

Programmable Pet Feeder

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Abstract: Over the years, more and more households are beginning to have pets. Pet feeders came into existence as more and more pet owners found it difficult to cater time to feed their pets. Pet feeders are automated machines that dispense food at preset schedule. They are mainly timed based and dispense a certain amount of food at specific time of the day. The pet feeder is a programmable system which is mainly controlled by a microcontroller. It consists of a LCD screen for input display, buzzer to alert pets for meals, stepper motor to control the speed and a turn table which is divided into different sections for placement of different food. User will be able to select the food to be dispensed out at their desired timing.

Keywords: Turn-table, PIC18F4520 microcontroller, Buzzer Stepper Motor, DC motor

1. Introduction

1.1 Background

Pet feeding can be difficult in this busy age but the perfect Pet feeder delivers a worry free solution to modern, caring pet-parents while away. There are many various types of automated pet feeding devices in the market now. Generally most pet feeders are commonly for cats and dogs but for a few special cases, some pet feeders for instances, like the fish pet-feeder or the hamster pet feeder are specifically designed to suit only for that particular type of pet due to their size and environmental living conditions.

1.2 Overview

The design of the programmable pet feeder can be broken down into 2 stages. The first stage is the construction of individual components and the second stage involves interfacing the components with the goal of operating as one unit. During the construction stage, the components can be categorized as either hardware or software.

The basic hardware components consist of microcontroller, LCD, buzzer and motors. The basic software component consists of a motor control algorithm and a delay timer algorithm. User will input data on the LCD and the 40 pin microcontroller which is the brain of the pet feeder will perform motor control and delay algorithms.

2. Objective

There are some objective needs to be archived in order to accomplish this project. But the main objective of the project is to design a programmable system which is able to

- (I) Serve food for pets at programmable times
- (ii) Enhance the performance and stability of the system.
- (iii) Develop the system that works automatically.

The project shall adopt the Structured System Analysis and Design methodology approach to achieve the project objective.

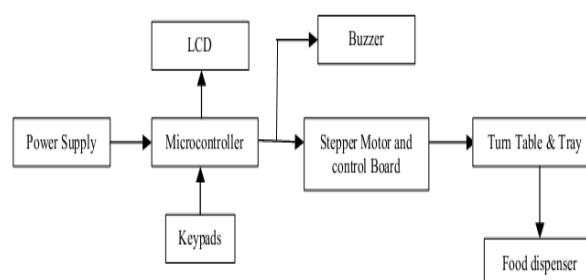


Figure 1: Block diagram of pet feeder system

The system will consist of the following modules:

1. Power supply to supply voltages to each modules
2. Microcontroller for programming and controlling
3. Buzzer for alerting pets
4. Stepper Motors to control the speed and positioning
5. Turn table to rotate at programmable time
6. LCD (Liquid Crystal Display)

3. Hardware System

Hardware Implementation

1. Micro-controller- programming and controlling
2. Power Supply- supply voltages
3. Stepper motor- to control the speed and positioning
4. Turn-Table- to rotate at programmable time
5. DC motor-to dispense food Buzzer-sound for alerting

3.1 Microchip Microcontroller (18F Series)

This family offers the advantages of all PIC18microcontrollers mainly:

High computational performance at an economical price with addition of high endurance Enhanced Flash program memory Design enhancements for many high-performances, power sensitive applications.

3.1.1 PIC18F4520

The microchip PIC18F4520 microcontroller is a 40 pin 8 bit processor with five ports available to be used depending on the device selected and features enabled. Some pins of the I/O ports are multiplexed with an alternate function from the peripheral features on the

device. In general, when a peripheral is enabled, that pin may not be used as a general purpose I/O pin. It can communicate with the workstation through a Universal Serial Bus (USB) to download or upload data

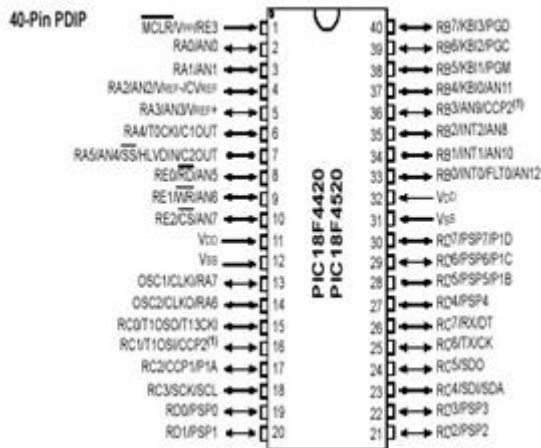


Figure 2: PIC18F4520 microcontroller

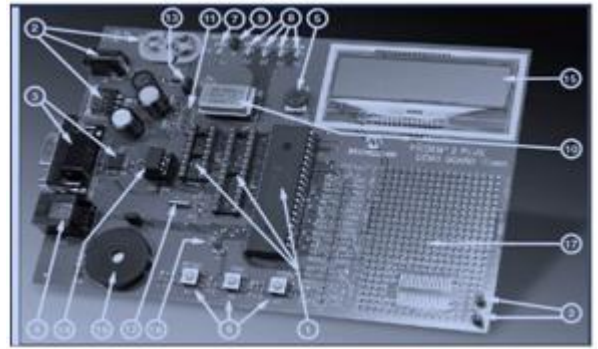


Figure 3: PICDEM 2 Plus board



Figure 4: In-circuit debugger (MPLAB ICD 2)

3.2 Microchip Development Kit

The PICDEM 2 Plus is a simple board that comes together with the microcontroller preinstalled. It demonstrates the capabilities of many of the 18-, 28- and 40-pin PIC16XXXX and PIC18XXXX devices. It can be used stand-alone with a programmed part, with an in circuit emulator (e.g., MPLAB[®] ICE or MPLAB[®] REAL ICETM) or with an in-circuit debugger, MPLAB ICD 2. The PICDEM PLUS Board has the following hardware features:

1. 18, 28 and 40-pin DIP sockets. (Although three sockets are provided, only one device may be used at a time.)
2. On-board +5V regulator for direct input from 9V, 100 mA AC/DC wall adapter or 9V battery, or hooks for a +5V, 100 mA regulated DC supply.
3. RS-232 socket and associated hardware for direct connection to an RS-232 interface.
4. In-Circuit Debugger (ICD) connector.
5. 5 K potentiometer for devices with analog inputs.
6. Three push button switches for external stimulus and Reset.
7. Power-on indicator LED.
8. Four LEDs connected to PORTB
9. Jumper J6 to disconnect LEDs from PORTB
10. 4 MHz canned crystal oscillator
11. Unpopulated holes provided for crystal connection
12. Jumper J7 to disconnect on-board RC oscillator (approximately 2 MHz)
13. 15. LCD display and 16. Piezo buzzer



Figure 5: MPLAB ICD 2 RJ-11 Pin out (The MPLAB ICD 2 is connected to the PICDEM 2 Plus board using RJ-11)

3.3 Stepper Motor

A stepper motor, as its name suggests, moves one step at a time, unlike those conventional motors, which spin continuously. If we command a stepper motor to move some specific number of steps, it rotates incrementally that many number of steps and stops. Because of this basic nature of a stepper motor, it is widely used in low cost, open loop position control systems. Open loop control means no feedback information about the position is needed. This eliminates the need for expensive sensing and feedback devices, such as optical encoders. Motor position is known simply by keeping track of the number of input step pulses.

These motors feature enhanced mini-angle stepping with good speed/ torque characteristics over a wide size range. The Hybrid Stepper ranges comprise six main types or frame sizes each offered in one or more basic step angles. Parameters such as the supply voltage, drive electronics and size constraints determine the type of stepper that can be employed.

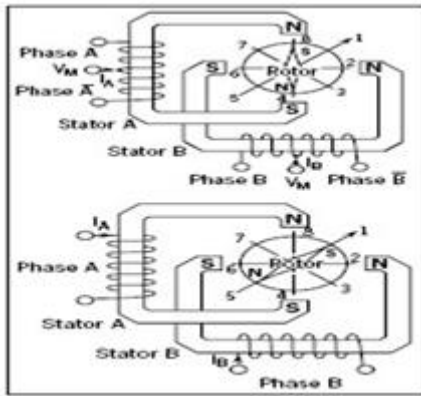


Figure 6: Unipolar Stepper Motors



Figure 7: Astrosyn stepper motor

3.4 Buzzer

A buzzer or beeper is an electric signaling device that makes a buzzing sound. It commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound.

Uses of buzzer:

- Alert pets it is time for meals
- Alert pets that food is dispensing



Figure 8: Buzzer

3.5 DC Motor

A DC (direct-current) motor works by converting electric power into mechanical. This is accomplished by forcing current through a coil and producing a magnetic field that spins the motor. In this project the DC-motor will be used to dispense the food.



Figure 9: DC motor

3.6 Power Supply

The PICDEM 2 plus Board can be powered using a 100-240V, 100mA AC/DC wall adapter. The adaptor will step the voltage down to 9V and to be plugged into J2 of the board. The 9V will then be regulated to 5V using a voltage regulator at



Figure 10: Connection of adaptor to J2 of board

3.7 Turn-Table

The turn-table is some sort of a container which is divided into 4 sections. The motor will be placed at the bottom to hold and control the positioning.



Figure 11: Turn-table

4. Software Development

The software programming for the STC89C52RC Microcontroller is C-program and will be compiled using C18 compiler of the MPLAB Integrated Development Environment. This software provides a single integrated environment to develop codes for embedded microcontrollers.

4.1 MPLAB Integrated Development Environment (IDE)

MPLAB Integrated Development Environment (IDE) is a free, integrated toolset for the development of embedded applications employing Microchip's PIC microcontrollers. It is easy to use and includes a host of free software components for fast application development and super-charged debugging. MPLAB support both Assembly Language and C programming languages, others language may be supported through the use of third party programs.

4.2 Process Flow Chart

4.2.1 MPLAB IDE

The MPLAB IDE is a windows operating system (OS) software program that runs on a PC to develop applications for Microchip microcontrollers and digital signal controllers. It is called an IDE (Integrated Development Environment) because it provides a single integrated "environment" to develop code for embedded microcontrollers.

4.2.2 MPLAB Configuration

Before starting development, you need to select the device and decide which development tools to use. There are a number of processors available supported. In this project, the PIC18F4520 is used.

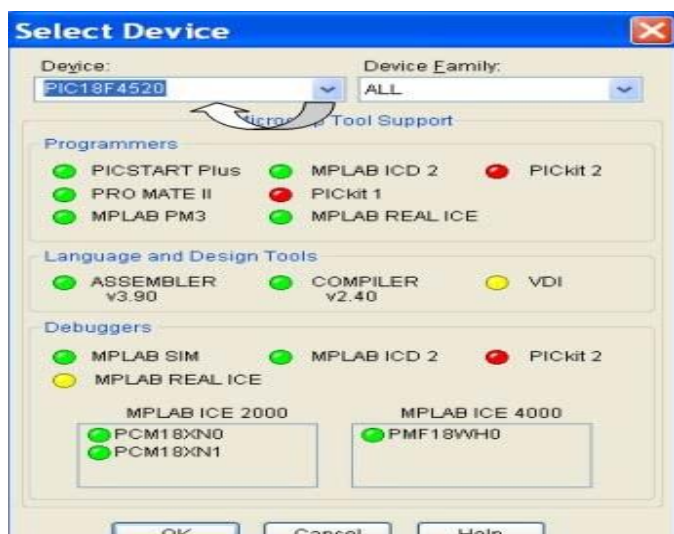


Figure 12: Selecting the device

4.3 Overview of the Program

The flowchart below illustrates the whole process of the program.

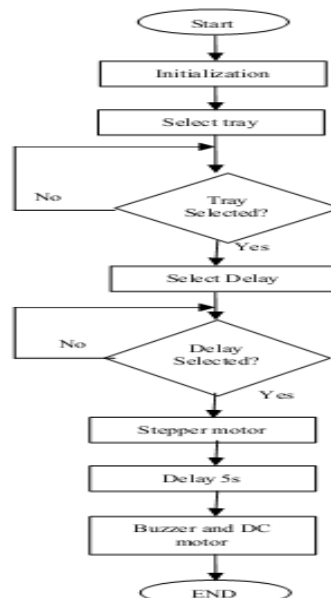


Figure 13: Flowchart of the Pet feeder

4.4 Software Programming

4.4.1 Motor

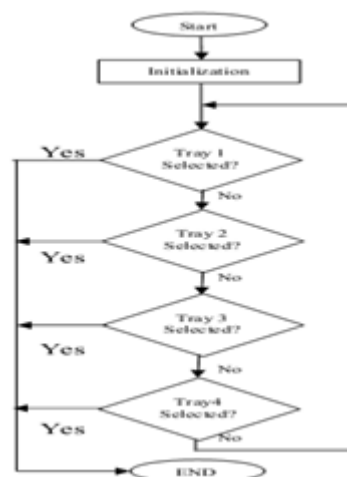


Figure 14: Flowchart of Motor

4.4.2 Timer

The other important program in this project is the timer program. It is used to set the time before the motor begins to rotate. In this program, I have only used the 3 delay options mainly 5s, 10s and 15s to act as the timer for this project.

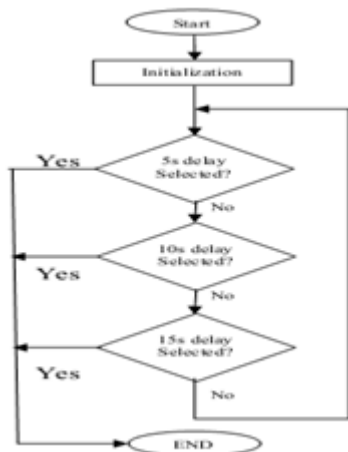


Figure 15: Flowchart of timer

4.4.3 Buzzer and DC Motor

The aim of the dc motor is to dispense food from the turn-table and the buzzer is to act as an alarm to notify pets that it is time for their meals. The program written for these 2 modules are explained together as they are similar. Both the buzzer and dc motor will always be in the waiting mode. They will only be activated once the turn-table is in position. Both the buzzer and the dc motor will then be on for 5 seconds before it turns off and back to the waiting mode.

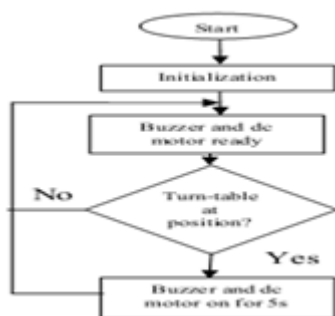


Figure 16: Flowchart of buzzer and dc motor

4.5 Source Code

```

/*****
*****/
#include <p18f4520.h>
#include <delays.h>
/* macro for LCD */
#define Lcd_VEE LATDbits.LATD7 // VEE - lcd contrast
#define Lcd_EN LATDbits.LATD6 // Enable signal
#define Lcd_RW LATDbits.LATD5 // read write signal
#define Lcd_RS LATDbits.LATD4 // register select signal
/* function declaration */ void Lcd_Title (void);
Voidmotor (void);
Void Write_Lcd (unsigned char, unsignedchar); void
DelayFor18TCY (void); /* global variables */ unsigned
char count; int Tray; int Delay;
Voidmain (void)
{
/* configure port */
ADCON1 = 0x0F; // default all pins to digital

```

```

/* configure LCD pin */
TRISDbits.TRISD7 = 0; // VEE // PICDEM2 PLUS
GREEN BOARD
TRISDbits.TRISD6 = 0; // EN
TRISDbits.TRISD5 = 0; // RW
TRISDbits.TRISD4 = 0; // RS
TRISDbits.TRISD0 = 0; // DB4
TRISDbits.TRISD1 = 0; // DB5
TRISDbits.TRISD2 = 0; // DB6
TRISDbits.TRISD3 = 0; // DB7
TRISA = 0xf0;
TRISB = 0x01; //Portpins RB1-RB3 as outputs TRISC
= 0x00;
Lcd_VEE = 1;
Delay10KTCYx(15);
Write_Lcd (0x20,0);
Write_Lcd (0x28,0);
Write_Lcd (0x0c,0);
Write_Lcd (0x01,0);

```

5. Conclusion

This project has been a very rewarding experience for me. As I am not working in the semi-con industry, this project has given me a chance to get more exposure in the field of electronics. As this project consists of both hardware and software, I was given the opportunity to get some hands-on and design experience on the hardware part. In addition, the development of software algorithm also allows me to incorporate the reasoning and logical skills.

Throughout the development phase of this project, many aspects of the electronic, mechanical and programming have been touched on and it has been an interesting. Most of the time is spent on the software portion. The most challenging issues that I faced are writing and debugging of software algorithm codes. Many areas need to be studied and considered thoroughly as I am not familiar with microcontroller and the programming language.

Overall, I have gained a lot of knowledge and experience in this project due to its broad engineering nature in areas of hardware and software design. I have learned to source for solutions when problems are encountered. This project has greatly improved my project management skills. Finally I believed what I have learned throughout the course especially in this module will greatly help me in my future career.

References

Internet:

1. [http //www.perfectpetfeeder.com](http://www.perfectpetfeeder.com) Accessed on 20 Feb 2009
2. <http://www.nextag.com/automatic-dog-feeder/search.html>
3. <http://en.wikipedia.org/wiki/Microcontrollers>
4. <http://www.zilog.com/application/application.asp?appid=1>

Books:

1. Shanefield D.J, Industrial Electronics for Engineers, Chemists, and Technicians, William Andrew Publishing, Norwich, NY, 2001
2. Schaum's Outline of Programming with C++ (Paperback) by John Hubbard publishing 2005
3. Programmable logic controllers 3rd edition by Gary Dunning Publishing 2006