DEVELOP A LINEAR MEASUREMENT SENSOR SYSTEM

ANG SEI QI

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Dedicated to my beloved family especially my father and mother, lecturer, and also to all my friends

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ABSTRACT

Linear measurement sensor system is a created to measure the linear distance, by using the reflective infrared system which controlled by PIC16F628A, and display result on the screen of the LCD. A combination of reflective IR sensor, 2X8 LCD and PIC controller, the reflective infrared sensor will detect black and white color in the roller, and give small differences voltage signal, then the small voltage signal will be converted by into linear measurement in mm. the output signal will be displayed in LCD 2x8. The PIC will be programmed by using PIC complier software. The 2x8 LCD display is used and this project will become small, easily to carry. The objective of this system is to investigate new measurement tools of linear distance that can avoid error occur when taking the measurement reading, this linear measurement sensor system is introduced to provide a more accurate linear measured reading. In addition, to shorten time taking of the reading after a measurement, by just looking at the 2x8 LCD display. To achieve the objectives, the Protues software is used in the schematic circuit design and simulation, and the MicroCode Studio software is used in the PicBasic programming development. The feature of this project is specified by stated the scope of the project. The PIC programming will be developed for converting the small voltage signal to linear measurement in mm. The measurement range will be around 0 – 9999mm and show on the LCD display. Furthermore, the precision of the project can also be stated in the designing of the black and white roller. This system will be extremely handy and convenience to operate at different environment condition with the special casing design to protect the circuit.

ABSTRAK

Sistem sensor pengukuran lurus yang dibuat untuk mengukur jarak lurus, dengan menggunakan sistem inframerah reflektif yang dikendalikan oleh PIC16F628A, dan hasilnya dipaparkan pada skrin LCD. Kombinasi sensor IR reflektif, 2X8 LCD dan controller PIC, sensor inframerah reflektif akan mengesan warna hitam dan putih di roller, dan memberikan perbezaan kecil isyarat voltan, maka tegangan isyarat kecil akan dikonversi kedalam pengukuran lurus dalam mm. isyarat keluaran akan dipaparkan di LCD 2X8. PIC akan diprogram dengan menggunakan "software compiler" PIC. Layar LCD 2X8 digunakan dan projek ini akan menjadi kecil, mudah untuk dibawa. Tujuan dari sistem ini adalah untuk mengetahui alat ukur baru jarak lurus yang boleh mengelakkan kesalahan terjadi saat memuat pembacaan pengukuran, sistem pengukuran garis lurus sensor diperkenalkan untuk memberikan yang lebih tepat membaca lurus diukur. Selain itu, untuk memendekkan masa turun membaca selepas pengukuran, dengan hanya melihat layar LCD 2X8. Untuk mencapai tujuan, Protues perisian yang digunakan dalam desain skema litar dan simulasi, dan microcode Studio adalah software yang digunakan dalam pembangunan program PicBasic. Ciri-ciri dari projek ini adalah ditentukan oleh lingkup projek lain. Pemprograman PIC akan dikembangkan untuk menukar isyarat voltan kecil untuk pengukuran lurus dalam mm. Rentang pengukuran akan sekitar 0 – 9999mm dan menunjukkan pada paparan LCD. Selain itu, ketepatan projek juga boleh dinyatakan dalam perancangan roda hitam dan putih. Sistem ini akan sangat berguna dan kemudahan untuk beroperasi pada keadaan persekitaran yang berbeza dengan kotak rekaan khusus untuk melindungi litar.

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LIST OF ABBREVIATION

PIC   -   Programmable Interface Controller

LCD   -   Liquid Crystal Display

IEEE   -   Institute of Electrical and Electronics Engineers

PSM   -   Projek Sarjana Muda

CPU   -   Central Processing Unit

ROM   -   Read-Only Memory

I/O   -   Input/Output

RISC   -   Reduced Instruction Set Computer

EPROM   -   Erasable Programmable Read-Only Memory

UART   -   Universal Asynchronous Receiver/Transmitter

PWM   -   Pulse Width Modulation

RAM   -   Random-Access-Memory

EEPROM   -   Electrically Erasable Programmable Read Only Memory

IDCC   -   Integrated Data Communications Controller

DVI   -   Digital Visual Interface

VGA   -   Video Graphics Array

MCU   -   Microcontroller Unit

EN   -   Encoder

PCB   -   Printed Circuit Board

LIST OF APPENDIX

CHAPTER I

INTRODUCTION

This chapter will give reader a basic introduction to how the idea of this project generated. The chapter contains introduction, objective of the project, problem statement, scopes of project, brief methodology, and report structure.

1.1   Introduction

Linear measure is used to express distance and to indicate the differences in their elevations. The standard units of linear measure are the foot and the meter. In surveying operations, both of these standard units are frequently divided into tenths, hundredths, and thousandths for measurements. For longer distances are involved; the foot is expanded into a statute or to a nautical mile and the meter into a kilometer. But for the short distance or short range measurement, normally will use centimeter (cm) as a unit. 1 meter is equal to 100 centimeter.

Measuring instruments similar in function to rulers are made portable by folding (carpenter's folding rule) or retracting into a coil (metal tape measure) when not in use. When extended for use they are straight, like a ruler. Although both of these

measurement tools, can be folder or retracts, nevertheless, the long scale of these measurement tools have bring a lot of inconveniences for the user.

Figure 1.1: carpenter's folding rule and metal tape measure

Digital measuring tools seem to be a great idea and new trend in the measurement world. There is no tape or scale to deal with. But with a digital measuring tape it have to holding both ends of the tape measure and the tape measure bending and giving an inaccurate reading. Digital measuring tools accuracy with an old fashion measuring tools there were so many ways to make the reading inaccurate. With the combination of electronic technology, the reading can also be memorized by using the digital measurement tools, to avoid the user in forgetting the reading. The character LCD also is a trend in the developing measurement tools.

This project title is "Develop a linear measurement sensor system". A measurement tool will be developed to measure linear distance. A combination of reflective infrared sensor and PIC controller, the reflective infrared sensor will detect black and white color in the roller, and give small differences voltage signal, through the programmed PIC, then the small voltage signal will be converted by into linear measurement in unit cm. The output reading will send from the PIC to display on the 2X8 character LCD. The PIC will be programmed by using PIC complier software Microcode Studio in the form of PIC Basic language. The 2x8 LCD display is used and this project, so that this project produces in small, easily to carry. The circuit board cover with a special designed casing which can move smoothly with the roller stated above and suitable to be use in different condition.
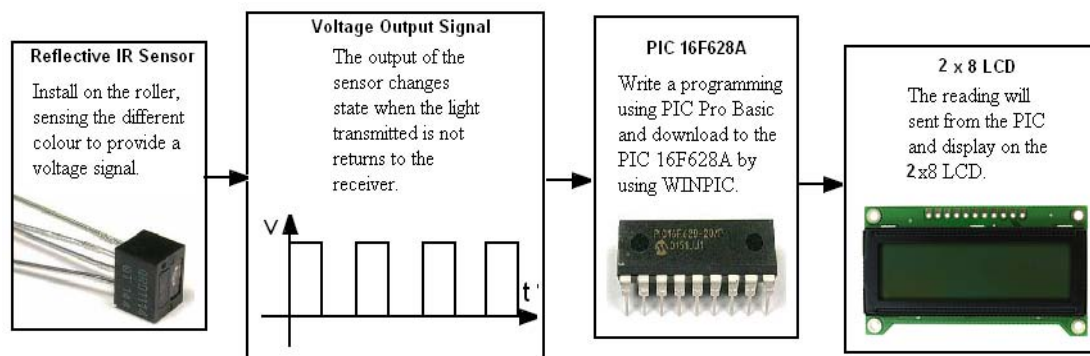
Figure 1.2: System Block Diagram

1.2 Objectives

The main purpose of this project is to develop a linear measurement sensor system with three main electronic components, which is reflective infrared sensor, PIC and character LCD display. Therefore the objectives below should be achieved.

1.2.1 To avoid error occur when taking the measurement reading, this linear measurement sensor system is introduced to provide a more accurate linear measured reading.

1.2.2 To apply electronic technology and to investigate new measurement tools of linear distance.

1.2.3 To shorten time taking of the reading after a measurement, by just looking at the 2x8 LCD display.

1.2.4 To explore the programming of PIC controller by using PIC Pro Basic for distance measurement application.

1.2.5 To explore the application of infrared sensor in industry and to design a prototype using infrared sensor.

1.3 Problem Statement

1.3.1 There will be some error occur when taking the reading from measurement tools, such as parallax error.

1.3.2 For someone who is not familiar to the measurement tools, they may take time to take the reading from the scale of the measurement tools.

1.3.3 Old fashion measurement device cannot memorize the reading.

1.3.4 Some measurement tools may not suitable to measure curve line.

1.3.5 The measurement tools may be suitable to use on any kind of surfaces.

1.3.6 Others problem may be faced in this project are to write a programming to generate the output reading according the range had been stated.
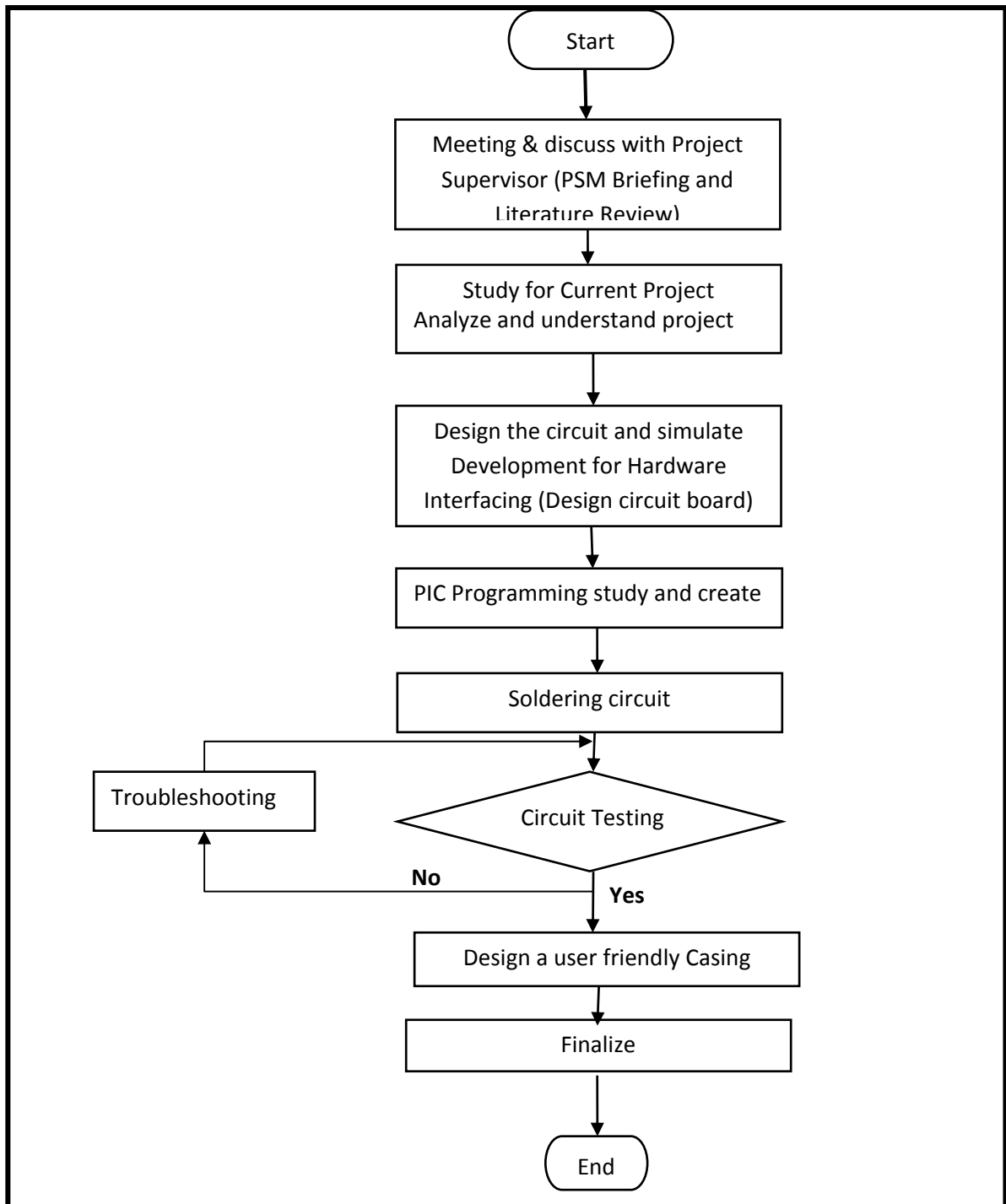
1.4 Scopes of Project

1.4.1 Write the PIC programming for converting the small voltage signal to linear measurement in cm. The measurement range will be around 0 – 9999mm and show on the LCD display.

1.4.2 Design the sensor system circuit board with a 5V voltage regulator.

     i. PIC controller (PIC 16F628A) with input voltage 5V,

     ii. Reflective infrared sensor with input current $100\mu A - 10mA$.

     iii. 2x8 LCD display with input voltage 5V.

     iv. Push button as a memory button.

     v. Other components such as, resistors, power switch, and etc.

1.4.3 The rubber roller will be used and the black-white will be colored inside the roller for determining the precision of the measurement.

1.4.4 Design a casing that can use to protect the circuit board, and can be use under different condition.

1.5 Briefly Explanation of Methodology

First of all, this project is beginning by having a discussion with supervisor about the general ideas and concepts that would be used in this project. Next, for literature review stage, the background of this project is studied and research is done by referring various sources like: reference book, I.E.E.E journals, website of Labcenter (Proteus Software Company), and the datasheet. For the following stage, all the information related to components, PIC, infrared sensor, character LCD display information is searching, and the most suitable would be selected for used in this project.

On next stage, the PIC Basic programming is studied, and the schematic circuit is designed and simulated in the Proteus software before construct on the stripboard. If the functional testing of the circuit on the stripboard is successfully, then will proceed to the PCB layout design, to produce an as small as possible circuit. Lastly, the casing design is start; the design must be suitable for protecting the circuit board and fit all components, to make the project function at any condition. If the outputs of this system fulfill the project requirements and specification, so this project is considered success. If the output of this system did not fulfill the desired output, so the troubleshooting would be carrying out until it reaches the project requirements.

Figure 1.3: Flow Chart