CONTROLLING AGV VIA PC

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MAY 2006

"I hereby declare that I have read through this report and found that is sufficient in terms of scope and quality to be awarded of the degree of Bachelor in Electrical Engineering (Industrial Power)."

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Date : 4/5/2006.

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This Report Is Submitted In Partial Fulfillment of Requirements for the Degree of Bachelor in Electrical Engineering (Industrial Power)

Faculty Of Electrical Engineering
Kolej Universiti Teknikal Kebangsaan Malaysia

"I hereby declared that this report is a result of my own work except for the excerpts that have been cited clearly in the references"

Signature : .....

Student : **MOHD IRFAN BIN MOHD**

Date : **MAY 4 2006**

This dedicated to my beloved father and mother

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ABSTRACT

This project is about controlling a model of AGV via personal computer. The based aspect and characteristic of this project is to implement the theory of sending data between two main devices using the serial port RS232. The project was divided into two major sections which is the input section and the output section. The input section consists of a pc and the microcontroller circuit while the output section includes the relay circuit and the wireless transmitting and receiving circuit. All data will be sent in decimal form to the brain of the project which is the microcontroller 16F877A. In testing and creating the system, a remote control car will be used to replace the AGV. The user only has to insert the input range of 0 to 255 in decimal to the panel command box and click the command button to send the data. The data will be convert to binary form by the MAX232 and the least significant bit is set as and the output from the microcontroller output port. An additional relay circuit needed as a switch to connect the supply 9V to the transmitter circuit. The controller circuit acts to send the signal operated by the microcontroller to the receiver transmission at the car. So the output of the user input is that the car will move according to the given input. This project can be applied to the industry where involving many AGVs. It will act as the supervisory system to all the AGVs and has the ability to interrupt the main routine of each the AGV. In this case, the system will surely avoid the AGV from involved in collision or hitting each other that will cause a major disturbance to their operations. At the end of this report, there will be stated the achievement of the objectives of this project. Other than that, the recommendations to improve the project to be more users friendly are given.

ABSTRAK

Projek ini adalah berkenaan mengawal suatu model 'AGV' menggunakan komputer peribadi. Aspek dan ciri-ciri asas yang digunakan di dalam projek ini adalah berkenaan teori penghantaran data diantara dua peranti utama dengan menggunakan pot serial RS232. Projek ini terbahagi kepada dua seksyen utama iaitu seksyen masukkan dan seksyen keluaran. Seksyen masukkan terdiri daripada komputer peribadi dan litar mikropengawal manakala seksyen keluaran pula merangkumi litar geganti dan litar penghantar dan penerima tanpa wayar. Kesemua data akan dihantar dalam berbentuk desimal kepada otak projek ini iaitu mikropengawal 16F877A. Dalam pengujian dan mengolah sistem, kereta kawalan jauh akan digunakan menggantikan 'AGV'. Pengguna hanya perlu mamasukkan masukkan berjulat 0 hingga 255 dalam bentuk desimal pada panel arahan dan menekan punat hantar untuk menghantar data. Data akan diubah kepada bentuk binari oleh peranti MAX232 dan bit terendah akan ditetapkan pada pot keluaran pada mikropengawal. Litar geganti tambahan diperlukan sebagai suis untuk menyambungkan sumber bekalan 9V kepada litar penghantar. Litar pengawal bertujuan menghantar signal yang dihasilkan oleh mikropengawal kepada litar penerima pada kereta kawalan jauh. Jadi, hasil daripada masukkan pengguna, kereta kawalan jauh akan bergerak berdasarkan nilai masukkan yang diberi. Projek ini dapat diaplikasikan kedalam industri yang melibatkan banyak penggunaan 'AGV'. Ia akan berfungsi sebagai pemantau system kepada semua 'AGV' dan berkebolehan mengganggu rutin utama setiap 'AGV'. Dalam kes ini, system akan memastikan kesemua 'AGV' tidak berlanggar atau pelanggaran yang akan menyebabkan gangguan besar pada operasi mereka. Pada akhir laporan ini, terdapat kesimpulan yang menceritakan tentang pencapaian objektif projek ini. Selain itu, cadangan bagi memperbaiki projek ini supaya lebih mesra pengguna ada diberikan.

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CHAPTER 1

INTRODUCTION

1.0 Controlling a model of AGV via computer

This project outlined in this document concerns the development of inter connection between two devices to control an AGV (Automated Guided Vehicle). The system will track an AGV and provide instructions for the movement of the AGV. One way to achieve this is through serial communication. Controlling an automated guided vehicle (AGV) is a main project which is Design & Implementation of Intelligent Vision-based AGV System. The scope of project is minimized to satisfy the final year project. Refer Fig. 1 to view the block diagram of the main project. This project is about controlling AGV via computer monitored by a camera. The AGV will able to move in its territory viewed by a camera located above the AGV. When the AGV move across the range of the camera's view, it will create a signal and send to the computer. The computer will process the signal and send a command to the model of AGV to turn around and just move within the area under the camera vision.

Generally, the implementation of this project is applicable to control the movement of the radio frequency car that will be controlled by the computer as a controller and link by the serial communication. That will include the microcontroller circuit, which are the hardware design, the modification of existing RF circuit and supply circuit for the microcontroller circuit.

The process input represent the movement of the RF car will be programmed and the programming will be kept in the EPROM (Erasable Programmable Read Only Memory) which already inside the microcontroller that will be use.

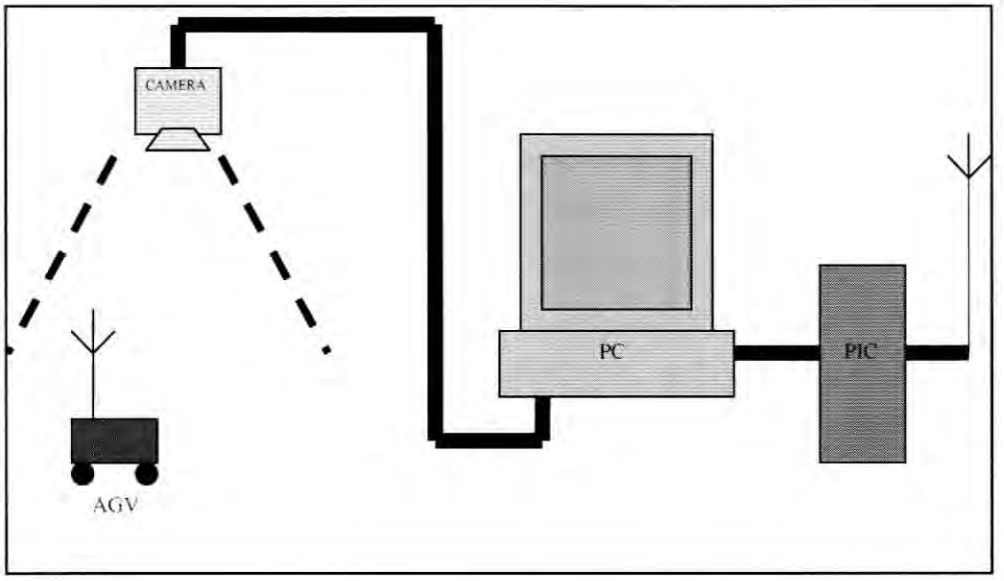

Fig. 1: Overview of the main project

1.1 Problem statement

Nowadays, the usages of automated guided vehicles are widely used not only in industries but also being implemented to daily activities. The idea of creating this system is overcome an expected problem which could effect the movement of the AGV. An AGV is devices which are well known of its self controlled mechanism. The AGV will be able to move and make decision by it own. In the other hand, if our industries nowadays were full with AGV, there might be unexpected incident happens such as collision might occurs.

To overcome the problem, systems to interrupt the movement of the AGV should been construct. The system should be able to guide an AGV using computer as an input. In the real world, the computer represents the supervisory control room for the AGV. So,

the project is lack of a system which is used to create communication between computers to the AGV. Other then that, the implementation of microcontroller in the system eases the process of the interrupting process of an AGV. To accomplish that, a circuit and system had to be construct from PC to the model of AGV through a microcontroller and a RF (radio frequency) circuit.

So, it is my responsibility to construct a system and held an experiment to identify the characteristic and implementation of the system. Along this project, a remote controlled car will be used represent the AGV. So, the microcontroller will act to interrupt the movement of the AGV and to collect data from the computer. The main idea of this project is by applying the serial interfacing concept. As a result, the aim of this project is to send a signal from computer to PIC and might as well control an RF control car via computer using serial communication. As a conclusion to the problem statement is that a system to interrupt the movement of an RF control car represent an AGV is needed to organize the AGV activities.

1.2 Scope of work

The scope of this project is to create communication between two devices which is the computer and the RF control car. The microcontroller will acts as the interfacing device between these two devices. The computer function is to send data through the microcontroller and move the RF car according to the input. From Fig. 2 the block diagram represent the scope of the project. It is a part of the main project which is minimized focusing the main communication of the project. The input at PC is being sent to the PIC using serial port in the form of ASCII codes. The serial port is an Asynchronous port which transmits one bit of data at a time, usually connecting to the USART Chip. At, the receiving end of the communication, the data received will be process by the MAX232. To continue the sending and processing data, processor used is 16F877A as a microcontroller device in this project. It is used because it is cheaper and much easier to use which only contains 35 commands for complier. The PIC will give

output to the transmitter device. In this section, the concept of RF (radio frequency) communication is used to communicate from transmitter to the receiver of RF car.

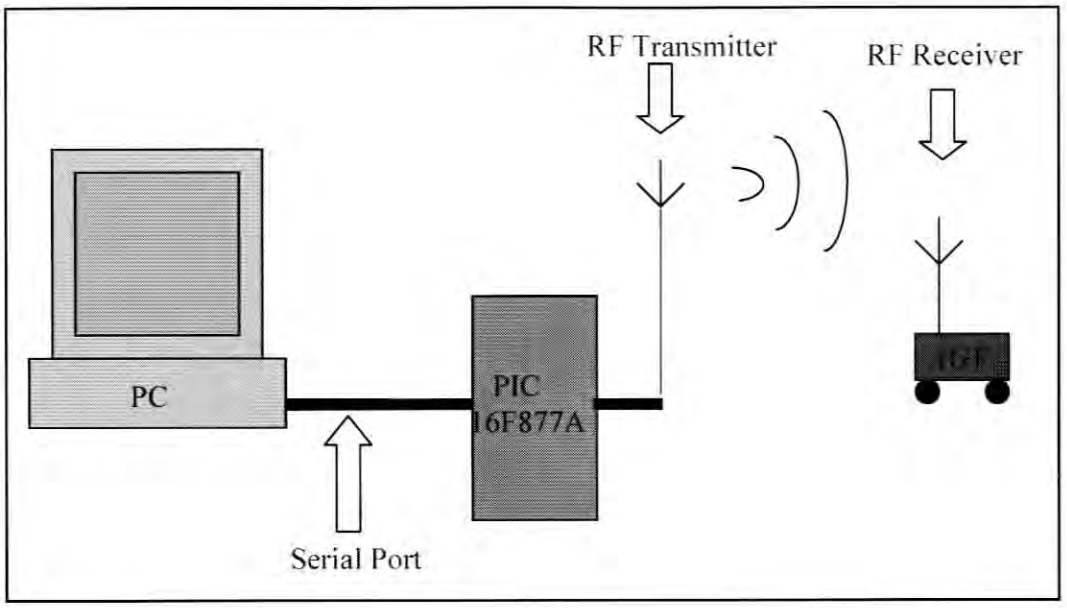

Fig.2: Scope of the project

1.3 Objective

The objectives are the element that measures the success of this project. For the project, the main objectives are to control an RF car which is as an AGV in the main project. There are sub objectives which support the project to accomplish. The sub objectives represent the solving method of the problem statement. Each problem statement given follows with a solution in order to create the connection and might as well bring success to the project.

The project is divided into three section which involving different ways of communication and data collecting. The main part of this project is to give input from personal computer to the PIC. In order to full-fill the needs, the communication between

PIC to the personal computer is established. The input from the PC will be able to reach the PIC for further operations.

As soon as the input is received by the PIC, an assembler programming codes will play their role to convert and collect data in order to interrupt the movement of the AGV. The programming codes must be able to receive input data and translate into pulse form as an output of the PIC. The programming codes are supported by the microcontroller circuit.

The final process is to connect the PIC to the modified the existing radio frequency circuit (RF). The function of this circuit is to transmit the signal in the form of High/Low from PIC to radio frequency signal form. In this section, the usage of existing RF circuit involved to represent the AGV.

As a conclusion, the objectives for this project are:

1. To establish communication between computer and microcontroller.
2. To be able to send signal from microcontroller to the transmitting device.
3. To construct source code that controls the flow of the system.

1.4 Project outline

This project report is organized into five chapters. Chapter one is a general introduction and outline of this thesis topic. The first chapter introduces the problem to be solved and how this report hopes to accomplish a solution to that problem and the objectives of this project. Chapter Two discusses about the theory which is reliable and useful to bring success to this project. Other than that, the introduction of the component and particular items used will be exposed. The existing or similar project done will be roughly reviewed in this chapter. Chapter Three discusses the steps of methodology including experiment to gain information and mention about software

involved with this project. All of the programming done in relation to this project is either in PICC-lite. The requirements for sending serial data over an RS-232 link are discussed. Chapter Four and Five are the most important chapter which includes the result, discussion and conclusion of the whole project. From here, the objective can be monitored to measure the success to the project.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This project involved a communication between a PC (personal computer) and PIC (microcontroller). There are many ways of creating communications between PC and PIC such serial and parallel operation. As for the serial communication type such as I^2C, SPI and USART each of these types of communications has their own advantages and disadvantages in their characteristics. So to choose the most suitable ways are by doing some literature review on this topic. Other than that, the function of literature review is to review the existing project which is similar to this project. The motive is to make a comparison and some observation to produce the method and variation of application of this project.

2.1 Computer controlled car

The first literature review entitles "computer controlled car" by D.K.L. Tung, Department of Computer Science and Software Engineering, Monash University (Clayton), Australia. The overview of the computer controlled car project is that it describes the process involved in bridging the existing system to a PC and details a vision-based track extraction method. A software-driven navigation unit is implemented

which enabled a RF car to drive itself autonomously by following a track. The use of *Autonodes* is motivated.

In this project, the existing prototype had three main components: a RF car, a video transmission unit and a modified hand-held controller. This section further describes the existing prototype architecture and the flow of information through different parts of the system. The prototype car itself had a camera and a video modulator mounted on board. When the video modulator began transmitting, the signal would be picked up by a VCR. This signal was then fed into a Silicon Graphics INDY computer. By analyzing the real-time images provided by the on board camera, a simple software navigation system was implemented. Sequences of moves were forwarded to the RF controller which in turn controlled the movement of the car. The basic architecture of the overall design remains the same this year. The following diagram illustrates how different parts of the system integrate together.

In order to interface this existing hand-held controller with a PC, a DIN-8 to RS-232 connection must be established. DIN-8 is a set of connection specifications. A DIN-8 port is commonly found in Macs and INDYs. In contrast, a PC is usually equipped with two RS-232, commonly known as a com port. A DIN-8 to RS-232 cable was sought after because the existing hand-held controller was only equipped with a DIN-8 connector output. Unfortunately, there were no such cables at the stores. A cable was constructed manually by breaking apart a DIN-8 to DIN-8 wire. One end of this wire was soldered onto a female type RS-232 connector. An extensive test on the controller command-set was performed and mapped. The command set available for navigation is summarized in the following table. The port parameters used must be: 9600, none, 8, 1, representing baud, parity, data and stop respectively.

The overall concept of this project functions involving sensor tracking and video conference to guide the RC car. The connection from the PC is established using the serial port RS-232. The project is more advance which implement the new hand-held equipment.

Value*	Symb	Action
0000 (0)	HALT	NIL
0001 (1)	↓	Backward
0010 (2)	↑	Forward
0011 (3)	↑ ↑	Forward (fast mode)
0100 (4)	→	Right turn
0101 (5)	→↓	Right & Back
0110 (6)	→↑	Right & Forward
0111 (7)	→↑	Right & Forward (fast mode)
1000 (8)	←	Left
1001 (9)	←↓	Left & Back
1010 (10)	←↑	Left & Forward
1011 (11)	←↑ ↑	Left & Forward (fast mode)
1100 (12)	HALT	NIL
1101 (13)		Same as 1
1110 (14)		Same as 2

*value represents the char value being sent to the serial port. (i.e: value 3 means '\003')

Table 1 : A Command set for controlling the movement of the car