Car Parking Control System By Using Microcontroller

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Abstract

When a car enters, the entrance unit sends a signal to the central processing unit. If a car goes out, the exit unit sends a signal to the central processing unit. The embedded program inside the PIC microcontroller increases the number of cars for entering and decreases the number of cars for exiting. The central processing unit sends signals to display unit and alarm unit simultaneously. The display unit shows the number of cars. The alarm unit shows whether entering is allowed or not. The required program is written in Pic BASIC Pro language. Then it is compiled and downloaded into PIC16F84A microcontroller via GTP USB Lite programmer board.

Keywords: PIC16F84A microcontroller, Liquid crystal display, Pic BASIC Pro language.

Introduction

Car parking can be found in many places. It is important to control entering cars and exiting cars properly. A microcontroller differs from a microprocessor in many ways. The main difference is that a microprocessor requires several other components for its operation, such as program memory and data memory, I/O devices and external clock circuit. A microcontroller on the other hand has all the support chips incorporated inside the same chip. All microcontrollers operate on a set of instructions (or the user program) stored in their memory. A microcontroller fetches the instructions from its program memory one by one, decodes these instructions, and then carries out the required operations. In this work, car entering or exiting is taken at enter unit and exit unit. Then the signal is sent to microcontroller control unit which is formed by PIC16F84A microcontroller. The program inside the microcontroller processes and sends signals not only to display unit but also to indicator unit simultaneously. The operation of the system can be seen by display unit and indicator unit.

PIC16F84A Microcontroller

A microcontroller is an inexpensive single-chip computer. Single-chip computer means that the entire computer system lies within the confines of the integrated circuit chip. The microcontroller has features similar to those of standard personal computer. Primarily, the microcontroller is capable of storing and running a program. The microcontroller contains a CPU (central processing unit), RAM (random-access memory), ROM (read-only memory), I/O (input/output) lines, serial and parallel ports, timers and sometimes other built-in peripherals such as A/D (analog-to-digital) and D/A (digital-to-analog) converters.

The PIC16F84A microcontroller is an 18-pin device and it offers 1024 x 14 flash program memory, 68 bytes of data RAM, 64 bytes of non-volatile EEPROM (electrically erasable programmable read only memory), data memory, 13 I/O pins, a timer, a watchdog, and internal and external interrupt sources. The timer is 8-bits wide but can be programmed to generate internal interrupts for timing purposes. PIC16F84A can be operated from a crystal or a resonator for accurate timing. A resistor-capacitor can also be used as a timing device for application where accurate timing is not required.

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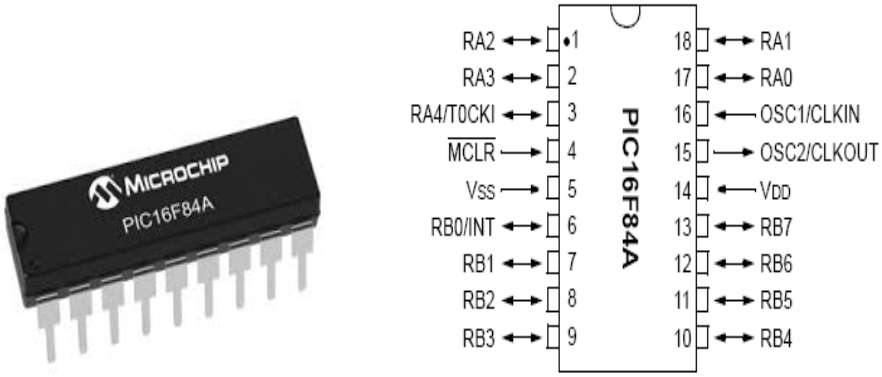

Figure (1). Photograph and pin configuration of PIC16F84A

Liquid Crystal Display (LCD)

Alphanumeric dot matrix liquid crystal displays are used for displaying visual information, symbols, alphanumeric and icons in an impressive fashion. These modules have built-in controllers, drivers, character generator RAM/ROM, and associated circuitry for easy implementation of the logic for refreshing, multiplexing and updating the display. It has a LMB162A controller IC. The LMB162A module incorporates the control circuits, data RAM, and character generator RAM required for display. This module provides both 8 bit and 4 bit parallel interfaces and allows the controlling microprocessor to read and write data directly. General features of the LMB162A are 16 characters x 2 lines, 5 x 7 dots character structure, 80 characters data RAM, 192 characters generator, 8 characters generator RAM. Most LCD modules conform to a standard interface specification. A 14-pin access having eight data lines, three control lines and three power lines is provided.

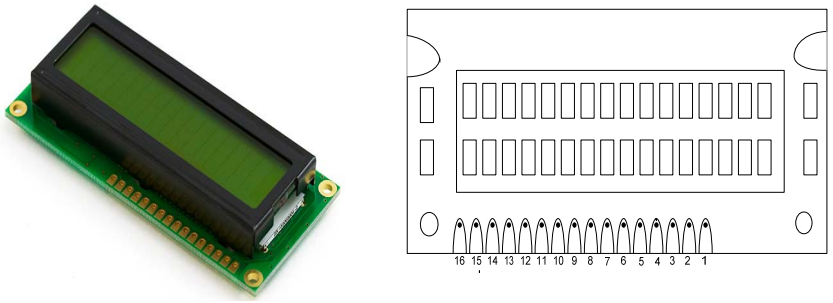

Figure (2). Photograph and pin layout of the LCD

Design and Construction

There are six main parts of "Car Parking Control System By Using Microcontroller". They are

(i) Regulated Power Supply Unit
(ii) Enter Unit
(iii) Exit Unit
(iv) Microcontroller Control Unit
(v) Display Unit
(vi) Indicator Unit

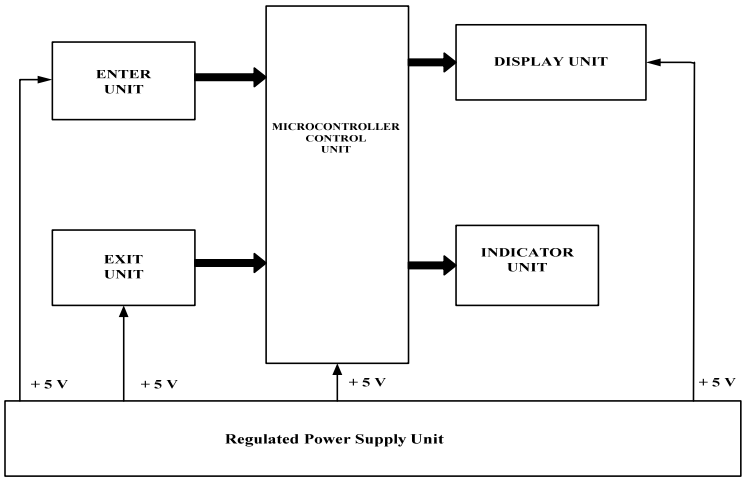

Figure (3). The block diagram of the constructed system

Regulated Power Supply Unit

The PIC16F84A microcontroller works at DC +5V well. The required DC voltage is taken from voltage regulator (LM7805). The input pin of LM7805 is connected to positive terminal of DC +6V, 4A battery. The middle pin of LM7805 and negative terminal of battery are connected to ground. The output voltage of DC +5V is taken from output terminal of LM7805.

Enter Unit

To count the number of incoming cars, enter unit is constructed. One end of the limit switch is connected to DC +5V and other end is connected to pin 17 (RA0) of PIC16F84A microcontroller. This pin is also connected to ground through 10 kΩ resistor. Normally, logic (0) is sent to pin 17(RA0).When a car enters, limit switch is pressed and logic (1) is sent to pin 17 (RA0).

Exit Unit

The exit unit is constructed to count the outgoing cars. One end of limit switch is connected to DC +5V and other end is connected to pin 18 (RA1) of PIC 16F84A microcontroller. This pin is also connected to ground through 10 kΩ resistor. Normally, logic (0) is sent to pin 18 (RA1). When a car goes out, limit switch is pressed and logic (1) is sent to pin 18 (RA1).

Microcontroller Control Unit

The operation of the constructed system is controlled by this unit. The required program for the system is embedded into the PIC16F84A microcontroller. The pin 14 (V_{DD}) is powered by DC +5V and pin 5 (V_{SS}) is connected to ground. The pin 4 ($\overline{MCLR}$) is connected DC +5V through 10 kΩ resistor. When RESET switch is pressed, pin 4 is logic (0) and the microcontroller is reset condition. A 4 MHz crystal oscillator is used in the circuit. The pin 17 (RA0) is connected to enter unit and pin 18 (RA1) is connected to exit unit. The pin 6 (RB0), pin 7 (RB1), pin 8 (RB2), pin 9 (RB3), pin 10 (RB4) and pin 11 (RB5) of PIC16F84A are connected to display unit. Pin 12 (RB6), pin 13 (RB7) of PIC 16F84A are also connected to indicator unit.

Display Unit

The display unit shows the maximum number of cars, the present number of cars. It also shows a car enters or exits and it is permitted or not. The 16 characters x 2 lines liquid crystal display (LMB162A) is used in this unit. The pin 2 (V_{DD}) is connected to DC +5V. The pin 1 (V_{SS}), pin 5 $(R / \overline{W})$ and pin 16 (K) are connected to ground. The upper end of 10 $k\Omega$ variable resistor is connected to DC +5V, the middle pin is connected to pin 3 (V_{EE}) of LMB 162A and the lower end is connected to ground. The brightness of LMB 162A is adjusted by this variable 10 $k\Omega$ resistor. For back lighting, pin 15 (A) of LMB 162A is also connected to DC +5V through 100Ω resistor. The pin 11 (DB4), pin 12 (DB5), pin 13 (DB6), pin 14 (DB7), pin 6 (E) and pin 4 (RS) of LMB 162A are connected to pin 6 (RB0), pin 7 (RB1), pin 8 (RB2), pin 9 (RB3), pin 10 (RB4) and pin 11 (RB5) of PIC16F84A microcontroller respectively.

Indicator Unit

To know whether a car enters or exits, the operation is permitted or not, the indicator unit is constructed. The GREEN LED is turned on for entering in to the car park and RED LED is turned on for exiting from the car park. When the condition is not permitted both GREEN LED and RED LED are turned on simultaneously. The pin 12 (RB6) and pin 13 (RB7) of PIC16F84A microcontroller are connected to anode pins of GREEN LED and RED LED respectively. The cathode pins of LEDs are connected to ground.

Results and Discussion

The work of "Car Parking Control System By Using Microcontroller" is designed and implemented. The required program for this work is written, compiled and downloaded into PIC16F84A microcontroller with the help of GTP USB Lite programmer. The pin 17 (RA0) and pin 18 (RA1) are configured as input pins. The pin 6 (RB0), pin 7 (RB1), pin 8 (RB2), pin 9 (RB3), pin 10 (RB4), pin 11 (RB5), pin 12 (RB0) and pin 13 (RB7) are configured as output pins. The RESET switch is fixed at pin 4 ($\overline{MCLR}$) of PIC16F84A microcontroller.

Normally, ENTER switch and EXIT switch are open circuits and logic (0) is produced. Therefore, pin 17 (RA0) and pin 18 (RA1) are at logic (0). The liquid crystal display shows "WELCOME MAX=10" on the first line and "CAR NO. =000"on the second line. Both GREEN LED and RED LED are turned off.

When a car enters, ENTER switch is closed circuit and logic (1) is produced at pin 17 (RA0) and pin 18 (RA1) is at logic (0). The number of cars is incremented by one as long as it does not exceed ten cars. The liquid crystal display shows "ENTERING MAX=10" on the first line and "CAR NO.=001" on the second line. GREEN LED is turned on and RED LED is turned off.

When a car exits, EXIT switch is closed circuit and logic (1) is produced at pin 18 (RA1) and pin 17 (RA0) is at logic (0). The number of cars is decreased by one as long as it does not exceed zero car. The liquid crystal display shows "EXITING MAX=10" on the first line and "CAR NO. =001" on the second line. RED LED is turned on and GREEN LED is turned off.

If entering and exiting occur simultaneously both ENTER switch and EXIT switch are closed circuits and logic (1) is produced at pin 17 (RA0) and pin 18 (RA1). This condition is not permitted in this work. The liquid crystal display shows "WAIT MAX=10" on the first

line and "CAR NO.=001" on the second line. Both GREEN LED and RED LED are turned on for this condition.

Conclusion

Car parking is found in many places. To control the car parking system by electronic device, the work of "Car Parking Control System By Using Microcontroller" is designed and implement. In this work, the maximum amount of cars is taken as ten cars. The limit switch is also applied in this work. The constructed system gives knowledge on application of PIC microcontroller in our surrounding. It is suggested to carry out using different types of sensors and fixing alarm systems and control gates are also suggested to be carried out as further works.

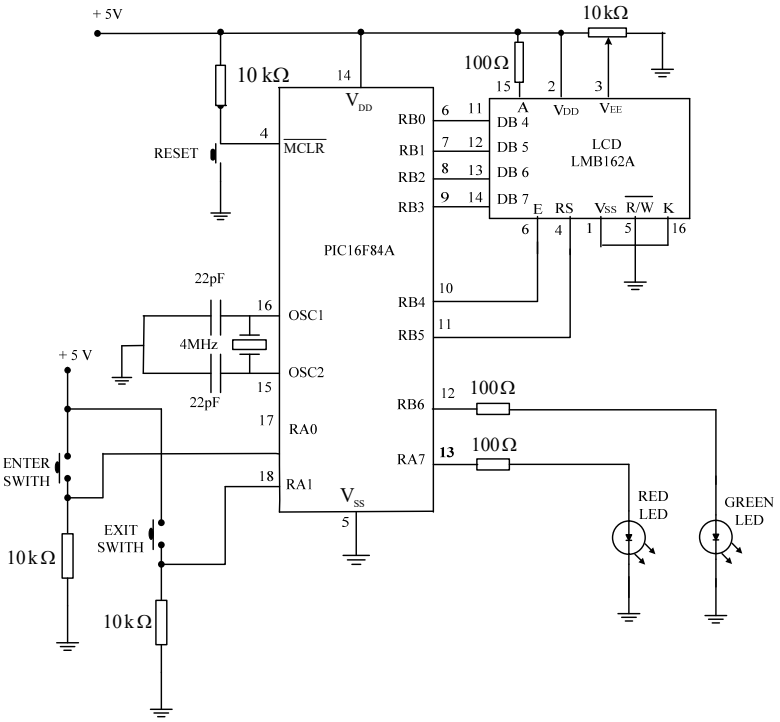

Figure (4). Complete circuit diagram of "Car Parking Control System By Using Microcontroller"

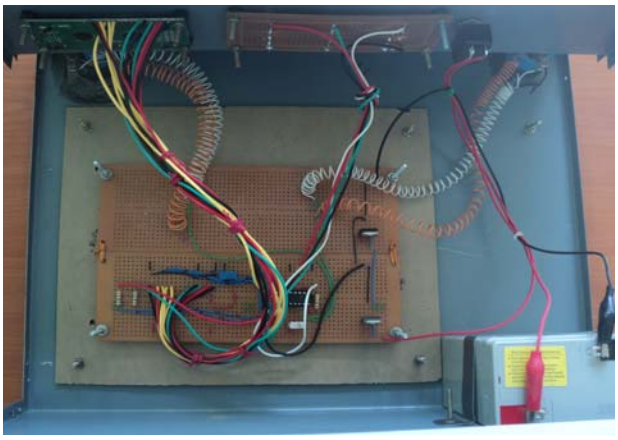

Figure (5). The photograph of constructed circuit

Figure (6). The display of enter and exit simultaneously

Acknowledgements

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