DIGITAL INSTRUMENT DISPLAY FOR CARS

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This report is submitted in partial fulfillment of requirements for the award of Bachelor of Electronic Engineering (Industrial Electronic) With Honours.

Faculty of Electronic and Computer Engineering
Universiti Teknikal Malaysia Melaka

May 2008

UNIVERSTI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : **DIGITAL INSTRUMENT DISPLAY FOR CARS**

Sesi Pengajian : **2007 / 2008**

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DECLARATION

"I hereby declare that this report is the result of my own except for quotes as cited in the references."

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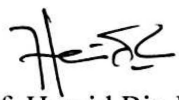
Signature : 

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DEDICATION

To my parents, family members, friends and all which involved;
My all time beloved.

ACKNOWLEDGEMENT

Alhamdulillah, finally I have successfully completed this bachelor report project within the time prescribed. Thank you to my supervisor Prof.Abdul Hamid Bin Hamidon for his assistance. Without his support I would be unable to solve encountered problems during this project. Thank you also to the lecturers that have taught me at Universiti Teknikal Malaysia Melaka.

Last but not least, a million thanks to my parents and friends for trusting and encouraging me to finish this project. Therefore, I end this acknowledgement with only two words "Thank You"

ABSTRACT

Almost every car use analog meter. Analog meter has weaknesses Drivers are unable to estimate quantities such as the volume of oil and engine temperature. To tackle this problem a digital Instrument display for cars project is to be designed. This project consists of two parts, hardware and software development. Based on a PIC microcontroller, these projects convert the analogue instruments in the car to a digital display. It is suitable for use with fuel gauges, oil pressure gauges or temperature gauges. It is also, ideal for use with sender units that have relatively slow changing values. In operation the unit can be calibrated so that the display will show any value in the range from -99 to 999. The decimal point can also be placed in one of two positions, so that the values can be from -.99 to 99.9. In addition, the unit can be calibrated to display metric or imperial units. Fuel and temperature gauges do not usually show precise values. Instead, they give a general indication of how things are going, they also remaining fuel level between full and half empty and temperature midway between hot and cold. By contrast, it can calibrate this digital display unit to show the actual values. The digital instrument display is calibrated at two values and the instrument calculates the remaining values from these in a linear fashion. For example, if the unit is to be used as a fuel gauge it is best calibrated when the fuel tank is full and then calibrated when the tank is close to empty. The display will then subsequently be able to show the remaining fuel in the tank over the complete range from full to empty. Through reading broadcast driver can detect oil volume and engine temperatures during the journey go and back. This readings can also record in the system computerize as reference.

ABSTRAK

Hampir setiap kereta menggunakan meter analog. Meter analog mempunyai kelemahan dan kekurangan tertentu iaitu bacaan yang dipaparkan adalah kurang tepat. Akibat daripada kelemahan ini pemandu tidak dapat menganggar isipadu sebenar minyak dan suhu enjin. Bagi mengatasi masalah ini projek "Digital Instrument Display for Cars" direka. Objektif utama projek ini adalah untuk menukarkan paparan analog ke paparan digital. Ini akan memudahkan pemandu mengetahui isipadu minyak dan suhu enjin dengan tepat. Projek "Digital Instrument Display for Cars" ini terdiri daripada dua bahagian iaitu "hardware" dan "software. Berdasarkan satu mikropengawal PIC, projek ini mudah menukar alat-alat analog didalam kereta paparan digital. Ia adalah sesuai untuk penggunaan dengan suhu enjin dan isipadu minyak. Ia juga, digunakan sebagai unit-unit pengirim yang berubah-ubah secara perlahan. Dalam operasi menentukur supaya paparan akan menunjukkan sebarang nilai dalam lingkungan daripada -99 sehingga 999 berserta titik perpuluhan daripada -.99 sehingga 99.9. Penentukuran boleh menentukur suhu tidak umumnya menunjukkan nilai tepat. Sebaliknya, mereka memberi satu ukuran isipadu minyak antara kosong, penuh dan separuh dan di pertengahan suhu antara panas dan sejuk. Ia juga boleh menyelaras unit paparan digital ini untuk menunjukkan nilai-nilai sebenar. Pameran alat berdigit adalah tertentukur di antara dua nilai dan alat mengira nilai baki Sebagai contoh, jika pengesan adalah digunakan sebagai satu penyukat minyak ia adalah terbaik tertentukur apabila tangki minyak adalah penuh dan kemudian tertentukur. Melalui bacaan yang dipaparkan pemandu boleh mengesan isipadu minyak dan suhu enjin sepanjang perjalanan pergi dan balik. Bacaan-bacaan ini juga boleh direkod dalam sistem perkomputeran sebagai rujukan.

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LIST OF ABBREVIATIONS

PIC	-	Peripheral Interface Controller
PCB	-	Printed Circuit Board
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
ADC	-	Analog to Digital Converter
PWM	-	Pulse Width Modulation
BCD	-	Binary Code Decimal
SAR	-	Successive-Approximation Register
RAM	-	Random Access Memory
CPU	-	Central Processing Unit
SMD	-	Surface Mount Devices
DIP	-	Dual in Package
Dp	-	Decimal Point
POV	-	Persistance of Vision
PC	-	Personal Computer
RISC	-	Reduce Instruction Set Computer
ICSP	-	In-Circuit Serial Programming
POR	-	Power-on Reset
PWRT	-	Power-up Timer
OST	-	Oscillator Start-up Timer
WDT	-	Watchdog Timer
ASM	-	Assembly Language
DC	-	Direct Current
REG	-	Regulator
REF	-	Reference
IC	-	Integrated Circuit

GND - Ground

LSB - Less Significant Bit

MSB - More Significant Bit

LIST OF APPENDIXS

CHAPTER I

INTRODUCTION

1.1 Introduction Of The Project

Most vehicles have analogue readouts for displaying fuel level and engine temperature. The oil pressure is either shown on an analogue gauge or more commonly, there is no gauge but just an "idiot" warning light. Some drivers would rather have these outputs displayed in digital format to the meaning recorded oil volume use-of travel go and back and ensure engine temperatures stay in case stable. That is where this digital instrument display comes in.

The digital instrument display for cars is based on a PIC microcontroller. This project converts the analogue instruments in cars to a digital display. It is suitable for use with fuel gauges, oil pressure gauges or temperature gauges in cars. It is designed to operate with any sensor or sender unit which varies its resistance or voltage signal output due to changes in input. The result is displayed on a 3-digit LED readout.

Basically, it is ideal for use with sender units that have relatively slow any changing values. In operation the unit can be calibrated so that the display will show any value in the range from -99 to 999. The decimal point can also be placed in one of two positions, so that the values can be from -.99 to 99.9. In addition, the unit can be calibrated to display metric or imperial units. Fuel and temperature gauges do not usually show precise values. Instead, they give a general indication of how things

are going, they also show the remaining fuel level between full and half empty and engine temperature midway between hot and cold. By contrast, it can calibrate this digital display unit to show the actual values. The digital instrument display is calibrated at two values and the instrument calculates the remaining values from these in a linear fashion. For example, if the unit is to be used as a fuel gauge it is best calibrated when the fuel tank is full and then calibrated when the tank is close to empty. The display will then subsequently be able to show the remaining fuel in the tank over the complete range from full to empty.

1.2 Project Objective

The main objective of this project is to convert the analogue display to digital display. To ensure that the project is successful one must be able to program the Program Interface Controller (PIC) for example to convert analogue display to digital display and to display the digital value by BCD 7-segment.

1.3 Problem statement

Most cars have analogue readouts for displaying fuel level and engine temperature. Analog meter only show estimate oil volume and engine temperatures while through digital display driver will know more precisely oil volume and engine temperatures. Digital display this makes supply purpose recorded volume oil in use a trip and engine temperatures during the journey. Apart from that display reading digital also show values a more accurate over reading those given by analog meter. This resulted in the form digital display was more suitable to be used at the present over analog display.

1.4 Scope of work

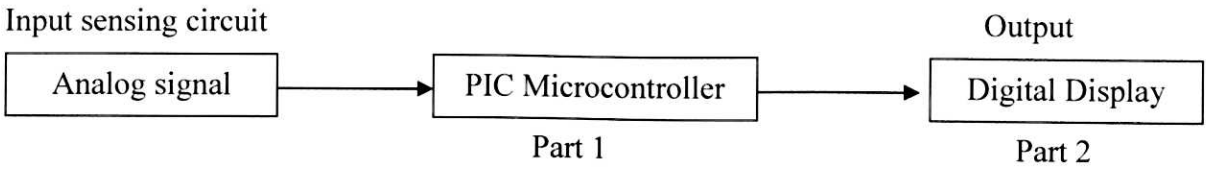

Figure 1.1: Diagram Process

This project is divided into two parts, part 1 is the controller circuit using PIC (Microchip Peripheral Interface Controller) and part 2 is the digital instrument display circuit.

1. Part 1 (PIC Microcontroller)

   The operation of this project will be controlled by PIC. When the sensor detects the temperature and amount oil in the tank, program will send data to be display at 3-unit seven segments. Program will be written and simulate using source boost and transfer all the program using Proteus 6 Professional (ARES 6 Professional).

2. Part 2 (Digital Display)

   The digital instrument display circuit will be constructed. Testing and calibration on real hardware will be carried out to ensure it is functionally correct.

1.5 Method of project

Figure 1.2 describes the flow chart for the overall steps involve in this project from the first step until the end of the project.

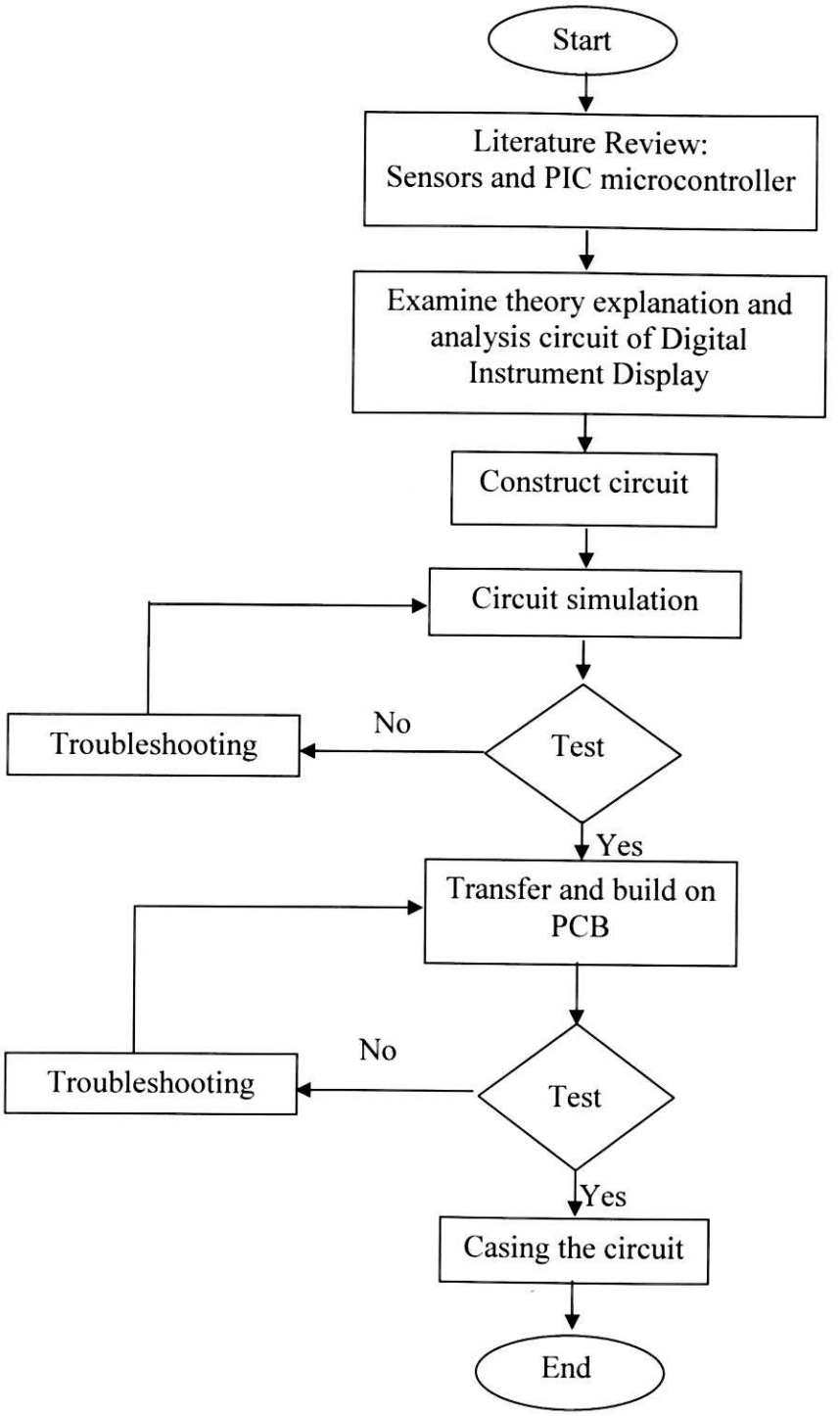

Figure 1.2: Flow chart for the overall project

1.6 Outline of thesis

This report is divided into several chapters, they are

I. Introduction

II. Literature review

III. Project Methodology

IV. Result and Discussion

V. Conclusion and Suggestion

This thesis is divided into five chapters. Chapter I will focus on brief introduction of the project carried. The important overview or description including the problem statement, project objectives and project scopes are well emphasized in this part.

Chapter II will be based on the literature review of the project. It is mainly focused on the analog to digital converter, PIC16F877A and about seven-segment display (multiplexing). It also defined the details including PIC programmer.

Chapter III will explain on the concepts, theories and principle used in order to complete the project. This part consists of the methodology and also the information on research, experiment and simulation carried during the project development.

Chapter IV mainly focused on the result and analysis done using the device. All testing and verification result are attached with the aid of figure, table and statistic related to the project.

Chapter V is a conclusion of previous four chapters. It describes on the overall project, discussion and suggestion for the project. All matters arise including the problems and unachieved objectives will be described clearly in this part.

Chapter II

LITERATURE REVIEW

2.1 INTRODUCTION TO MICROCONTROLLER

2.1.1 Microcontroller

Microcontroller is essentially an electronic device that changes the electronic device and change the electronics design topology since its inception few decades ago. Basically, microcontroller is a computer system that is fabricated in a single integrated chip. A microcontroller chip consists of a central processing unit (CPU) memory module, and several input/output peripherals.

The PIC microcontrollers are based on RISC (Reduced Instruction Set Computer) architecture; therefore use a relatively small number of instructions. Most PICs used 35 instructions compared to some general-purpose microprocessors (like Motorola 68000 and Intel 8085) that may have several hundred.

Important feature of modern PIC devices is to use of electrically erasable and programmable Flash memory for program storage. These Flash memory devices are often denoted by the use of the letter "F" as part of the device coding (e.g PIC16f84). Flash devices are much easier to work with for one-off prototyping because erasure and reprogramming is greatly simplified. The specifications for PIC16F877A please refer to Appendix D.

2.1.2 Pin Description of PIC16F877A

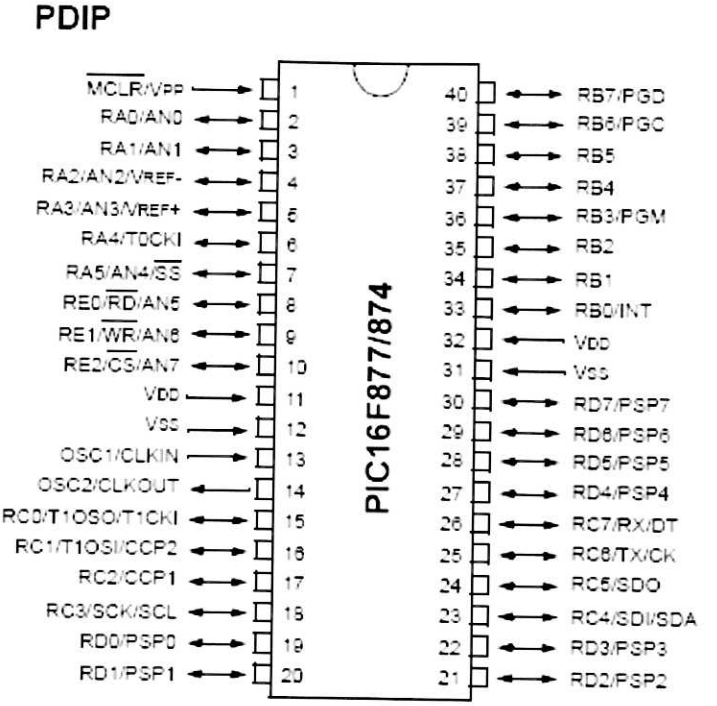

Figure 2.1: Pin diagram for 16F877A (40 pin)

Details for the description of PIC16f877A table please refer to Appendix B. The tables include buffer type and description of each pin of PIC16f877A.