typical factory layout, there are various machine sections between which the flow of materials takes place by method of automated guided vehicles. Automated guided vehicles are among the modern material handling equipment in manufacturing plants. They are preferred to their counterpart and non-computer controlled systems due to their flexibility, and to robots due to their mobility. AGV application also leads to increased productivity and improved product quality [1].



The concept of an automated guided vehicle system includes all transport systems, which are capable of functioning without driver operation. AGVs find various applications in the industry and can be of various types. Some of the industries where AGVs are used are newsprint, distribution, warehouse, food, pharmaceutical, apparel, communications equipment, household appliances, motor vehicles and parts, office and computer equipment, cosmetics, toys, athletic goods, electronics manufacturing, textiles, paper production, etc [2].

AGVs are also classified on the basis of capacity. There are AGVs available for high capacity loading as well as for unit loads with various different specifications.

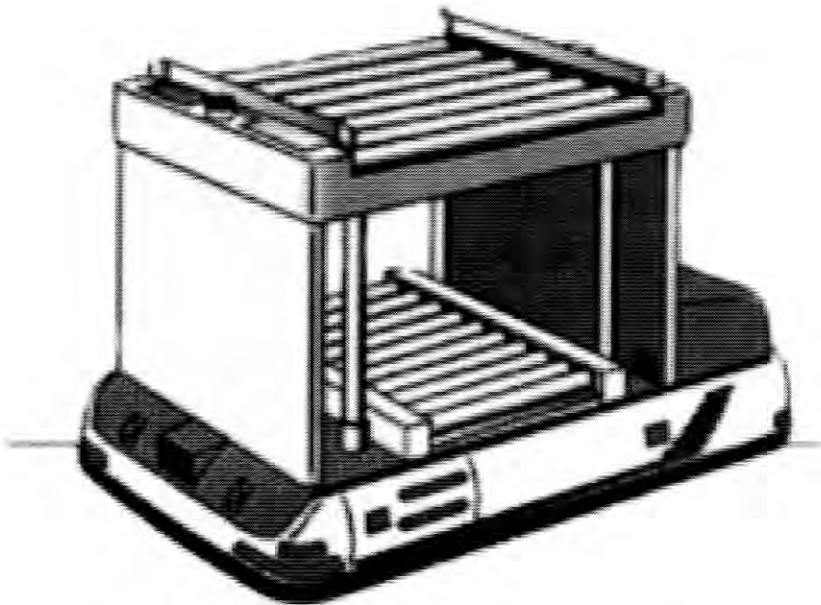


Figure 1.1: An Example of Automated Guided Vehicle

## 1.2 Objectives

The Automated Guided Vehicle is developing to help the industries delivery the load from one station to another station automatically. The Automated Guided Vehicle prototype has been designed and constructed with a low cost material but high flexibility. Low cost has been achieved by using simple, reliable systems that are based on readily available off the shelf components [3]. The AGV prototype compliments the desire for low cost, since the vehicle can be configured for a specific application by including only those features that are necessary. Thus, the title of Automated Guided Vehicle is chosen for PSM and the objectives of the project are to :

- a) Design and construct a AGV prototype by using microcontroller as control unit in AGV operation system.
- b) Develop an assembly language program for smooth AGV operation system.
- c) Investigate the suitable sensor that can be used for AGV to detect the track precisely.
- d) Create a stable motor control system by using H-bridge motor driver.
- e) Design an intelligence system to ensure AGV can be stop immediately during emergency and obstacle detected.

### 1.3 Problem Statement

The Automated Guided Vehicle System still new and not much apply in local industry. Because of AGV System is still new for local industry, the application is rarely used in local industry compare with developed country.

The Automated Guided Vehicle is developed to replace the traditional method such as deliver the load manually in industries. The manufacturer use fork truck even manpower delivery the load from one station to another station. The workers maybe forget which station for loading and waste the user's time. Besides, this method will waste the manpower and money.

The AGV system used in industry is given good efficient output than workforce. The system can deliver the load automatically from one station to another station. This system will save a lot of working space as the path is fixed. The user also can save the manpower and money.

The AGV for market price is very expensive and only marketing place mostly focus in manufacturing factories. The AGV project is the best chance to build a low cost but flexibility prototype. With the lower cost AGV product, it may widely commercialize in medium or small company for future planning.

## 1.4 Scopes

Generally, all project have own scope or limitation as a guideline. The Automated Guided Vehicle Project aspires to construct a vehicle automatically guided with some intelligence way to choose the correct path of travel. Hence, the following scopes are been highlight for primary selection as below :

- a) AGV System is controlled by using the model of 8051 microcontroller. The microcontroller must be working effectively as control unit or as the brain of AGV System.
- b) The AGV program is written by using assembly language program.
- c) The good sensitivity sensors are used as navigation guidance for AGV. The sensor able to sense the track and give the input signal correctly as a feedback.
- d) An ultrasonic circuit is design and build up for AGV obstacle avoidance system.
- e) A pair of radio frequency remote control circuit is design and build up to stop the AGV in case of emergency.
- f) Build up and construct a prototype of AGV.



## 1.5 Dissertation Outline

The dissertation has been organized with a set of chapters to encourage nonlinear use. Following is a synopsis of each of the chapters. This dissertation discussed the philosophy, design and implementation of Automated Guided Vehicle Project. Chapter 1 presents an introductory chapter, includes an introduction, project objectives, problem statements and scopes of project. Chapter 2 covered literature review of the automated guided vehicle that led the ideas to do this project. Chapter 2 is a microcosm of the entire dissertation because it introduces all of the aspect involved in AGV development technology, AGV system, and benefit. Chapter 3 is a set of project design and methodology in which an entire working automated guided vehicle is design, construct and programmed to exhibits various behaviors. Chapter 4 explains the result and discussion of the project. This chapter also discussed the problem, project schedule and project costing. Chapter 5 is about the conclusion from the project and including the suggestion for future planning.

## **CHAPTER 2**

### **LITERATURE REVIEW**

In this chapter, overview of automated guided vehicle and the development technology is discussed. From the AGV research, there are several type of AGV system including the drive system, control system, navigation system, communication system, safety system and AGV benefit.

#### **2.1 Overview**

An automatic apparatus or device that performs functions ordinarily ascribed to humans or operates with what appears to be almost human intelligence. A robot is a programmable multifunctional manipulator designed to move material, parts, tools or specialized devices through variable programmed motions for the performance of a variety of tasks. Robotics is the primary field in science and technology which is going to form the beyond of the human competition [4].

Automated Guided Vehicle, AGV, is one of the programmable robot term for dynamic vehicle to ensure the robot able to transport the load from one station to another station by moving accuracy and automatically on the track without human control. Automated guided vehicle systems are commonly used for transporting material within a manufacturing, warehousing, or distribution system. These systems provide for asynchronous movement of material through the system and are used in a wide variety of applications.

## 2.2 AGV Development Technology

For industrial view, AGV is driverless carriers use on factory floors mobile production platform or for material transportation. The first commercial automatic guided vehicle in the United States went into service in 1953. After 50 years, many technological improvements in AGV systems and the systems have been used to automate material handling tasks in many industries [3].

Modern AGV systems are represent a significant investment for a firm. The cost for a single AGV is very expensive and a systems that includes multiple vehicles, navigation aids, communication hardware, and safety devices can cost several times of the cost. The vehicle applied in production line, is used to carry material, parts, subassemblies, and products from one workstation to another one. AGV is difference from general vehicles as it is automatically guided by sensor and control system.

Rapistan Systems is one of the world's leading AGV system companies; able to retain total control of its own technology. From onboard controls to vehicle frames,



Rapistan Systems designs and manufactures critical components in its own vertically integrated plant [5]. The history of Rapistan Systems AGVS product group dates back to 1953 with the introduction of the world's first automatic guided vehicle. Since then, Rapistan Systems aggressive engineering has produced a series of breakthroughs, such as the first solid state controls (1962), the first microprocessor controls (1978), and the first autonomous guidance system - Virtual Path Guidance (1994) [5].

### **2.3 Automated Guided Vehicle System Research**

The automatic delivery system, Automated Guided Vehicle is a very important part of all for it's a kind of delivery vehicle that can direct load and unload goods from by following the guide route to do the motion as well as stop at the programmed work station. Being short of workers and high labor cost, the industries face difficult situation. Therefore, this is showing a tendency that automation become necessary in the industries. In fact, automated guided vehicle system has played an important part in automatic factory. The Automated Guided Vehicle Systems consist of several components, including the power source, drive and control systems, navigation and communication systems, and safety devices.

### **2.3.1 Vehicle Power Supply**

Normally AGVs operate on battery power with battery voltages ranging from 12 to 48 VDC. Batteries are commonly lead acid and are usually sized to last at least eight hours during normal use. The batteries are often recharged with an on-board charger that can be plugged into any conventional wall outlet. An alternative way for AGVs to operate around the clock is a power system that uses batteries that are easily swapped out and can be recharged off-line [3].

### **2.3.2 Drive System**

Automated Guided Vehicles use differential drive where two drive wheels, one on each side of the vehicle and each driven independently. Further mechanical support for the vehicle is provided by caster wheels. Thus, AGV can typically move in either forward or reverse direction, turn either right or left, or spin around in place. Most vehicles use four quadrant drives for speed control in which wheel can be accelerated or decelerated in either the forward or reverse direction. Deceleration is accomplished via dynamic braking where the motion of the vehicle is used to generate power back into the batteries. This provides excellent speed control on ramps or uneven surfaces as well as improving efficiency and therefore battery life.