Smart Irrigation System Using Weather Forecast With Using Wireless Sensor Network For Monitoring Soil Parameter

B.E. Dissertation

Submitted in partial fulfillment of the requirement of

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For the Degree of

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(Electronics and Telecommunication Engineering)

by

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"SMART IRRIGATION SYSTEM BASED ON WEATHER FORECAST WITH USING WIRELESS SENSOR NETWORK FOR MONITORING SOIL PARAMETERS "

is a bonafide work done by

Kazi Simran (15DET61)
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and is submitted in the partial fulfillment of the requirement for the degree of

Bachelor of Engineering
in
Electronics and Telecomunication Engineering
to the
University of Mumbai.

Guide	Project Coordinator
Head of Department	Principal

Certificate of Approval by Examiners

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Abstract

This project deals with enhanced water conservation using weather forecast which collects data from a web page about the rain prediction and then accordingly adjusts and delays the irrigation cycle .It also consist of WSN which monitors soil parameters like humidity, temperature, etc, which communicates with the coordinator ,using ZigBee protocol, which then sends updates to the farmer via SMS using GSM protocol. .Based upon the sensors value from the field and rainfall forecast obtained from the internet, irrigation cycle of crop is modified..Hence ,we will develop an experimental setup to implement the proposed idea which can be easily and effectively extended to actual crop field. Ultimately ,this reduces the fresh water consumption and irrigation costs by maximizing the crop yields.

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Chapter 1

Introduction

1.1 Introduction

This project deals with enhanced water conservation using weather forecast which collects data from a web page about the rain prediction and then accordingly adjusts and delays the irrigation cycle .It also consist of WSN which monitors soil parameters like humidity, temperature, etc, which communicates with the coordinator ,using ZigBee protocol, which then sends updates to the farmer via SMS using GSM protocol. .Based upon the sensors value from the field and rainfall forecast obtained from the internet, irrigation cycle of crop is modified..Hence ,we will develop an experimental setup to implement the proposed idea which can be easily and effectively extended to actual crop field. Ultimately ,this reduces the fresh water consumption and irrigation costs by maximizing the crop yields.

Figure 1.1: Stressed Farmer

1.2 Motivation

This project aims at monitoring and scheduling irrigation time according to weather forecast and soil parameters.This scheduling helps in reducing wastage of water and crops.It reduces burden on farmers.The project is useful for easy user interface.The system utilizes powerful data retrieval and data manipulation.The project provides useful data.This project gives all the information useful for smart irrigation and hence provides uniformity and balance is maintained. It provides smart co-ordination between website, processor unit and user. It also gives display about the final result obtained from soil and weather forecast. It also have additional functionality of control using (Short Message Service) using GSM.

Figure 1.2: Farmer Suicide

The above points shows the problems faced by the farmers.

Chapter 2

Literature Survey

- **Automated Irrigation and Fire Alert System based on Hargreaves Equation using Weather Forecast and ZigBee Protocol :** This paper presents the automated irrigation system with enhanced water conservation, using weather forecast and concept of wireless sensor networks. Each node consisting of soil moisture, smoke and temperature sensors communicates with the coordinator, using ZigBee protocol, which then sends updates to the farmer via SMS using GSM protocol. Hargreaves equation for reference evapotranspiration has been used for the determination of water requirements of the crop. Based upon the calculated crop evapotranspiration from the equation and rainfall forecast obtained from the internet, irrigation cycle of the crop has been modified. An experimental test bed has been developed to implement the proposed idea which can be easily and effectively extended to actual crop fields. The proposed work is very useful for farmers due to the prevailing unpredictable weather conditions. In this paper, there is an an efficient technique for water management along with prevention of the fields from fire hazards, by using a network of sensors communicating via ZigBee protocol, Hargreaves equation and weather forecast available from internet. Rest of the paper is organized as follows. Technical background is presented is Section II, the proposed solution in Section III, implementation in Section IV, result in Section V and conclusion in Section VI.

  Review This system successfully provides an appropriate amount of water for the selected crop and soil combinations, thereby reducing wastage of water resource

as well as resulting in better yields for the crop. In addition, chances of rainfall gathered from a weather forecasting were also taken into account so as to prevent over irrigation of the crop and make use of rainwater. The fire accidents are also prevented by early detection and quick prevention measures. Moreover, all the information about what is going on in the field has been continuously sent through SMS on farmers mobile phone. This reduces human intervention and also the labour cost. The proposed solution is highly efficient in terms of performance installation and operational cost. The system does not require any special training and can be used by anyone easily.

- **Automated Irrigation System Using a Wireless Sensor Network and GPRS Module:** An automated irrigation system was developed to optimize water use for agricultural crops. The system has a distributed wireless network of soil-moisture and temperature sensors placed in the root zone of the plants. In addition, a gateway unit handles sensor information, triggers actuators, and transmits data to a web application. An algorithm was developed with threshold values of temperature and soil moisture that was programmed into a microcontroller-based gateway to control water quantity. The system was powered by photovoltaic panels and had a duplex communication link based on a cellular-Internet interface that allowed for data inspection and irrigation scheduling to be programmed through a web page. The automated system was tested in a sage crop field for 136 days and water savings of up to 90

  Review The irrigation system can be adjusted to a variety of specific crop needs and requires minimum maintenance. The modular configuration of the automated irrigation system allows it to be scaled up for larger greenhouses or open fields. In addition, other applications such as temperature monitoring in compost production can be easily implemented. The Internet controlled duplex communication system provides a powerful decision-making device concept for adaptation to several cultivation scenarios. Furthermore, the Internet link allows the supervision through mobile telecommunication devices, such as a smart-phone.

  Besides the monetary savings in water use, the importance of the preservation of this natural resource justify the use of this kind of irrigation systems.

- **A New Agriculture Monitoring System Based on WSNs:** Recent developments in information technologies provide facility agriculture monitoring system a new perspective of networking and automation. This paper presents a new agriculture monitoring system based on WSNs (Wireless sensor networks) with IP cameras, which can be controlled remotely to have close vision of plants. WSNs can deploy freely, collect sensor data periodically to the control center, process and store historical data, which could facilitate clients and experts in agriculture to monitor the conditions in a large field. Traditional WSNs monitoring system only focused on environmental parameters, such as temperature and humility. We integrate video informa tion and environmental data. Also the sleeping methods based on small-scale time synchronization and alarming mechanism of our system achieve better communication and less power consumption. Through experiments we validated the system in a greenhouse and outdoors fields successfully.

  Review Contrary to conventional agriculture monitoring system which mainly depending on analog monitoring machines and deploying with large amount of cables, our proposed system is designed not only monitor the environmental conditions wirelessly, but to integrate video monitoring technologies to agriculture monitoring. Whats more, the agriculture monitor ing system based on WSNs matches the sensed data in WSNs with images in video monitoring system because we deploy the IP cameras nearby known-position nodes.

Chapter 3

Existing Design Method

3.1 Methods Used

Studies have shown minimal impact by smart irrigation controllers when installed indiscriminately, but targeting overirrigators increases the water conservation potential. The objective was to evaluate different methodologies defining residential overirrigators. Two independent smart controller studies were conducted by utilities in Hillsborough County [Hillsborough County Water Resource Services (HCWRS)] and Orange County [Orange County Utilities (OCU)], Florida. In HCWRS, the cooperators qualified when irrigation was in the top 50th percentile of potable water users in the county. Additionally, the 21 cooperators were located in three cities determined as having high water use relative to other cities in the same area. In OCU, 132 cooperators received smart controllers when frequently irrigating more than 1.5 times the gross irrigation requirement (GIR). Actual ratios of historical average irrigation to the GIR ranged from 1.45 to 2.37 in HCWRS and 6.048.33 in OCU. As a result, cooperators in OCU showed significant reductions in irrigation with a return on investment of 414 months compared to HCWRS with a payback period of 1727 months despite higher water rates and larger irrigated areas in HCWRS. Using the GIR as a benchmark proved to be a better method than using utility-wide percentile ranges of irrigation application to target homeowners for smart controllers to ensure irrigation reductions. Smart controllers are recommended for homeowners who average two times the monthly GIR for at least three months per year over at

least three years when implemented in conjunction with relatively well-maintained irrigation systems. Water savings were guaranteed when ratios averaged more than six using the same frequency standards. Additional requirements for successful implementation include site-specific programming and providing basic knowledge to the homeowner.

3.2 Problem Statement

1. Most common problem of farmers with recent irrigation system :When do I water?, How long should I water ?
2. Starting irrigation too early or running irrigation too long : over watering which leads to crop damage and wastage of water.
3. Likewise starting irrigation too late can cause reduce yields and poor crops quality which can affect crop price.
4. Looking at these problems in depth is a key to minimize their financial and practical impact on crops.

3.3 Project Overview

This project deals with enhanced water conservation using weather forecast which collects data from a webpage about the rain prediction and then accordingly adjusts and delays the irrigation cycle .It also consist of WSN which monitors soil parameters like humidity, ph, temperature, etc, which communicates with the coordinator ,using ZigBee protocol, which then sends updates to the farmer via SMS using GSM protocol. .Based upon the calculated values from soil and rainfall forecast obtained from the internet, irrigation cycle of crop is modified..Hence ,we will develop an experimental setup to implement the proposed idea which can be easily and effectively extended to actual crop field. Ultimately ,this reduces the fresh water consumption and irrigation costs by maximizing the crop yields.

Chapter 4

Hardware Design

4.1 Practical Function Of The Design

4.1.1 ARM 7 LPC2148

LPC2148 is the widely used IC from ARM-7 family. It is manufactured by Philips and it is pre-loaded with many inbuilt peripherals making it more efficient and a reliable option for the beginners as well as high end application developer

The features of LPC214x series controllers.
1.8 to 40 kB of on-chip static RAM and 32 to 512 kB of on-chip flash program memory.128 bit wide interface/accelerator enables high speed 60 MHz operation.

2.In-System/In-Application Programming (ISP/IAP) via on-chip boot-loader software.Single flash sector or full chip erase in 400 ms and programming of 256 bytes in 1ms.

3.EmbeddedICE RT and Embedded Trace interfaces offer real-time debugging with theon-chip RealMonitor software and high speed tracing of instruction execution.

4.USB 2.0 Full Speed compliant Device Controller with 2 kB of endpoint RAM.In addition, the LPC2146/8 provides 8 kB of on-chip RAM accessible to USB by DMA.

5.One or two (LPC2141/2 vs. LPC2144/6/8) 10-bit A/D converters provide a total of

6/14analog inputs, with conversion times as low as 2.44 us per channel.

6.Single 10-bit D/A converter provides variable analog output.

7.Two 32-bit timers/external event counters (with four capture and four comparechannels each), PWM unit (six outputs) and watchdog.

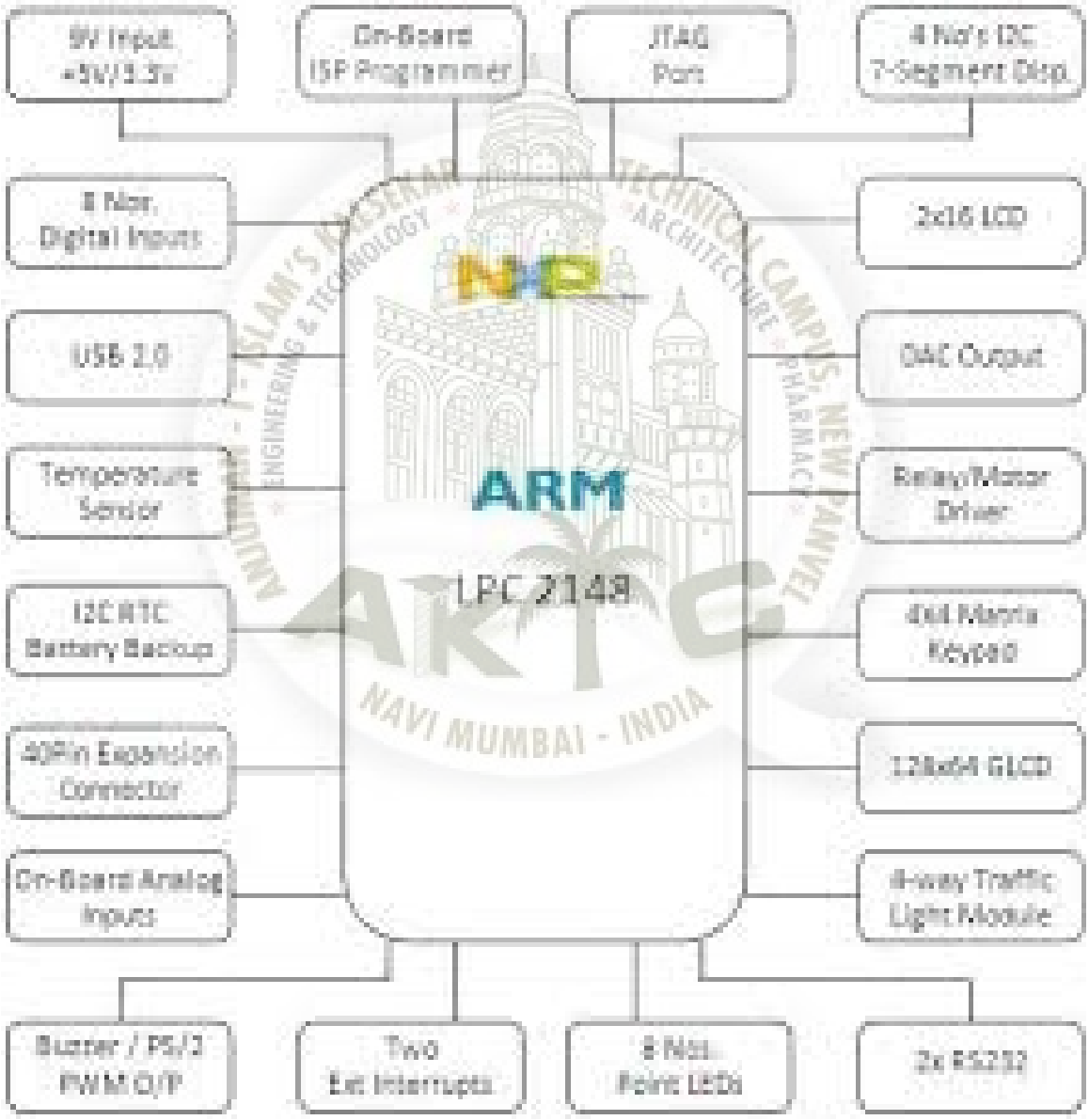


Figure 4.1: ARM7 LPC2148

8.Low power real-time clock with independent power and dedicated 32 kHz clock input.

9.Multiple serial interfaces including two UARTs (16C550), two Fast I2C-bus(400 kbit/s), SPI and SSP with buffering and variable data length capabilities.

10.Vectored interrupt controller with configurable priorities and vector addresses.

11.Up to 45 of 5 V tolerant fast general purpose I/O pins in a tiny LQFP64 package.

12.Up to nine edge or level sensitive external interrupt pins available.

13.On-chip integrated oscillator operates with an external crystal in range from 1 MHz to30 MHz and with an external oscillator up to 50 MHz.

14.Power saving modes include Idle and Power-down.

15.Individual enable/disable of peripheral functions as well as peripheral clock scaling foradditional power optimization.

16.Processor wake-up from Power-down mode via external interrupt, USB, Brown-OutDetect (BOD) or Real-Time Clock (RTC).

17.Single power supply chip with Power-On Reset (POR) and BOD circuits:
CPU operating voltage range of 3.0 V to 3.6 V .

Now let us start with the hardware requirement of LPC2148. LPC2148 need minimum below listed hardware to work properly.

1.Power Supply

2.Crystal Oscillator

3.Reset Circuit

4.RTC crystal oscillator (This is not necessary if you are not using RTC. However this is considered as necessary requirement)

5.UART

1.**Power Supply**:LPC2148 works on 3.3 V power supply. LM 117 can be used for generating 3.3 V supply. However, basic peripherals like LCD, ULN 2003 (Motor Driver IC) etc. works on 5V. So AC mains supply is converted into 5V using below mentioned circuit and after that LM 117 is used to convert 5V into 3.3V.

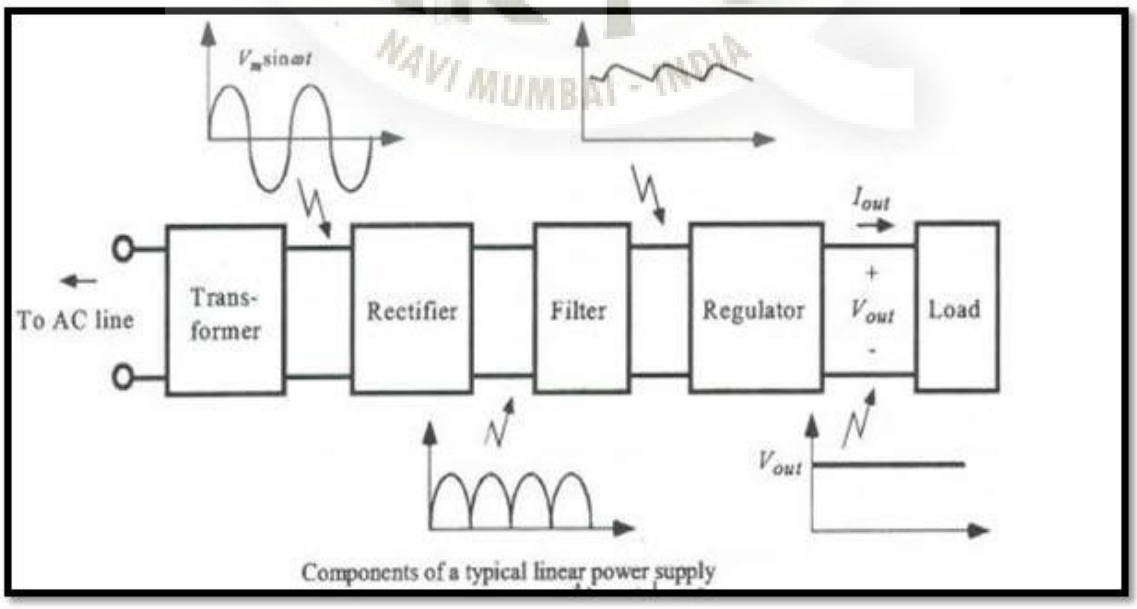


Figure 4.2: Power Supply

Transformer:It is used to step down 230V AC to 9V AC supply and provides isolation between power grids and circuit.

Rectifier: It is used to convert AC supply into DC.

Filter:It is used to reduce ripple factor of DC output available from rectifier end.

Regulator:It is used to regulate DC supply output.

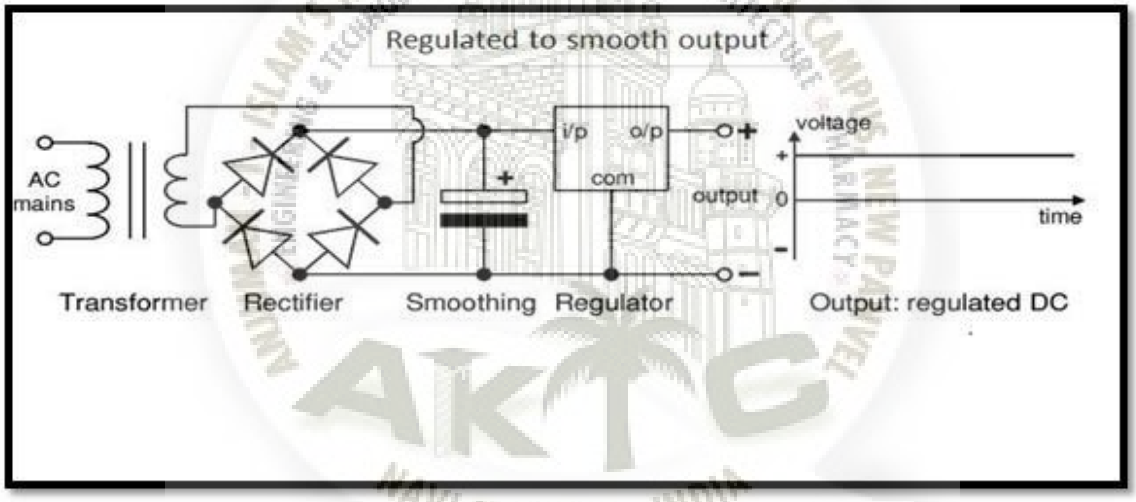


Figure 4.3: Regulator

Here, Regulator IC 7805 is used to provide fix 5V dc supply.
Now we can use LM 117 for generating 3.3V supply from 5V using below circuit.

2.**Reset Circuit**:Reset button is essential in a system to avoid programming pitfalls and sometimes to manually bring back the system to the initialization mode. Circuit diagram for reset is as shown below.

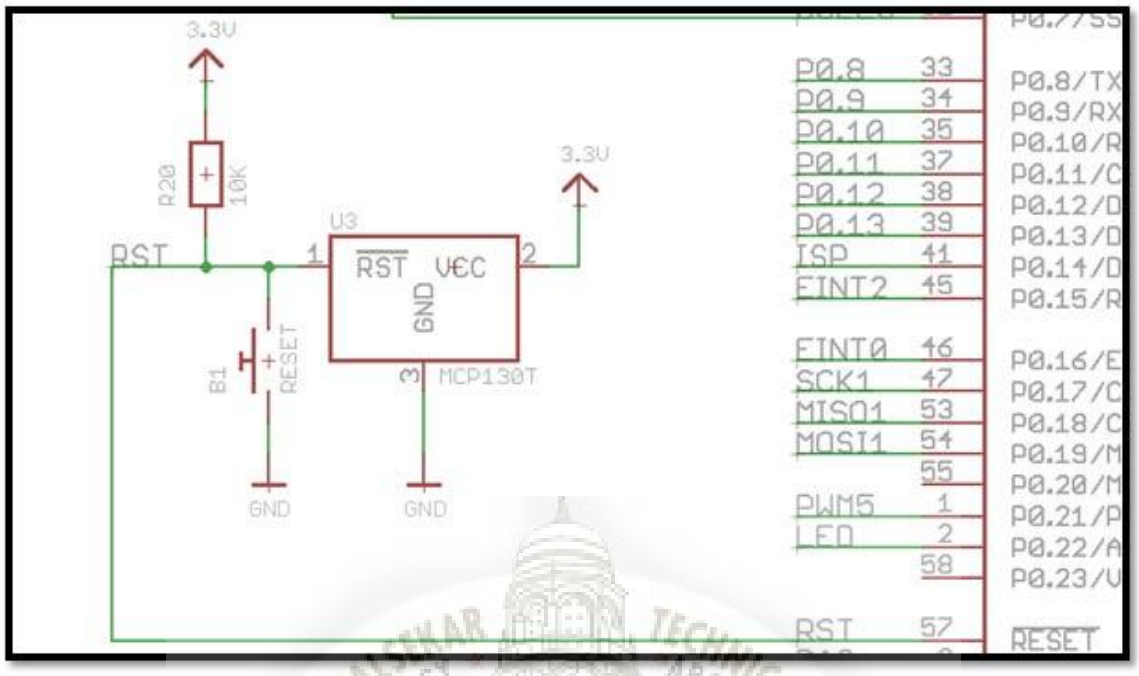


Figure 4.4: Reset Circuit

3.**Oscillator Circuit** :Discuss about every detail about configurations of Clock and PLL in LPC2148 ARM7 Microcontroller. There are several ways we can clock ARM Microcontroller. One way is to use External Clock with duty cycle 50-50 and in a frequency range 1 MHz to 50 MHz connected to XTAL1 Pin. The second way is by connecting External Crystal Oscillator but its range is lower between 1 MHz to 30 MHz. We can also use on-chip PLL Oscillator but here external clock frequency should not exceed range from 10 MHz to 25 MHz. In this tutorial, we will concentrate on External Crystal with PLL. External Clock source and External Crystal only will be discussed in future since its not required at this moment PLL is used to generate system clock from between 10 MHz to 25 Mhz. PLL may multiply frequency to range from 10 MHz to 60 MHz (LPC21xx Series) and 48 MHz for USB if used. PLL uses frequency multiplier which can be in a range from 1 to 32, in real world situation this value should not be higher than 6 due to upper frequency limit. PLL generator allows running ARM at high speed with low frequency oscillator connected. Also, this minimizes EMC emission as frequency is multiplied inside ARM Chip. PLL allows changing frequency dynamically. In LPC2148 microcontrollers there are two PLLs which provide programmable frequencies to the CPU and USB System.

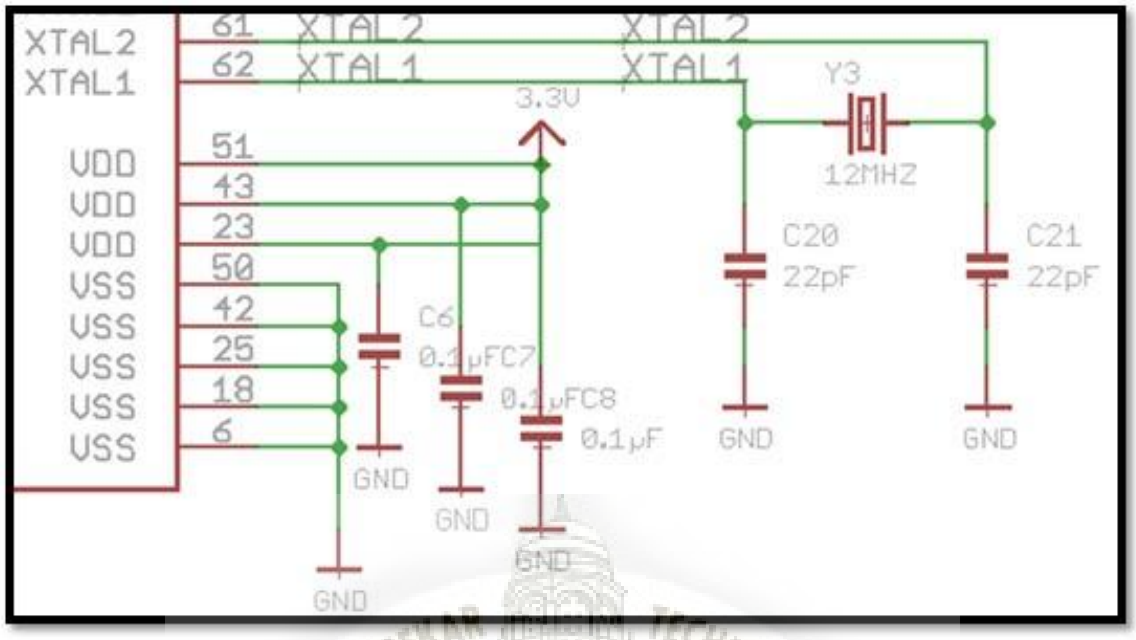


Figure 4.5: Oscillator Circuit

4.**RTC Oscillator Circuit**:It provides clock for RTC operation.

5.**UART**:LPC 2148 has inbuilt ISP which means we can program it within the system using serial communication on COM0. It has also COM1 for serial communication. MAX 232/233 IC must be used for voltage logic conversion.

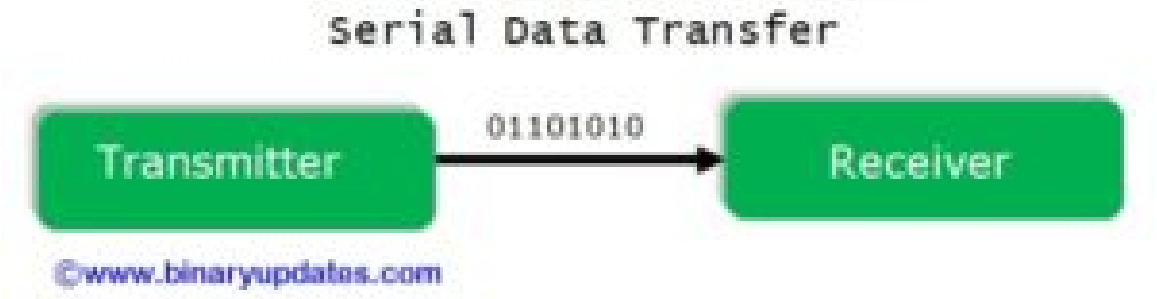


Figure 4.6: UART

4.1.2 XBee S2

This is the XBee XB24-Z7WIT-004 module from Digi. Series 2 improves on the power output and data protocol. Series 2 modules allow you to create complex mesh networks based on the XBee ZB ZigBee mesh firmware. These modules allow a very reliable and simple communication between microcontrollers, computers, systems, really anything with a serial port! Point to point and multi-point networks are supported. These are essentially the same hardware as the older Series 2.5, but have updated firmware. They will work with Series 2.5 modules if you update the firmware through X-CTU.

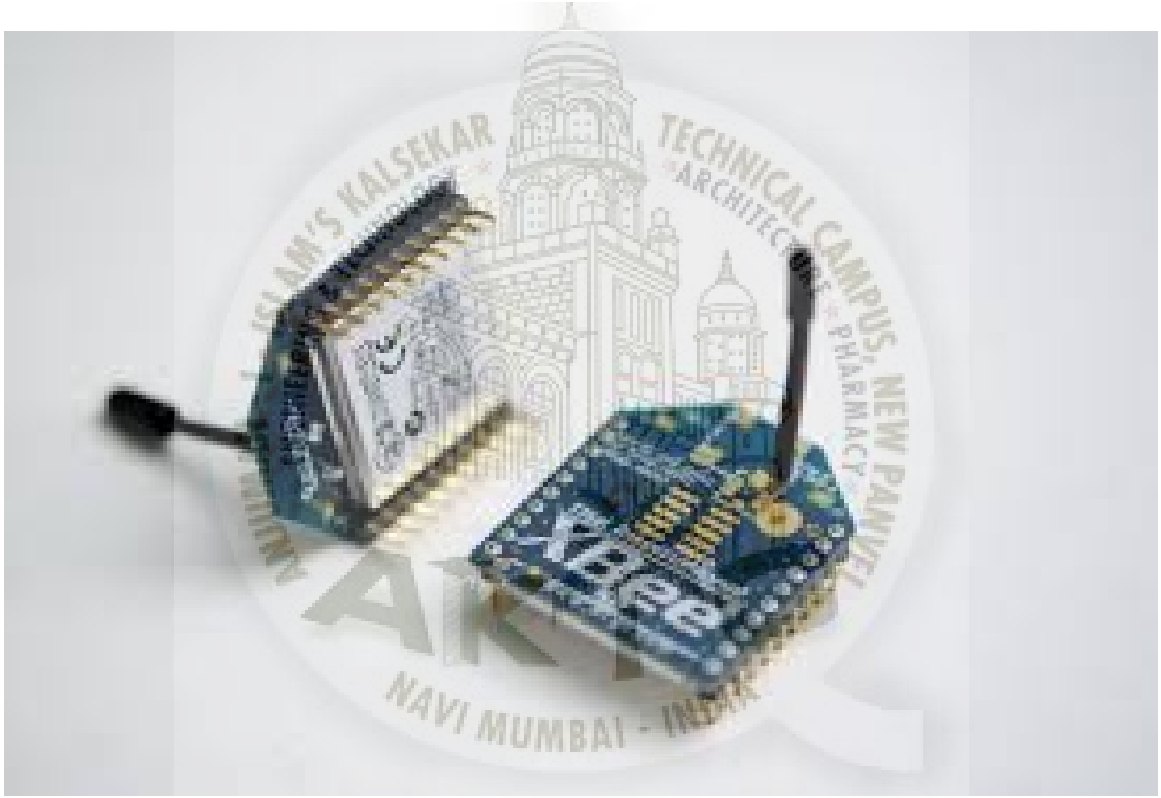


Figure 4.7: XBee S2

For simple point-to-point configuration, we need to use the Series 1 instead. The Series 2 requires considerable setup and configuration. The highly recommend Building Wireless Sensor Networks as a guide for setting up mesh networks.Series 1 and Series 2 XBee modules have the same pin-out. However, Series 1 modules cannot communicate with Series 2 modules.

4.1.3 GSM SIM800

SIM800 is a quad-band GSM/GPRS module designed for the global market. It works on frequencies GSM 850MHz, EGSM 900MHz, DCS 1800MHz and PCS 1900MHz. SIM800 features GPRS multi-slot class 12/ class 10 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4. With a tiny configuration of 24*24*3mm, SIM800 can meet almost all the space requirements in users applications, such as M2M, smart phone, PDA and other mobile devices.

Figure 4.8: GSM SIM800

4.1.4 LM35 Temperature Sensor

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies.

Figure 4.9: Temperature Sensor

4.1.5 Soil Moisture Sensor

This is an easy to use digital soil moisture sensor. Just insert the sensor in the soil and it can can measure moisture or water level content in it. It gives a digital output of 5V when moisture level is high and 0V when the moisture level is low in the soil. The sensor includes a potentiometer to set the desired moisture threshold. When the sensor measures more moisture than the set threshold, the digital output goes high and an LED indicates the output. When the moisture in the soil is less thatn the set threshold, the output remains low. The digital output can be connected to a micro controller to sense the moisture level. The sensor also outputs an analog output which can be connected to the ADC of a micro controller to get the exact moisture level in the soild.This sensor is great for making water gardening projects, water sensing, etc.

Specifications:-

1.Operating voltage: 3.3V 5V

2.Dual output mode,analog output more accurate

3.A fixed bolt hole for easy installation

4. power indicator (red) and digital switching output indicator (green)

5.Having LM393 comparator chip, stable

6.Panel PCB Dimension: Approx.3cm x 1.5cm

7.Soil Probe Dimension: Approx. 6cm x 3cm

8.Cable Length: Approx.21cm

9.VCC: 3.3V-5V

10.GND: GND

11.DO: digital output interface(0 and 1)

12.AO: analog output interface

Connections:-

1.VCC connect to 3.3V-5V

2.GND connect to GND

3.DO digital value output connector0 or 1

4.AO analog value output connector

Usage:-

Soil moisture module is most sensitive to the ambient, generally used to detect the moisture content of the soil. When the module can not reach the threshold value, DO port output high, when the the soil humidity exceeds a set threshold value, the module D0 output low; The small board digital output D0 can be connected directly to the MCU, MCU to detect high and low, to detect soil moisture; Small board digital output DO can directly drive the buzzer module or relay module in our store, which can form a soil moisture alarm equipment; Small board analog output AO and AD module connected through the AD converter, you can get more precise values of soil moisture.

Figure 4.10: Soil Moisture Sensor

4.1.6 SPDT Relay

The Single Pole Double Throw SPDT relay is quite useful in certain applications because of its internal configuration. It has one common terminal and 2 contacts in 2 different configurations: one can be Normally Closed and the other one is opened or it can be Normally Open and the other one closed. So basically you can see the SPDT relay as a way of switching between 2 circuits: when there is no voltage applied to the coil one circuit receives current, the other one doesnt and when the coil gets energised the opposite is happening.

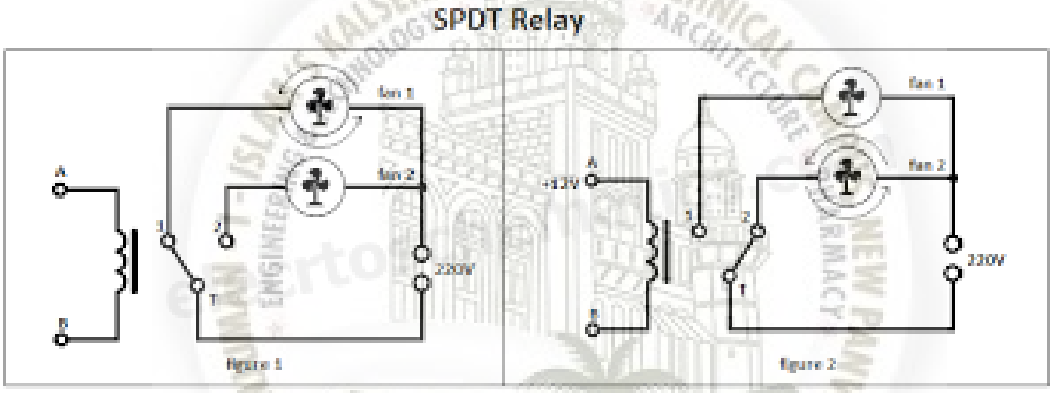


Figure 4.11: SPDT Relay

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches.Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits, the link is magnetic and mechanical.

4.1.7 16x2 LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special even custom characters (unlike in seven segments), animations and so on.A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

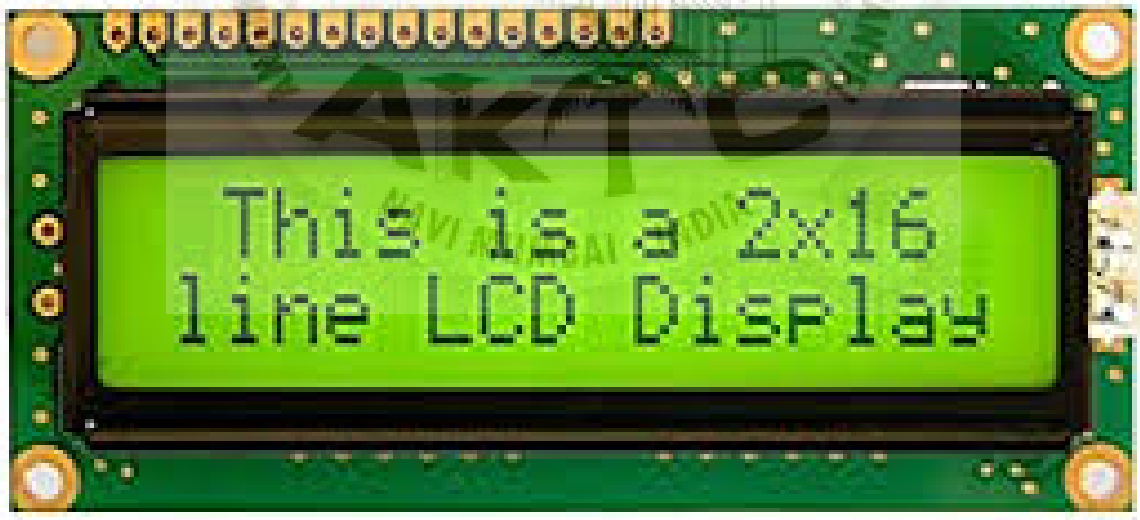


Figure 4.12: 16X2 LCD

Chapter 5

Software Design

5.1 Software Used

5.1.1 Visual Basic

The software used here is Visual Basic. The software used here is Visual Basic. Visual Basic is a third-generation event-driven programming language and inte-grated development environment (IDE) from Microsoft for its Component Object Model(COM) programming model rst released in 1991 and declared legacy during 2008. Microsoft intended Visual Basic to be relatively easy to learn and use. Visual Basic was derived from BASIC, a user-friendly programming language designed for beginners, and it enables the rapid application development (RAD) of graphical user interface (GUI) applications, access to databases using Data Access Objects, Remote Data Objects, or ActiveX Data Objects, and creation of ActiveXcontrols and objects. A programmer can create an application using the components pro-vided by the Visual Basic program itself. Over time the community of programmers developed third-party components.Programs written in Visual Basic can also use the Windows API, which requires external function declarations. The nal release was version 6 in 1998 (now known simply as Visual Basic). On April 8, 2008, Mi-crosoft stopped supporting Visual Basic 6.0 IDE. The Microsoft Visual Basic team still maintains compatibility for Visual Basic 6.0 applications on Windows Vista, Windows Server 2008 including R2, Windows 7, Windows 8, Windows 8.1, Windows Server 2012 and Windows 10 through its "It Just Works" program.

In 2014, some software developers still preferred Visual Basic 6.0 over its successor, Vi-

sual Basic .NET. In 2014 some developers lobbied for a new version of Visual Basic 6.0. In 2016, Visual Basic 6.0 won the technical impact award at The 19th Annual D.I.C.E. Awards. A dialect of Visual Basic, Visual Basic for Applications (VBA), is used as a macro or scripting language within several Microsoft applications, in-cluding Microsoft O ce. Forms are created using drag-and-drop techniques. A tool is used to place controls (e.g., text boxes, buttons, etc.) on the form (window). Controls have attributes and event handlers associated with them. Default values are provided when the control is created, but may be changed by the programmer. Many attribute values can be modi ed during run time based on user actions or changes in the environment, providing a dynamic application. For example, code can be inserted into the form resize event handler to reposition a control so that it remains centered on the form, expands to ll up the form, etc. By inserting code into the event handler for a keypress in a text box, the program can automatically translate the case of the text being entered, or even prevent certain characters from being inserted.

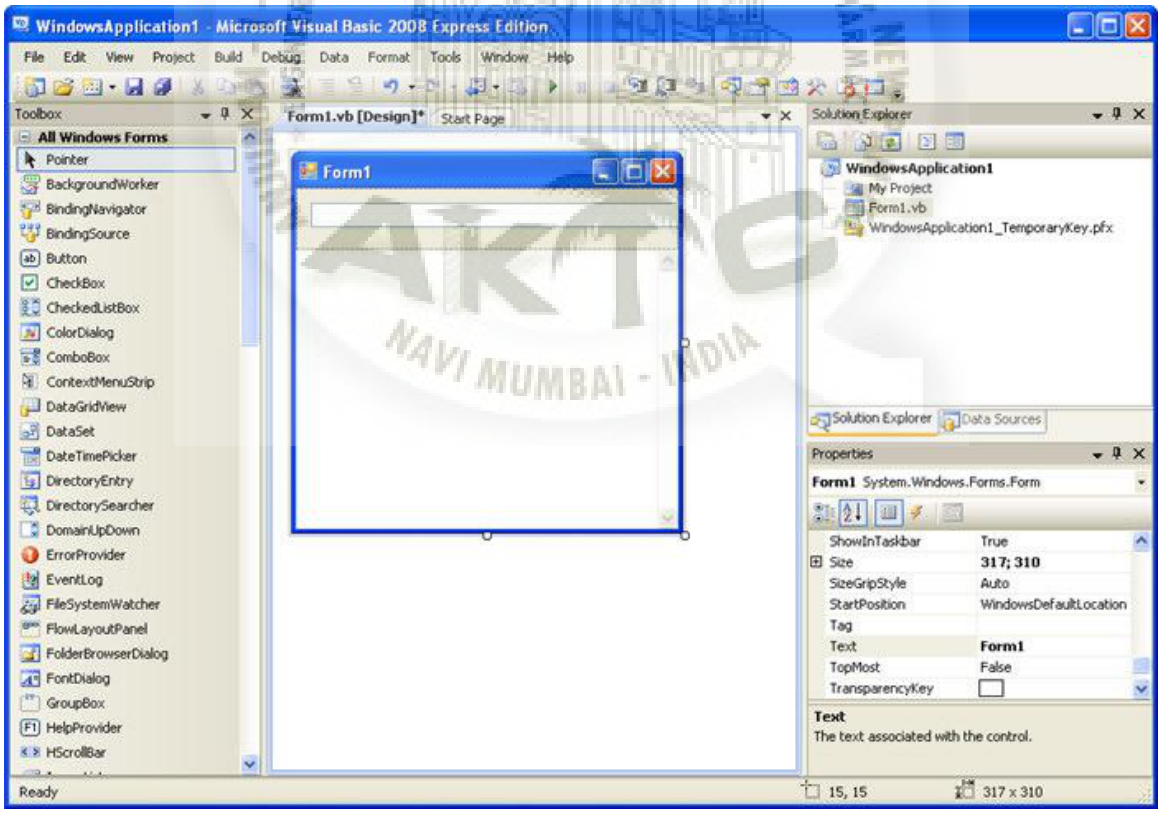


Figure 5.1: Visual Basic

Controls provide the basic functionality of the application, while programmers can insert additional logic within the appropriate event handlers. For example, a drop-down combination box automatically displays a list. When the user selects an element, an event handler is called that executes code that the programmer created to perform the action for that list item. Alternatively, a Visual Basic component can have no user interface, and instead provide ActiveX objects to other programs via Component Object Model (COM). This allows for server-side processing or an add-in module. The runtime recovers unused memory using reference counting, which depends on variables passing out of scope or being set to Nothing, avoiding the problem of memory leaks common to other languages. There is a large library of utility objects, and the language provides basic support for object-oriented pro-gramming. Unlike many other programming languages, Visual Basic is generally not case-sensitivethough it transforms keywords into a standard case con guration and forces the case of variable names to conform to the case of the entry in the symbol table.

String comparisons are case sensitive by default. The Visual Basic compiler is shared with other Visual Studio languages (C, C++). Nevertheless, by default the restrictions in the IDE do not allow creation of some targets (Windows model DLLs) and threading models, but over the years, developers have bypassed these restrictions.Visual Basic builds upon the characteristics of BASIC. There are no line numbers as in earlier BASIC, code is grouped into subroutines or methods: Sub...End Sub . ll editions from Windows 98 to Windows 7 (some editions of Win-dows 7 do not include it). A Windows 95 machine would however require inclusion with the installer of whichever DLL was needed by the program. Visual Basic 5 and 6 can compile code to either native or P-Code but in either case the runtime is still required for built in functions and forms management. Criticisms levelled at Visual Basic editions prior to VB.NET include:[31] Versioning problems associated with various runtime DLLs, known as "DLL hell" Poor support for object-oriented programming[32] Can only create multi-threaded applications using ActiveX Variant types have a greater performance and storage "overhead" than strongly typed pro-gramming languages Dependency on complex and fragile Component Object Model (COM) Registry entries. Legacy development and support All versions of the Visual Basic development environment from 1.0 to 6.0 were retired by Microsoft by 2008.

The associated runtime environments are also unsupported, except for the Visual Basic

6 core runtime environment, which Microsoft o cially supports for the life-time of Windows 8 and Windows 10. Third party components that shipped with Visual Studio 6.0 are not included in this support statement. Some legacy Visual Basic components may still work on newer platforms, despite being unsupported by Microsoft and other vendors. Documentation for Visual Basic 6.0, its application programming interface and tools is best covered in the last MSDN release before Visual Studio.NET 2002. Later releases of MSDN focused on .NET development and had signi cant parts of the Visual Basic 6.0 programming documentation re-moved as the language evolved, and support for older code ended. Although vendor support for Visual Basic 6 has ended, and the product has never been supported on the latest versions of Windows, key parts of the environment still work on newer platforms. It is possible to get a subset of the development environment working on 32-bit and 64-bit versions of Windows Vista, Windows 7, Windows 8, and Windows 10. Database tables: Oracle is the backend of the project and this project has 8 tables.

5.2 Website Used

5.2.1 Open Weather Map

OpenWeatherMap is an online service that provides weather data, including current weather data, forecasts, and historical data to the developers of web services and mobile applications. For data sources, it utilizes meteorological broadcast services, raw data from airport weather stations, raw data from radar stations, and raw data from other official weather stations. All data is processed by OpenWeatherMap in a way that it attempts to provide accurate online weather forecast data and weather maps, such as those for clouds or precipitation. Beyond that, the service is focused on the social aspect by involving weather station owners in connecting to the service and thereby increasing weather data accuracy. The ideology is inspired by OpenStreetMap and Wikipedia that make information free and available for everybody. It uses OpenStreetMap for display of weather maps.

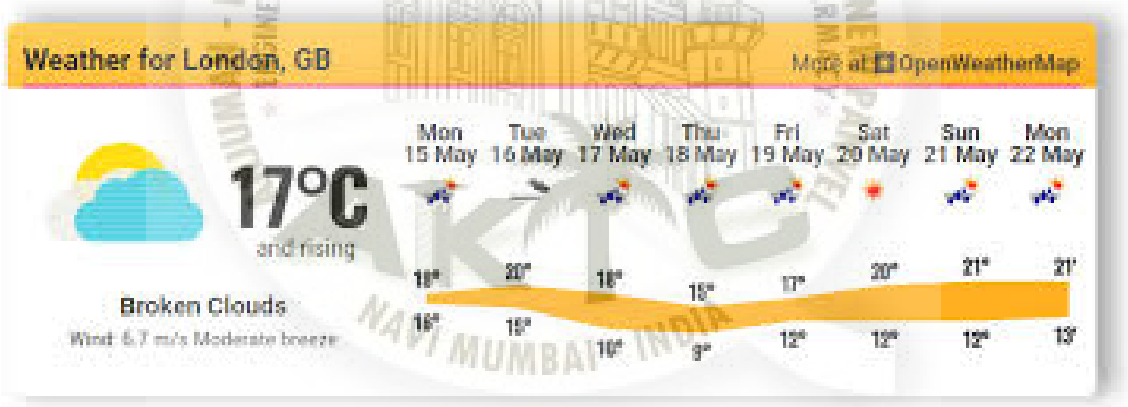


Figure 5.2: Open Weather Map

5.2.2 How To Use API Key In API Call?

Description: To get access to weather API you need an API key whatever account you chose from Free to Enterprise. Activation of an API key for Free and Startup plans takes 10 minutes. For other tariff plans it is 10 to 60 minutes.Keep right to not to process API requests without API key.

API Key: http://api.openweathermap.org/data/2.5/forecast?id=524901APPID=APIKEY

Parameters: APPID APIKEY is your unique API key

Example of API call: api.openweathermap.org/data/2.5/forecast?id=524901APPID=1111111111

5.2.3 How To Get Accurate API Response?

1.Do not send requests more than 1 time per 10 minutes from one device/one API key. Normally the weather is not changing so frequently.

2.Use the name of the server as api.openweathermap.org. Please never use the IP address of the server.

3.Call API by city ID instead of city name, city coordinates or zip code. In this case you get precise respond exactly for your city. The cities' IDs can be found in the following file: Cities' IDs list.

4.Free and Startup accounts have limitation of capacity and data availability. If you do not get respond from server do not try to repeat your request immediately, but only after 10 min. Also we recommend to store your previous request data.

5.2.4 Access Limitation

If account exceeds the limits, then a notification about limits exceeding is sent. If it repeats again, then the account is blocked for an hour. Therefore, the lock period is increased by one hour until 4 hours block sets. When blocking repeats the fifth time, then the lock period lasts 24 hours. This rule is cycled. Please be careful with the number of API calls you complete.

Chapter 6

Programs

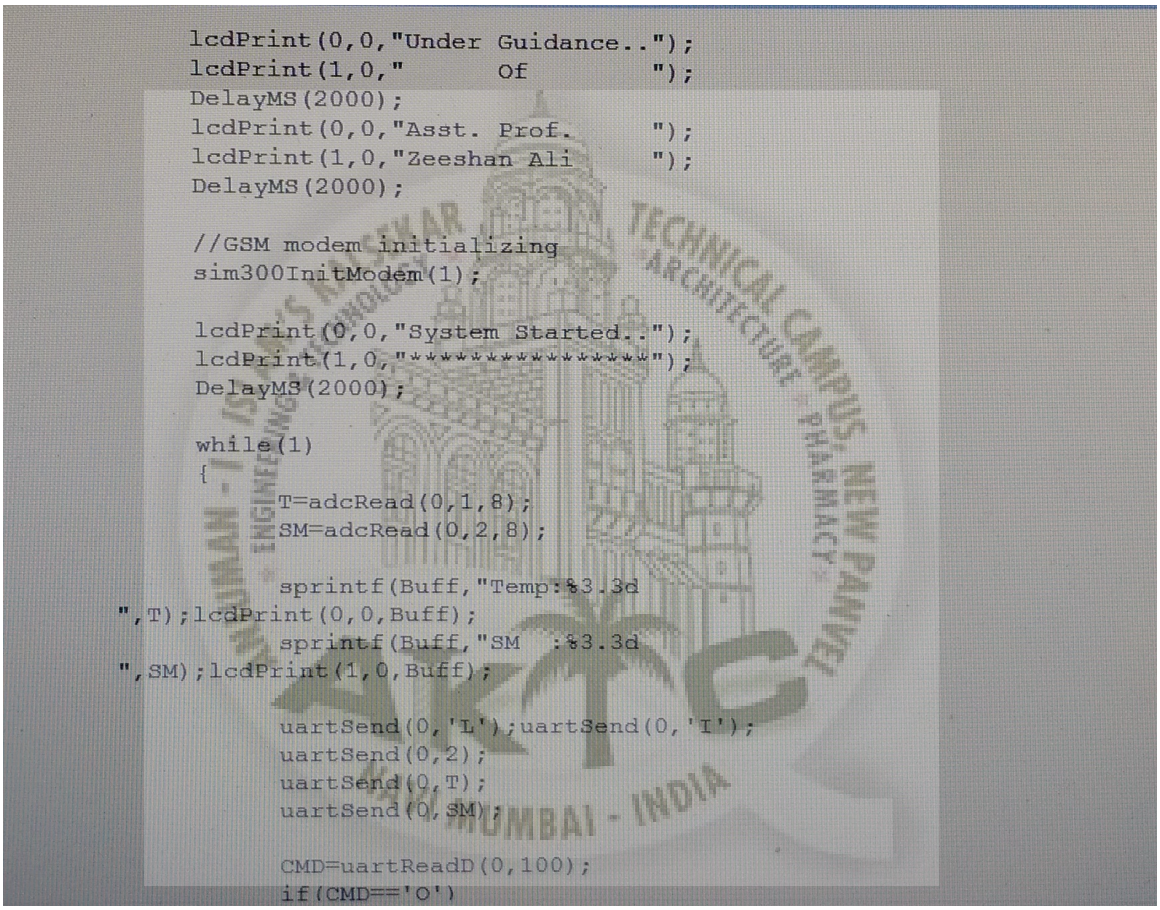
6.1 Main C program

```
//Headers-------------------------------------------------------------
-----------------------------------
#include <LPC214x.h>
#include <stdio.h>
#include <string.h>
#include "IO.h"
#include "Serial.h"
#include "Delay.h"
#include "LCD4.h"
#include "ADC.h"
#include "SIM300.h"
//Definitions---------------------------------------------------------
-----------------------------------
#define Buzzer      31
#define   RL              2
//Functions-----------------------------------------------------------
-----------------------------------
void portInit(void);
void Beep(unsigned char No,unsigned int Delay);
//Variables-----------------------------------------------------------
-----------------------------------
unsigned char Buff[20];
unsigned char T,SM;
unsigned char CMD;

unsigned char MEM[3];
unsigned char MN[14];
unsigned char SMS[20];
//-------------------------------------------------------------------
-----------------------------------
```

Figure 6.1: C Program 1

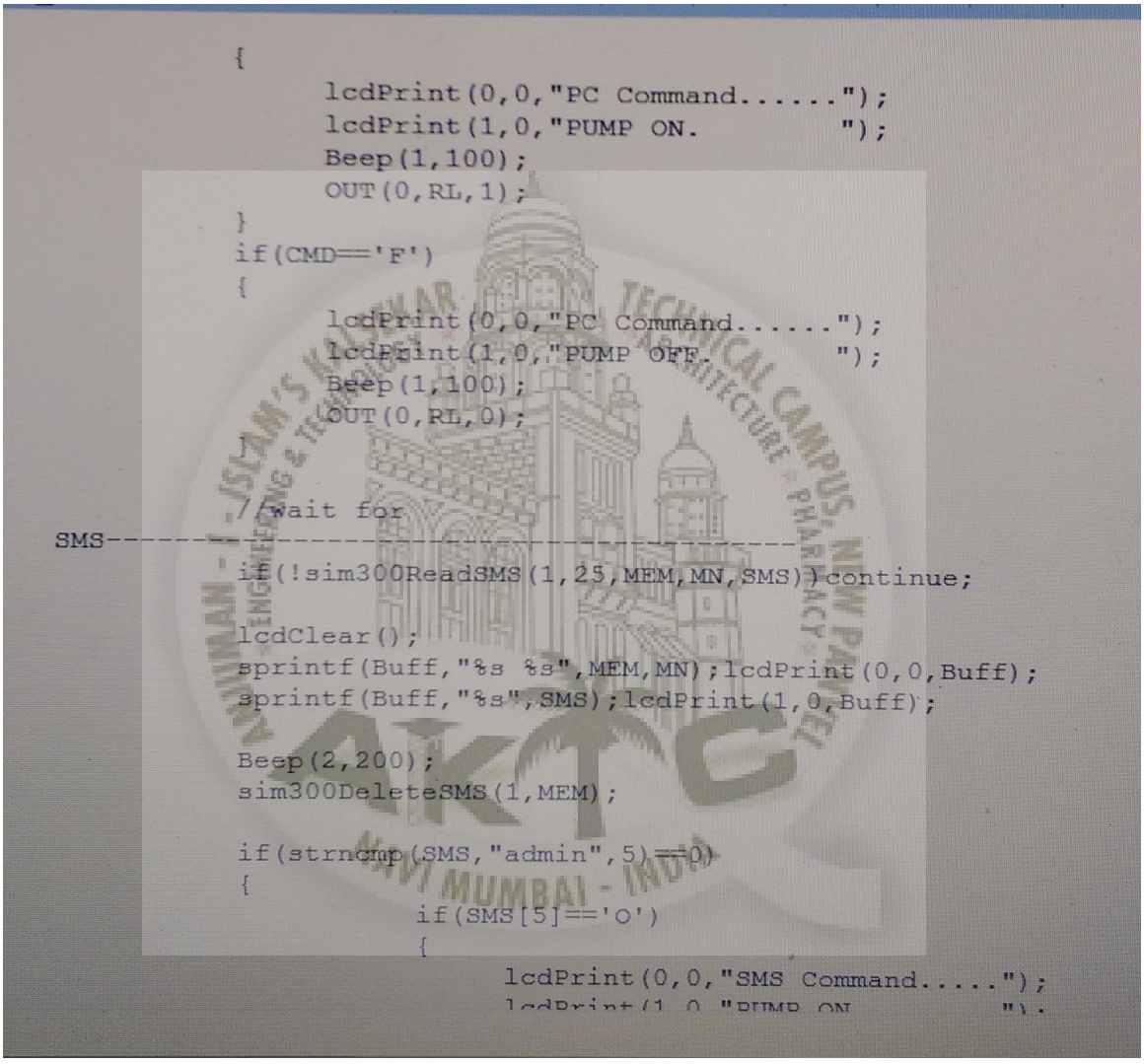
```
**********************************************************************
##################################
int main (void)
{
      portInit();
      OUT(0,RL,0);
      Beep(3,200);

      uartInit(0,9600);
      uartInit(1,9600);

      adcInit(0);
      adcInitCH(0,1);
      adcInitCH(0,2);

      lcdInit();
      lcdPrint(0,0,"   Welcome To   ");
      lcdPrint(1,0,"   A.I.K.T.C.   ");
      DelayMS(2000);
      lcdPrint(0,0,"     Smart      ");
      lcdPrint(1,0," Irrigation Sys.");
      DelayMS(2000);
      lcdPrint(0,0," Project Done   ");
      lcdPrint(1,0,"      By       ");
      DelayMS(2000);
      lcdPrint(0,0,"Kazi Simran     ");
      lcdPrint(1,0,"Memon Moin      ");
      DelayMS(2000);
      lcdPrint(0,0,"Abu Talha       ");
      lcdPrint(1,0,"Arfat Mujawar   ");
      DelayMS(2000);
```

Figure 6.2: C Program 2



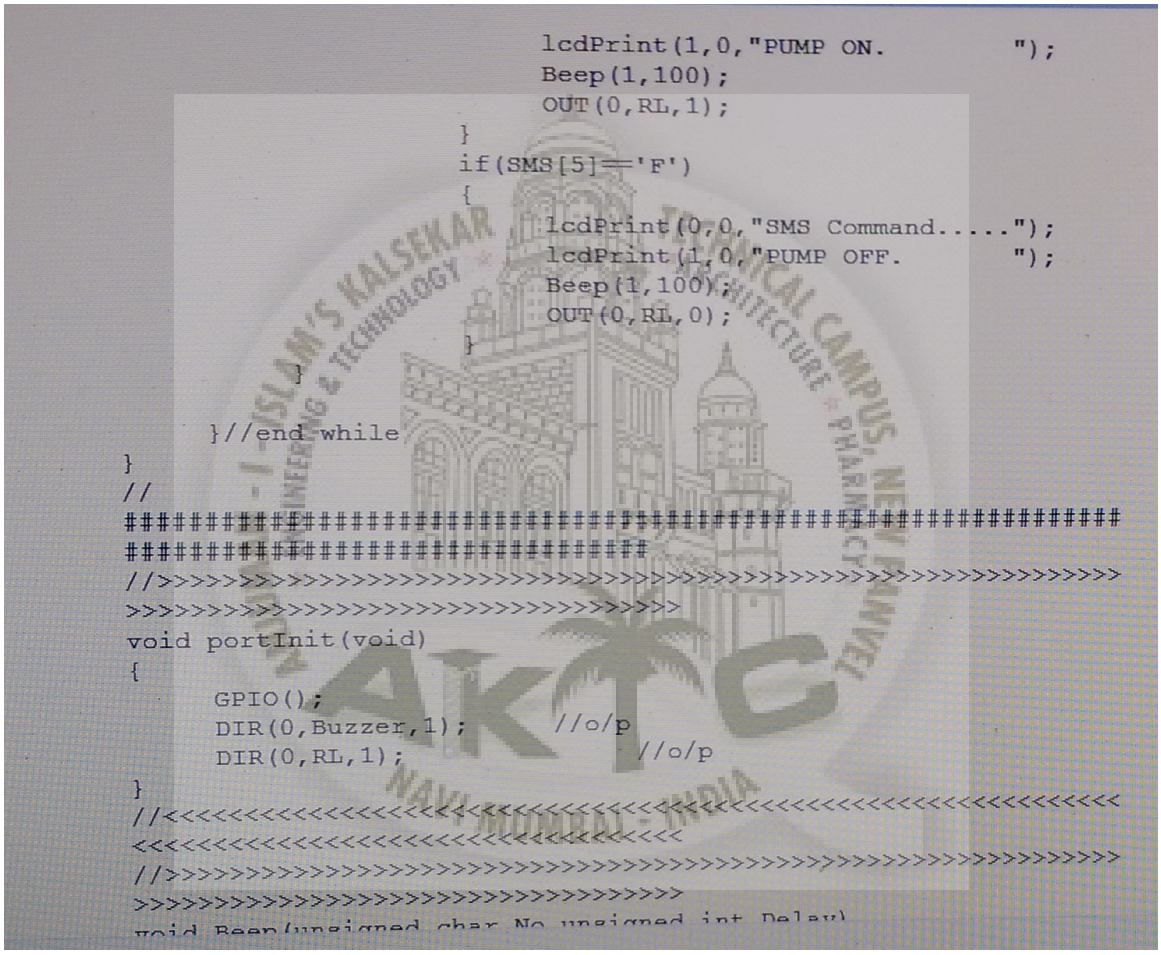
```
        lcdPrint(0,0,"Under Guidance..");
        lcdPrint(1,0,"      Of         ");
        DelayMS(2000);
        lcdPrint(0,0,"Asst. Prof.      ");
        lcdPrint(1,0,"Zeeshan Ali      ");
        DelayMS(2000);

        //GSM modem initializing
        sim300InitModem(1);

        lcdPrint(0,0,"System Started..");
        lcdPrint(1,0,"*****************");
        DelayMS(2000);

        while(1)
        {
            T=adcRead(0,1,8);
            SM=adcRead(0,2,8);

            sprintf(Buff,"Temp:%3.3d
",T);lcdPrint(0,0,Buff);
            sprintf(Buff,"SM  :%3.3d
",SM);lcdPrint(1,0,Buff);

            uartSend(0,'L');uartSend(0,'I');
            uartSend(0,2);
            uartSend(0,T);
            uartSend(0,SM);

            CMD=uartReadD(0,100);
            if(CMD=='O')
```

Figure 6.3: C Program 3



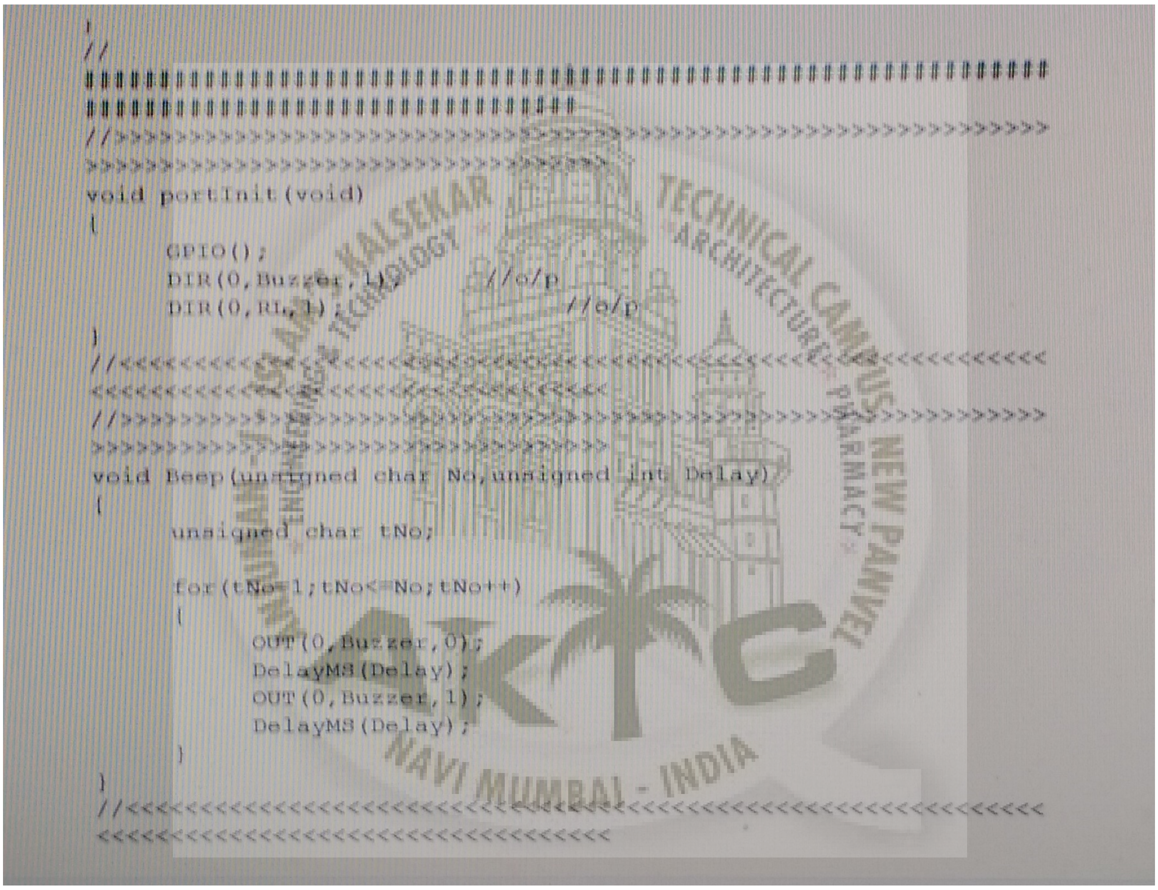
```
{
        lcdPrint(0,0,"PC Command......");
        lcdPrint(1,0,"PUMP ON.         ");
        Beep(1,100);
        OUT(0,RL,1);
}
if(CMD=='F')
{
        lcdPrint(0,0,"PC Command......");
        lcdPrint(1,0,"PUMP OFF.        ");
        Beep(1,100);
        OUT(0,RL,0);
}

//wait for
SMS-------------------------------------------
if(!sim300ReadSMS(1,25,MEM,MN,SMS))continue;

lcdClear();
sprintf(Buff,"%s %s",MEM,MN);lcdPrint(0,0,Buff);
sprintf(Buff,"%s",SMS);lcdPrint(1,0,Buff);

Beep(2,200);
sim300DeleteSMS(1,MEM);

if(strncmp(SMS,"admin",5)==0)
{
        if(SMS[5]=='O')
        {
                lcdPrint(0,0,"SMS Command.....");
                lcdPrint(1,0,"PUMP ON          ");
```

Figure 6.4: C Program 4



```
                    lcdPrint(1,0,"PUMP ON.          ");
                    Beep(1,100);
                    OUT(0,RL,1);
                }
                if(SMS[5]=='F')
                {
                    lcdPrint(0,0,"SMS Command.....");
                    lcdPrint(1,0,"PUMP OFF.         ");
                    Beep(1,100);
                    OUT(0,RL,0);
                }
            }
        }//end while
}
//
##########################################################################
##########################################
//>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
void portInit(void)
{
    GPIO();
    DIR(0,Buzzer,1);        //o/p
    DIR(0,RL,1);            //o/p
}
//<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
//>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
void Beep(unsigned char No,unsigned int Delay)
```

Figure 6.5: C Program 5



```
}
//
##################################################################
###################################
//>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
void portInit(void)
{
	GPIO();
	DIR(0,Buzzer,1);		//o/p
	DIR(0,RL,1);			//o/p
}
//<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
//>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
void Beep(unsigned char No,unsigned int Delay)
{
	unsigned char tNo;

	for(tNo=1;tNo<=No;tNo++)
	{
		OUT(0,Buzzer,0);
		DelayMS(Delay);
		OUT(0,Buzzer,1);
		DelayMS(Delay);
	}
}
//<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
```

Figure 6.6: C Program 6

Chapter 7

Proposed Method

7.1 System Overview

On the display the temperature sensor and soil moisture sensor value is displayed.The value from the website is taken under consideration and output is obtained and sensed by ON and OFF of the motor.This functions are performed using Xbee i.e wireless network.The motor can also be controlled using GSM SMS ,if we will type adminF motor switches off and if we will type adimO motor switches on.All the data is displayed on the screen of farmers computers explained by the graphs.

7.2 PCB's used

Studies have shown minimal impact by smart irrigation controllers when installed indiscriminately, but targeting overirrigators increases the water conservation potential. The objective was to evaluate different methodologies defining residential overirrigators. Two independent smart controller studies were conducted by utilities in Hillsborough County [Hillsborough County Water Resource Services (HCWRS)] and Orange County [Orange County Utilities (OCU)], Florida. In HCWRS, the cooperators qualified when irrigation was in the top 50th percentile of potable water users in the county.

Figure 7.1: Controller PCB

This board is designed for the purpose of learning various interfaces with the ARM7 LPC2148 microcontroller. The board contains two UARTs, LEDs, keypads, an ADC input and LCD Display to create a stand-alone versatile test platform. The board can be programmed using ISP programmer or Ulink emulator. This board can be debugged by using JTAG connector available in the board. User can use Keil compiler or IAR compiler do develop projects for this board. User can easily engage in development in this platform, or use it as reference to application development.

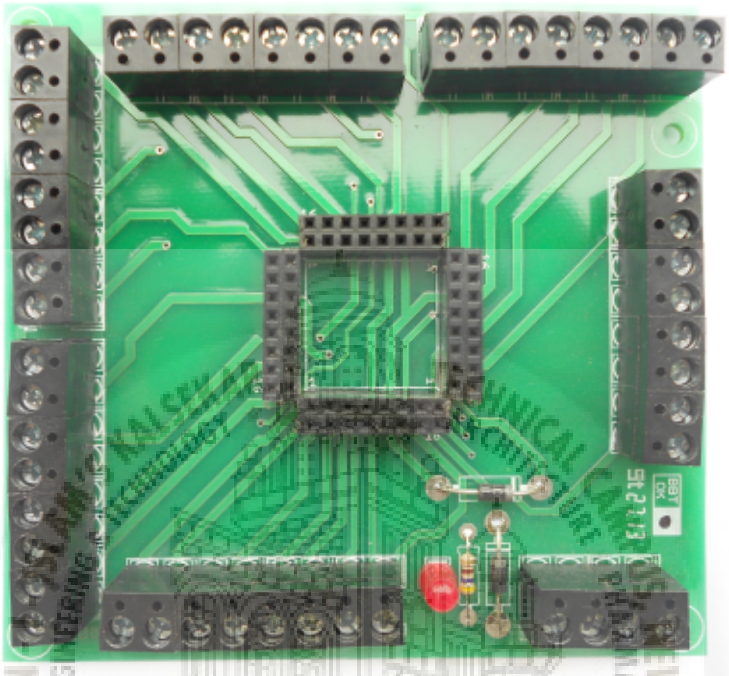


Figure 7.2: Controller Pins

Understanding what is IO Ports and how to use them is very important. Its because when we see micro chip, well find a black box i.e. IC with some pins. LPC2148 has two IO ports each of 32-bit wide, provided by 64 IO pins. Ports are named as P0 and P1. Pins of each port labeled as Px.y where x stands for port number, 0 or 1. Where y stands for pin number usually between 0 to 31. Each pin can perform multiple functions. For example: Pin no.1 which is P0.21 serves as GPIO as well as PWM5, AD1.6 (A/D converter1, input 6), CAP1.3 (Capture input for Timer1, Channel 3).

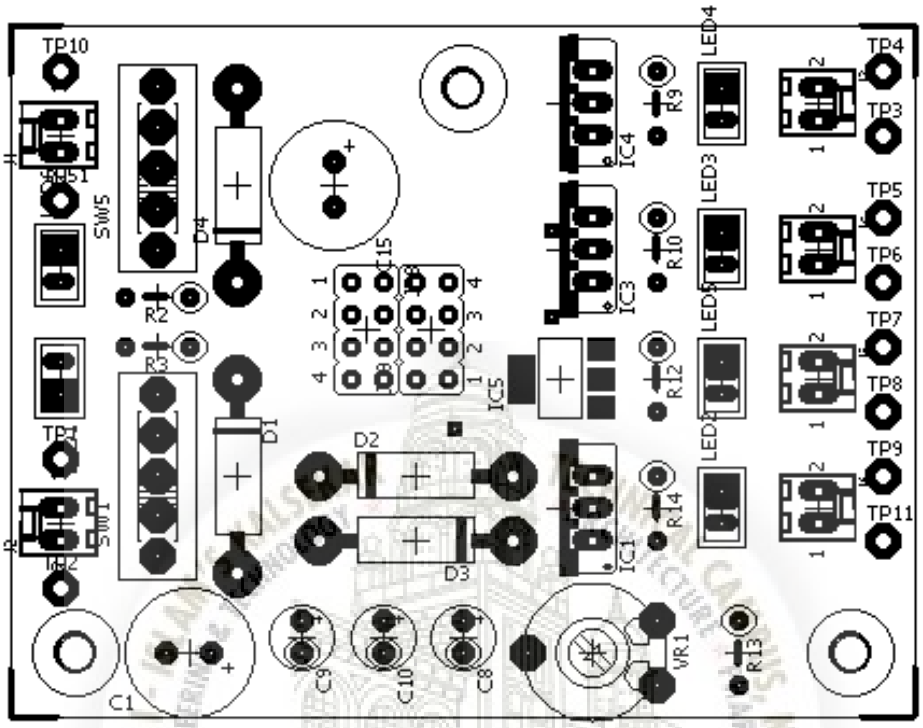


Figure 7.3: Circuit

1.PORT 2 is a 32-bit I/O port with individual direction controls for each bit. Total of 28 pins of the Port 0 can be used as a general purpose bi-directional digital I/Os while P0.31 provides digital output functions only. The operation of port 0 pins depends upon the pin function selected via the pin connect block. Pins P0.24, P0.26 and P0.27 are not available.

2.PORT 1 is a 32-bit bi-directional I/O port with individual direction controls for each bit. The operation of port 1 pins depends upon the pin function selected via the pin connect block. Pins 0 through 15 of port 1 are not available.

Chapter 8

Output

8.1 Project Designed

Figure 8.1: Project

8.2 GSM

8.2.1 Output 1

Figure 8.2: GSM Message

8.2.2 Output 2

Figure 8.3: GSM Command

8.3 Manual Mode

8.3.1 Output 1

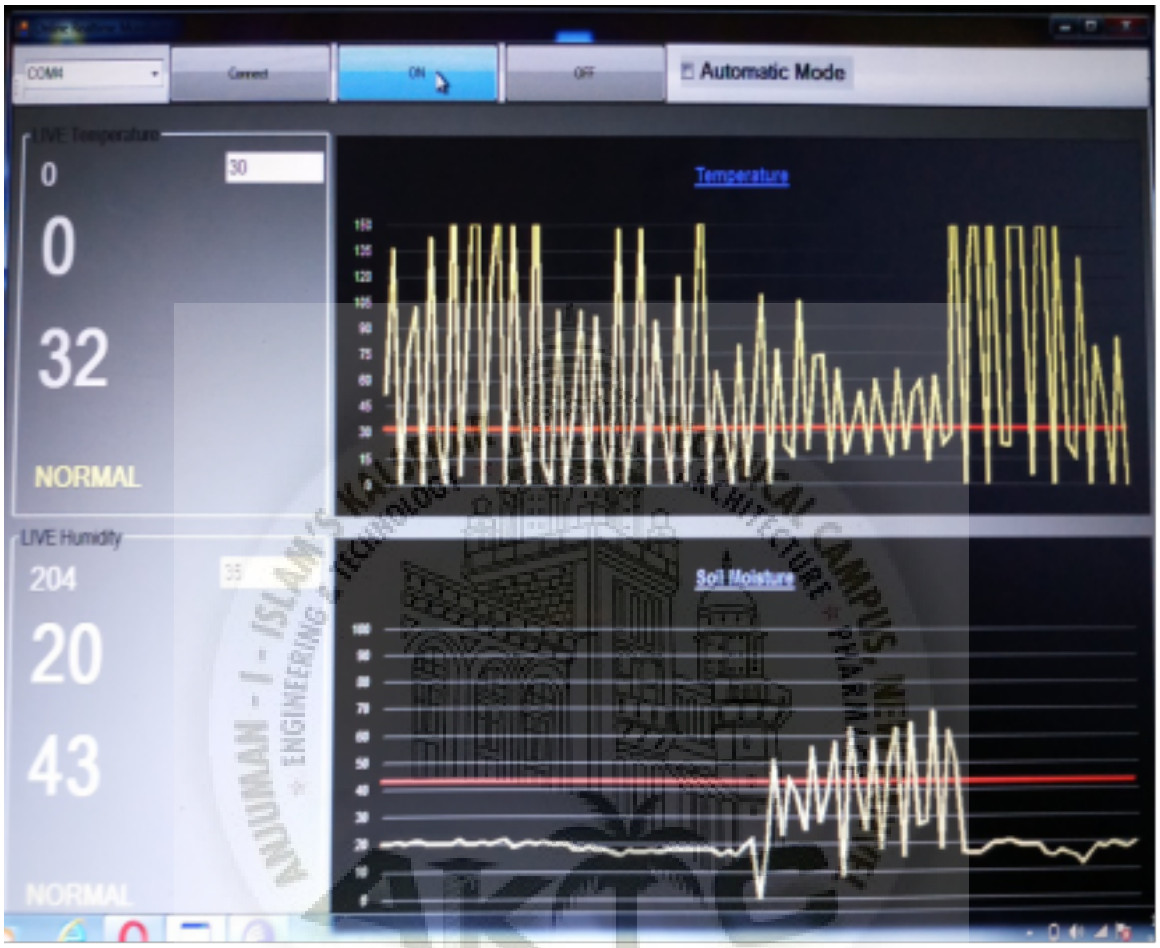


Figure 8.4: Manual Mode Output Switch ON

8.3.2 Output 2

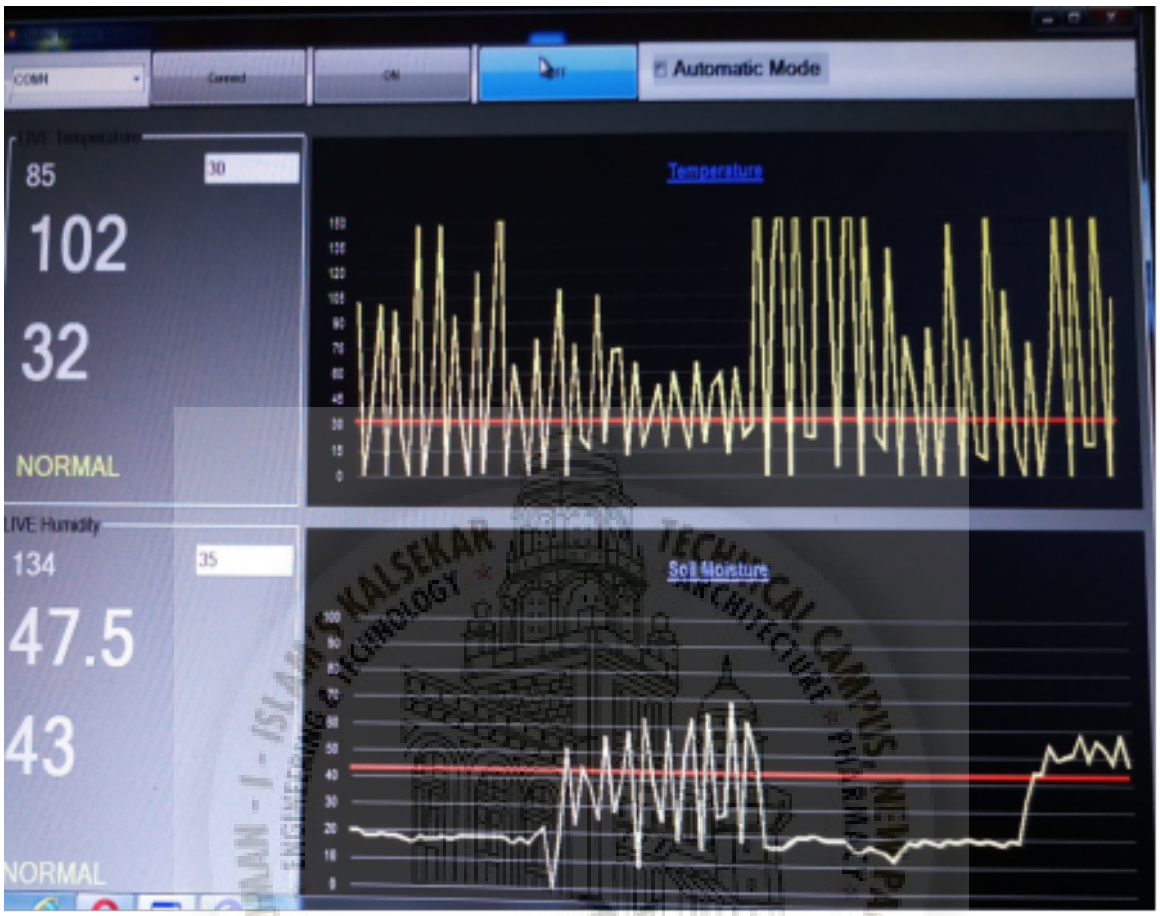


Figure 8.5: Manual Mode Output Switch OFF

8.4 Automatic Mode

Figure 8.6: Automatic Mode Output

Chapter 9

Result and Discussion

Hence we have finally designed a system and got the accurate data as was required.The output of sensors are displayed on the 16x2 LCD display correctly.We have also checked our system in different types of soil i.e wet,semi wet and dry soil respectively.We also got accurate data from website Open Weather Map.Our processor correctly compares the data from website and soil ,and accordingly waters the crops.Our work using GSM also worked properly,through SMS we are able to control the motor and according provide water to the crops.

Due to this now farmer don't need to schedule his irrigation time.He can sit at his home and initiate the control easily.He can also watch the live instances taking in farm about soil moisture and temperature through the graph on his screen.Farmer can now move to any remote location and control the watering of crops.Hence,due to this farmer time is saved as well as there is less reduction of crops.

Chapter 10

Conclusion and Future Scope

10.1 Future Scope

1.Using ph sensor for adjusting nutrient contents of soil.

2.Automatic irrigation with fire alert system can be developed.

10.2 Conclusion

1.Our system will provide an appropriate amount of water for selected crops and thereby reducing wastage of water and resulting better yields for crop.

2.Rainfall forecast will also be taken into account.

3.System can also be controlled using GSM.

4.Reduces human interference and labor cost.

5.System does not require any special training, hence can be used easily.

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