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HARDWARE DEVELOPMENT OF BARCODE SCANNER

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This Report Is Submitted In Partial Fulfillment of Requirements for the Bachelor Degree of Electronic Engineering (Computer Engineering)

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ABSTRACT

To realize this project, extensive research and study have to be done on barcode scanner, LCD display, PIC microcontroller and interface circuit. It is crucial to find right program and hardware to interface all that. Meanwhile the usage of PIC microcontroller increases the efficiency in circuit serial programming. The purpose of this project is to design a mobile barcode scanner, which the data can be saved in PIC Microcontroller and monitor using LCD module interface. So, the objective of this project is to develop and design a circuit which consists of the combination of hardware such as barcode scanner, PIC Microcontroller and LCD module to produce a system that have input and output signal. The barcode scanner is device that transmits data to a microcontroller and the result will be shown up instantly on the LCD. An analogue signal is triggered and processed through an analogue to Digital converter circuit in which a PIC16F877A is used, and then the data will be transported to LCD. This PIC microcontroller program will be created by using MPLAB IDE. This project can be commercialized because it is cheap to built, easy to use, portable and also the program is easy to use.

ABSTRAK

Untuk menjadikan projek ini suatu kenyataan, kajian yang lebih mendalam perlu dilakukan berkenaan dengan pengimbas kod bar, paparan LCD, PIC pengawal mikro, dan litar penyambung. Ini adalah sangat penting untuk mencari dan mendapatkan program dan hardware yang betul. Sementera itu, penggunaan PIC pengawal mikro juga boleh meningkatkan kecekapan siri aturan (serial programming) di dalam litar. tujuan projek ini adalah untuk mereka cipta satu pengimbas bar kod yang mudah dibawa dan boleh menyimpan data di dalam PIC pemproses mikro dan boleh di kawal menggunakan modul penyambung LCD. Oleh itu, objektif utama projek ini adalah untuk membangunkan dan mereka cipta satu litar yang mengadungi kombinasi beberapa hardware seperti pengimbas kod bar, PIC pengawal mikro, dan modul LCD untuk menghasilkan satu system yang boleh menerima isyarat masuk dan isyarat keluar. Pengimbas kod bar adalah satu alat yang digunakan sabagai pemindah data paparan LCD menggunakan kaedah komunikasi selari. Isyarat analog akan dicetuskan atau dihasilkan dan diproses melalui alat analog dan kemudiannya kepada litar pengubah berdigital dengan menggunakan PIC16F877A. Kemudian data yang terhasil akan dihantar kepada LCD. Pengaturcaraan PIC pengawalmikro pula akan dibentuk menggunakan MPLAB IDE program. Projek ini mempunyai potensi untuk dikomersialkan kerana ianya lebih murah untuk dibangunkan, senang digunakan, mudah dibawa dan juga mempunyai aturcara yang mudah difahami dan digunakan.

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LIST OF ABBREVIATION

PIC	Peripheral Interface Controller
ADC	Analogue to Digital Converter
TTL	Transistor Transistor Logic
V	Voltage
VCC	Supply Voltage
VDD	Supply Voltage
VI	Input Voltage
VIN	Input Voltage
Vo	Output Voltage
Vout	Output Voltage
VSS	Ground
GND	Ground
XTAL	Crystal Frequency
Ω	Ohms
UART	Universal Asynchronous Receiver
USART	Universal Synchronous Asynchronous
SPBRG	Serial Port Baud Rate Generator
RS232	Standard 9-pin PC port
UPC	Universal Product Code

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

From the local convenience store to grocery and hardware stores, barcode scanners are used in almost every store for purchasing and inventory. Today's technology calls for a sophisticated means of capturing the barcode and processing the data. Barcode data collection systems provide enormous benefits for just about any business not only data collection is faster and more accurate, but costs are lower, mistakes are minimized, and managing inventory is very simple.

1.2 PROJECT OBJECTIVES

The objectives of this project are:

- To design a mobile barcode scanner, which it can save data in PIC Microcontroller and monitor using LCD module interface.
- to develop and design a circuit which consists of the combination of hardware such as barcode scanner, PIC Microcontroller and LCD module
- To produce a system that have input and output signal.
- To understand the function of barcode scanner, PIC Microcontroller as a processor and LCD display as a data presented.

1.3 SCOPE OF WORK

This barcode scanner project is a combination of hardware and software. Both are important to determine whether the system can function properly and as desired. Below are the scopes of work for this project;

1) Hardware part:
   a) RS 232 is an asynchronous serial communication protocol
   b) PIC circuit for PIC microcontroller
2) Software part:
   a) PIC16F877A is used for controlling the system using 40 pin I/O
   b) PIC programming using MPLAB IDE to create the asm file, hex file and IC-Prog software to burn the program into the microcontroller.
   c) Simulation of the interface circuit by using P-Spice and Proteus software.

1.4 PROBLEM STATEMENTS

Most of the recent electronic product is using high voltage and complex devices. Normally, computer is used as the display device as the display device to display the data taken from a barcode.

The problem occurs because of the used of computer that need high voltage to be operated and not portable. Therefore, the used of PIC Microcontroller as interface between LCD modules can be used to solve the problem. As mention before, the LCD Microcontroller is using low voltage and portable.

1.5 REPORT ORGANIZATION

This report is divided into several chapters. They are introduction, literature review, project methodology, result and analysis and conclusion. The first chapter is introduction that introduce about the project. The objectives and scopes of the project is included in the introduction too. The second chapter is the literature review. It includes

research RS232, LCD display and the PIC microcontroller. In this chapter the theory and concept that is relevant to the project is discussed in detail.

The third chapter is about the project methodology. In this chapter, the methods and project flow is explained. The fifth chapter is about the result and also analysis of the project. In this chapter, the progress of the project is explained. This chapter will discuss about theoretical findings, design concept and simulation results. The last chapter is the conclusion for the project. This chapter will discuss about the conclusion and also further improvement that can be made in future.

CHAPTER 2

BACKGROUND AND LITERITURE REVIEW

2.1 THE HISTORY OF BARCODES

While it may seem like barcodes have been with us forever, barcodes didn't really make an impact until the 1970's. It wasn't until 1974 that the first barcode scanner was employed and the first product barcode.

But the idea had been around for quite awhile. In 1932, Wallace Flint suggested that an automated retail checkout system might be feasible. While his concept was deemed unworkable, Flint continued to support the idea of automated checkout throughout his career. In fact, Flint, who went on to become the vice-president of the association of food chains some 40 years later, was instrumental in the development of the UPC code.

During the 40's, 50's and 60's several code formats were developed including a bull's-eye code, numeral codes, and various other formats. Retail applications drove the early technological developments of bar coding, but industrial applications soon followed.

In 1948, a local food chain store owner approached Drexel Institute of Technology in Philadelphia asking about research into a method of automatically reading product information during checkout. Bernard Silver, a graduate student at Drexel Institute, along with fellow graduate student Norman Joseph Woodland, teamed together to develop a solution.

Woodland first proposed using ultraviolet light sensitive ink. A working prototype was built but rejected as being too unstable and expensive. On October 20, 1949, Woodland and Silver succeeded in building a working prototype describing their invention as "article classification...through the medium of identifying patterns". On October 7, 1952, they were granted a patent (US Patent #2,612,994) for their "Classifying Apparatus and Method". Efforts to develop a working system accelerated in the 1960's. Bar coding was first used commercially in 1966, but to make the system acceptable to the industry as a whole there would have to be some sort of industry standard. By 1970, Logicon Inc. had developed the Universal Grocery Products Identification Code (UGPIC). The first company to produce barcode equipment for retail trade using (using UGPIC) was the American company Monarch Marking (1970), and for industrial use, the British company Plessey Telecommunications (1970).

In 1972, a Kroger store in Cincinnati began using a bull's-eye code. During that same timeframe, a committee was formed within the grocery industry to select a standard code to be used in the industry. IBM proposed a design, based upon the UGPIC work and similar to today's UPC code. On April 3, 1973, the committee selected the UPC symbol (based on the IBM proposal) as the industry standard. The success of the system since then has spurred on the development of other coding systems. George J. Laurer is considered the inventor of U.P.C. or Uniform Product Code.In June of 1974, the first U.P.C. scanner was installed at a Marsh's supermarket in Troy, Ohio. The first product to have a barcode was Wrigley's Gum. Bars & Stripes was first introduced to the market in 1991 by Tippecanoe Systems, Inc. Since then, Bars & Stripes has gone on to be one of the industry's most popular barcode software applications enabling small businesses to adopt bar coding with minimal expense.

2.2 THE TECHNOLOGY OF THE BARCODE

A linear bar code is a binary code (1s and 0s). The lines and spaces are of varying thicknesses and printed in different combinations. To be scanned, there must be accurate printing and adequate contrast between the bars and spaces. Scanners employ various technologies to "read" codes. The two most common are lasers and cameras. Scanners may be fixed position, like most supermarket checkout scanners, or hand-held devices, often used for the taking of inventories. There should be (but typically is not), a distinction drawn between the code, which is a structure for the conveyance of data, and the symbol, the machine-readable representation of the code. The code is text, which can be translated into a multiplicity of languages - English, French, Japanese, symbol.

Even though its not boding well beginning, the bar code has become a remarkable success, a workhorse in many and varied applications. One of the first successful bar codes, Code 39 developed by Dr. David Allais, is widely used in logistical and defense applications. Code 39 is still in use today, although it is less difficult than some of the newer bar codes. Code 128 and Interleaved 2 of 5 are other codes that attained some success in niche markets.

Today, bar codes are everywhere. Rental car companies keep track of their fleet by means of bar codes on the car bumper. Airlines track passenger luggage, reducing the chance of loss (believe it or not). Researchers have placed tiny bar codes on individual bees to track the insects' mating habits. NASA relies on bar codes to monitor the thousands of heat tiles that need to be replaced after every space shuttle trip, and the movement of nuclear waste is tracked with a bar-code inventory system. Bar codes even appear on humans. Fashion designers stamp bar codes on their models to help coordinate fashion shows. (The codes store information about what outfits each model should be wearing and when they are due on the runway.) In the late 1990's in Tokyo, there was a fad for temporary bar code shaped tattoos among high school girls.

2.3 THE UNIVERSAL PRODUCT CODE

The best-known and most widespread use of bar codes has been on consumer products. The Universal Product Code, or U.P.C., is unique because the user community developed it. Most technological innovations are first invented and then a need is found for the invention. The U.P.C. is a response to a business need first identified by the US grocery industry in the early 1970s.

Believing that automating the grocery checkout process could reduce labor costs, improve inventory control, speed up the process, and improve customer service, six industry associations, representing both product manufacturers and supermarkets, created an industry wide committee of industry leaders. Their two-year effort resulted in the announcement of the Universal Product Code and the U.P.C. bar code symbol on April 1, 1973. The U.P.C. made its first commercial appearance on a package of Wrigley's gum sold in Marsh's Supermarket in Troy, Ohio in June 1974.

Economic studies conducted for the grocery industry committee projected over $40 million in savings to the industry from scanning by the mid-1970s. Those numbers were not achieved in that time frame and there were those who predicted the demise of bar code scanning. The usefulness of the barcode required the adoption of expensive scanners by a critical mass of retailers while manufacturers simultaneously adopted bar code labels. Neither wanted to move first and results looked unpromising for the first couple of years, with Business Week eulogizing "The Supermarket Scanner That Failed." As scanning spread, however, the $40 million projection began to look very small. A 1999 analysis by Price Waterhouse Coopers estimates the U.P.C. represents $17 billion in savings to the grocery industry annually. Even more astounding, the study concludes that the industry has not yet taken advantage of billions of dollars of potential savings that could be derived from maximizing the use of the U.P.C.

The big winners - as one should have expected given the competitive nature of the markets involved - were consumers, since U.P.C. scanning generated efficiencies and productivity improvements that led to lower costs and/or greater customer service.

Ironically, consumer advocates initially resisted the innovation and jeopardized its success by insisting that retailers forego substantial cost savings by continuing to mark prices on individual units. While the rise of bar coding benefited both manufacturers and retailers, it was the retailer who benefited the most. In addition to the labor savings, retailers now had access to detailed product movement data, which they turned into a profit center by selling the data to their suppliers.

The developers of the U.P.C. believed that there would be fewer than 10,000 companies, almost all in the US grocery industry, who would ever use the U.P.C. Today, there are over one million companies in more than 100 countries in over twenty different industry sectors enjoying the benefits of scanning, thanks to the U.P.C. U.P.C. symbols are everywhere in the retail environment. They can also be found in industries as diverse as construction, utilities, and cosmetics. Today, the U.P.C. is also spreading up the supply chain to use by the suppliers of raw materials. At the dawn of the twenty-first century, the Uniform Code Council, Inc., the administrator of the U.P.C., could say with confidence that the U.P.C. symbol was being scanned over five billion times a day.

But innovation is dynamic. The linear bar code continues to evolve. Today, there are two-dimensional bar codes such as PDF 417 and MaxiCode capable of incorporating the Gettysburg Address in a symbol one-quarter of an inch square. RSS and Composite symbologies will enable the bar code identification of very small items such as individual pills or a single strawberry.

2.4 BARCODE APPLICATION

Barcodes (and other machine readable tags like FRID) are used wherever physical objects need to be tagged with information that is to be processed by computers. Instead of typing strings of data into a terminal, the operator only has to display the code to a barcode reader. They also work well in fully automated environments such as baggage

routing at airports. The data contained in a barcode varies with the application. In the simplest case, an identification number is used as an index in database where the complete information is kept. The EAN-13 and UPC codes commonly found on retail articles work this way.

In other cases the barcode holds the complete information itself, with no need for an external database. This led to the environment of barcode symbiosis that can express more than decimal digits, raging from additionally encoding just the upper case alphabet to the complete SCII character set and beyond. The drive to encode ever more information in combination with the space requirements of simple barcodes led to the development of matrix codes (a type of 2D barcodes), which do not consist of bars but rather a grid of square cells. Stacked barcodes are a compromise between true 2D barcodes and linear codes, and are formed by taking a traditional linear symbology and placing it in envelope that allows multiple rows.

2.5 COMPUTER AND BARCODES

As computer systems have become more advanced, bar codes have become even more prevalent in our society. Now many retail stores, from supermarkets to hardware stores, use bar codes, and they are used in many industrial and military applications as well. With ever-increasing use, many companies have developed software to generate and manipulate bar codes. As newer technologies are developed, we may eventually see a disappearance of bar codes as we know them today, but for the present time, bar codes are alive and well. For this project, the LCD display focuses on using PIC 16F877A as an intrusion detection device. The use of programmable interface controller (PIC) microcontroller in LCD display system is very relevant because most alarm system today use it. A PIC microcontroller will certainly make the system more efficient.