POLYTECHNIC SEBERANG PERAI

AUTOMATED HYDROPONIC MONITORING SYSTEM (AHMS)

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EELECTRICAL DEPARTMENT

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Laporan ini dikemukakan kepada Jabatan electrik sebagai memenuhi sebahagian syarat penganugerahan Diploma electrik

EELECTRICAL DEPARTMENT

JUN 2016

DECLARATION

TITLE : AUTOMATED HYDROPONIC MONITORING SYSTEM

SESION : JUN 2016

1. WE, **1. DEVAA RANI A/P SUBRAMANI (10DEP14F1061)**
2. NURUL SYAHIRA BINTI REMZI (10DEP14F1011)

Are 5th semester student from DIPLOMA IN ELECTRIC AND ELECTRONIC ENGINEERING from ELECTRICAL DEPARTMENT OF POLYTECHNIC SEBERANG PERAI.

2. Here we declare that this report is based on our own work with the help of information from sources that are told in confession. We also declare the results of my project was never produced by any other students as well as from other institutions.

3. We agreed to relinquish ownership of intellectual property of project to polytechnic Seberang Perai for meet the requirement to award diploma in electronic (communication) engineering to us.

Created by

a) DEVAA RANI A/P SUBRAMANI (960524-08-6588) _____ DEVAA RANI A/P SUBRAMANI

b) NURUL SYAHIRA BINTI REMZI (961122-03-5862) _____ NURUL SYAHIRA BINTI REMZI

In front of Madam NORZILAWATI BINTI ABDULLAH (821004-03-5410) _____ NORZILAWATI BINTI ABDULLAH
As a supervisor of project

Date: 10-10-2016

APPRECIATION

Praise to God, the one and only, for giving me strength to complete this final year project. The project delivered in this paper could not have been accomplished without the help of many individuals. First and foremost, I would like to take this opportunity to extend my greatest gratitude to my family for their understanding and commitment during my crucial time researching and finishing this final year project.

ABSTRACT

The purpose of this project is to provide a framework for constructing automated hydroponic system using PIC16F877A. The method that we are using is hydroponic method. The main function of the hardware is to automate the system to moisture of the water control all the necessary devices and irrigate the area in the appropriate way. This is accomplished using multiple open hardware modules, such as PIC 16F877A, soil moisture sensor and water valve. It also will inform us by showing the moisture level at LCD display. The circuit is drawn using the program PCB wizard, and eagle software

ABSTRAK

Tujuan projek ini adalah untuk menyediakan satu rangka kerja untuk membina sistem hidroponik automatik menggunakan PIC 16F877A. Kaedah yang kami gunakan adalah kaedah hidroponik. Fungsi utama perkakasan adalah untuk mengautomasikan sistem untuk kelembapan kawalan air semua peranti yang diperlukan dan mengairi kawasan itu dengan cara yang sesuai. Ini dapat dicapai dengan menggunakan pelbagai modul perkakasan terbuka, seperti PIC 16F877A, sensor kelembapan tanah dan injap air,. Ia juga akan memberitahu kepada kami dengan menunjukkan tahap kelembapan pada paparan LCD. Litar ini dilukis menggunakan program PCB wizard dan software helang.

CONTENT

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

. The introduction is the most important part to produce a quality project in a long time. Identify the problem also can get things done by making the appropriate action. This will produce an objective in a project. Projects can be generated in perfectly with the use of existing facilities such as the software and hardware. Hydroponic systems are automated systems that extract water in the measure itself. In addition, the hydroponic system made it also can measure the temperature. Many types of plants that can be created through a hydroponic vegetable mustard and choose the option hydroponic plants.

1.2.1 PROBLEM STATEMENT

In the case of traditional irrigation system water saving is not considered, since the water is irrigated directly in the land. Plants undergo high stress from variations in soil moisture, therefore plant appearance is reduced. Weed growth is increased because areas between plants are irrigated. The high application rate and the absence of automatic controlling of the system results in improper water control, system's high flow rate allows irrigation of lower areas and few plants can be watered at once. So this is the serious problem in agricultural areas such as horticulture, flour planting areas, in greenhouses, forgot to water the plants and waste water. Therefore, Automated Hydroponic Monitoring System was developing.

1.3 OBJECTIVE

The objectives of this project are:

i) To design Automated Hydroponic Monitoring System by using PIC16F877A
ii) To design a watering system by using Moisture sensor.
iii) To study soil moisture sensor and water valve.

1.4 SCOPE AND LIMITATION PROJECT

Several scopes that need to be considered in this project:

i. The scope of this project is understanding the overview concept of PIC16F877A work for this project with the moisture sensor and safe the time using Automated Hydroponic Monitoring System.
ii. The scope of this project includes using the basic C to program PIC16F877A to control the valve which is used in the opening and closing of the flow of water.
iii. The sensors used to control the watering system are temperature sensor, and soil moisture sensor. For the last part of this project, Automated Hydroponic Monitoring System can be used easily with notification sensor. The minimum value of this project is 35 to 75.
iv. The plant will be automatically watered if, the moisture level is decreased. It will informed us by sending notification through LCD Display.

1.5 SIGNIFICANT OF PROJECT

This work approaches the problem of building such system by implementing modular design which is built around microcontroller open source hardware and software. Utilizing pre manufactured modules lowers the price and the learning curve,

it also provides easily accessible source code which can be modified to suit the needs of this project.

1.6 CONCLUSION

In a nutshell, the reason of this project are created to solve the problem that face by agriculture sector, problems that face by agriculture sector are the high application rate and the absence of automatic controlling of the system results in improper water control, system's high flow rate allows irrigation of lower areas and few plants can be watered at once. So this is the serious problem in agricultural areas such as horticulture, flour planting areas, in greenhouses, forgot to water the plants and waste water. Therefore, Automated Hydroponic Monitoring System was created.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

A Literature review is a body of text that the aims to review the critical points of drips systems knowledge and or methodological approaches on a particular topic. Literature review are secondary source, and as such, do not report any new original experiment work.

Most often associated with academic-oriented literature, such as these, a literature review usually precedes a research proposal and result section. Its ultimate goal is to bring constructing automated hydroponic system using open source hardware and software (PIC) literature on a topic and forms the basis for another goal, such as future research that may be needed in the area.

2.2 COMPONENTS THAT USE

2.2.1 Resistor

Resistor are the most commonly used component in electronics and their purpose is to create specified value of current and voltage in a circuit. A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors actually to reduce current flow and at the same time, to lower voltage levels within circuits. Resistor's is measured in units of ohms (symbol, Ω). (https://en.m.wikipedia.org/wiki/resistor)

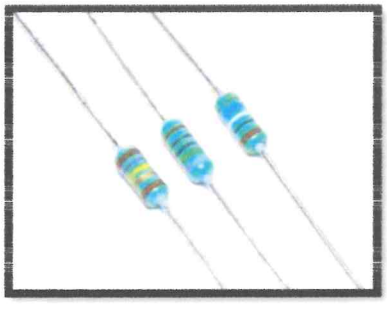


Figure 2.1: Component of resistor

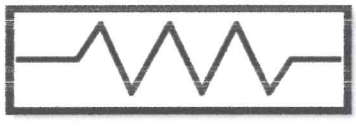


Figure 2.2: Symbol of resistor

2.2.2 Capacitor

A capacitor is a passive two-terminal electrical component used to store electrical energy temporary in an electric field. The form of practical capacitors very widely, but all contain at least two electrical conductors separates by a dielectric (an insulator that can store energy by becoming polarized). The capacitor can be thin film, foils or sintered beads of metal or conductive electrolyte. The no conducting dielectric actually to increase the capacitor's charge capacity. Capacitor are widely used as parts of electrical circuit in many common electrical devices. Capacitor consists two or more parallel conductive (metal) plates which are not connected or touching each other, but are electrically separated either by air or by some form gel as used in electrolytic capacitors. The insulating layer between a capacitors plates is commonly called the dielectric. (https://en.m.wikipedia.org/wiki/capacitor)

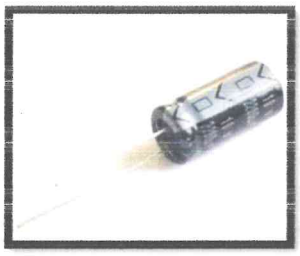


Figure 2.3: Component of capacitor

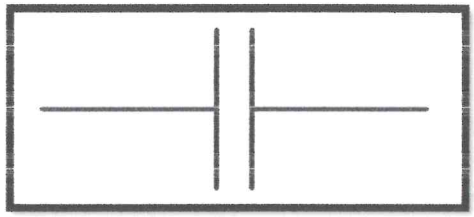


Figure 2.4: Symbol of capacitor

2.2.3 Transistor

A transistor is a semiconductor for device used to amplify and switch electronic signals and electrical power. It is composed of semiconductor material with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals changes the current through another pair of terminal. Because the controlled (output) power can be higher than the controlling (input) power, a transistors are packaged individually, but many are found embedded in integrated circuits. (https://en.m.wikipedia.org/wiki/transistor)

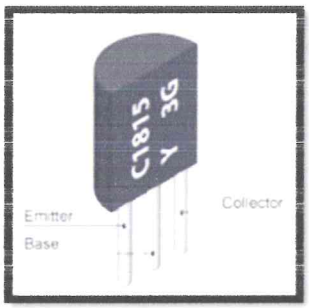


Figure 2.5: Component of transistor

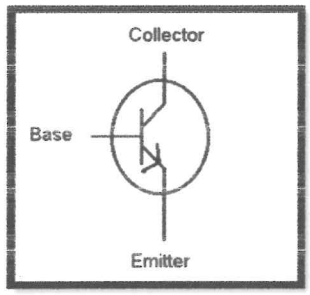


Figure 2.6: Symbol of transistor

2.2.4 Diode

In electronic a diode is a two-terminal electronic component which conducts electric current unidirectional; that is it conduct current more easily in one direction than in the diode, the most common type today. Which is a crystal of semiconductor connected to two terminals, a P-N junction. A vacuum tube diode, which was the first type of diode invented but it is now little used, is a vacuum tube with two electrodes; a plate and a cathode. The most common function of a diode is to allow an electric current in one direction while blocking current in the opposite direction. Thus, the diode can be thought as an electronic version of a check valve. This unidirectional behaviour, is called rectification, and is used to convert alternating current to direct current, and remove modulation from radio signals in radio receivers.

https://en.m.wikipedia.org/wiki/diode

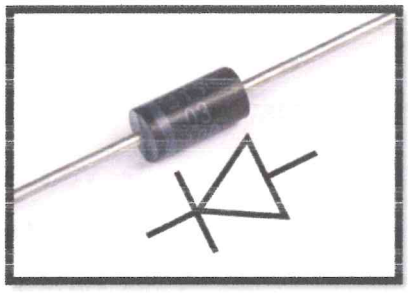


Figure 2.7: Component and symbol of diode

2.2.5 Moisture Sensor

The grove moisture sensor can be used to detect the moisture of soil, to judge if there is dampness around the sensor. It can be used to decide if the plants in a garden needs watering. It can be used in gardens to automate watering plants. It can be used very easily by just inserting the sensor into the soil and reading the output using ADC.

https://www.seeedstudio.com/grove---

Features

- Grove compatible interface
- Easy to use

Specification

- Operating voltage: 3.3~5V
- Operating current: 35mA
- Sensor Output Value in dry soil: 0~ 300
- Sensor Output Value in humid soil: 300~700
- Sensor Output Value in water: 700 ~ 950
- PCB size: 2.0cm X 6.0cm

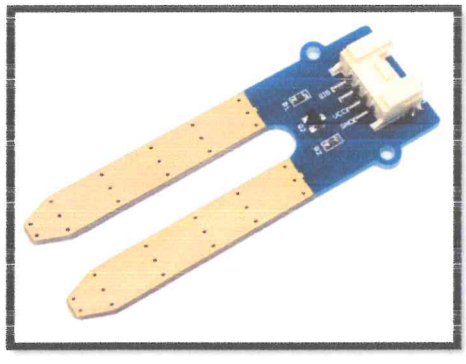


Figure 2.8: Moisture Sensor

2.2.6 LCD Display

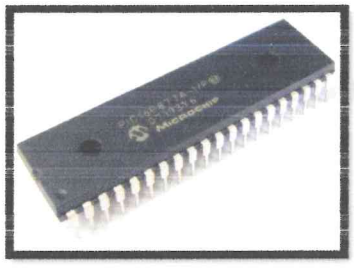
LCD (liquid crystal display) is made with either a passive matrix or an active matrix display grid. The active matrix LCD is also known as a thin film transistor (TFT) display. The passive matrix LCD has a grid of conductors with pixels located at each intersection in the grid. A current is sent across two conductors on the grid to control the light for any pixel. An active matrix has a transistor located at each pixel intersection, requiring less current to control the luminance of a pixel. For this reason, the current in an active matrix display can be switched on and off more frequently, improving the screen refresh. Some passive matrix LCD's have dual scanning, meaning that they scan the grid twice with current in the same time that it took for one scan in the original technology. However, active matrix is still a superior technology. https://en.m.wikipedia.org/.../liquid-crystal

Figure 2.9: Component of LCD Display

2.2.7 PIC16F877A

This controller is very convenient to use, the coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it use FLASH memory technology. It has a total number of 40 pins and there are 33 pins for input and output. PIC16F877A is used in many pic microcontroller projects. PIC16F877A also have many application in digital electronics circuits PIC16f877a finds its applications in a huge number of devices. It is used in remote sensors, security and safety devices, home automation and in many industrial instruments. An EEPROM is also featured in it which makes it possible to store some of the information permanently like transmitter codes and receiver frequencies and some other related data. The cost of this controller is low and its handling is also easy. It's flexible and can be used in areas where microcontrollers have never been used before as in coprocessor applications and timer functions etc.

https://en.m.wikipedia.org/wiki/pic16F877A



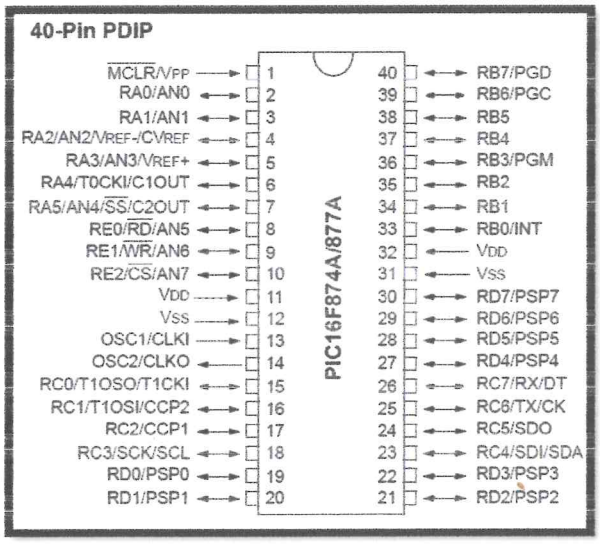


Figure 2.10: Component and configuration of PIC16F877A

DESCRIPTION of PIC16F877A

There are 40 pins of this microcontroller IC. It consists of two 8 bit and one 16 bit timer. Capture and compare modules, serial ports, parallel ports and five input/output ports are also present in it.

PIN 1: MCLR

The first pin is the master clear pin of this IC. It resets the microcontroller and is active low, meaning that it should constantly be given a voltage of 5V and if 0 V are given then the controller is reset. Resetting the controller will bring it back to the first line of the program that has been burned into the IC.

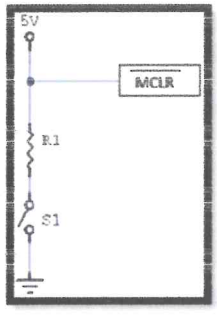


Figure 2.11

A push button and a resistor is connected to the pin. The pin is already being supplied by constant 5V. When we want to reset the IC we just have to push the button which will bring the MCLR pin to 0 potential thereby resetting the controller.

PIN 2: RA0/AN0

PORTA consists of 6 pins, from pin 2 to pin 7, all of these are bidirectional input/output pins. Pin 2 is the first pin of this port. This pin can also be used as an analog pin AN0. It is built in analogue to digital converter.

PIN 3: RA1/AN1

This can be the analog input 1.

PIN 4: RA2/AN2/Vref-

It can also act as the analog input2. Or negative analog reference voltage can be given to it.

PIN 5: RA3/AN3/Vref+

It can act as the analog input 3. Or can act as the analog positive reference voltage.

PIN 6: RA0/T0CKI

To timer0 this pin can act as the clock input pin, the type of output is open drain.

PIN 7: RA5/SS/AN4

This can be the analog input 4. There is synchronous serial port in the controller also and this pin can be used as the slave select for that port.

PIN 8: RE0/RD/AN5

PORTE starts from pin 8 to pin 10 and this is also a bidirectional input output port. It can be the analog input 5 or for parallel slave port it can act as a 'read control' pin which will be active low.

PIN 11 and 32: VDD

These two pins are the positive supply for the input/output and logic pins. Both of them should be connected to 5V.

PIN 12 and 31: VSS

These pins are the ground reference for input/output and logic pins. They should be connected to 0 potential.

PIN 13: OSC1/CLKIN

This is the oscillator input or the external clock input pin.

PIN 14: OSC2/CLKOUT

This is the oscillator output pin. A crystal resonator is connected between pin 13 and 14 to provide external clock to the microcontroller. ¼ of the frequency of OSC1 is outputted by OSC2 in case of RC mode. This indicates the instruction cycle rate.

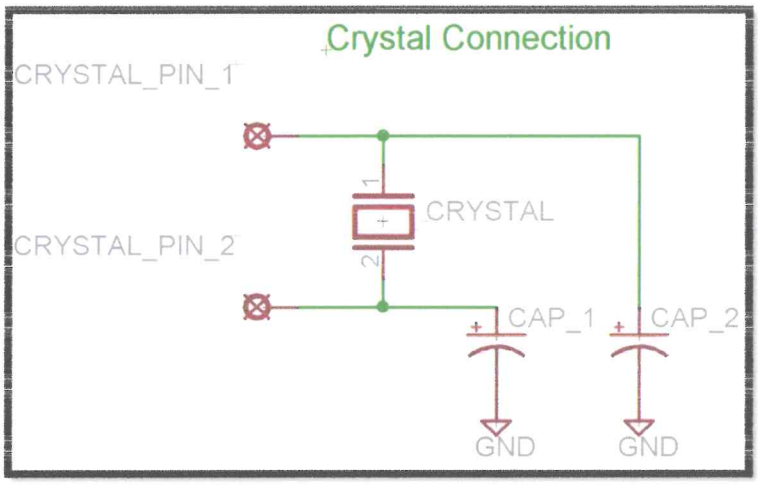


Figure 2.12

PIN 23: RC4/SDI/SDA

It can be the SPI data in pin. Or in I2C mode it can be data input/output pin.

PIN 24: RC5/SDO

It can be the data out of SPI in the SPI mode.

PIN 25: RC6/TX/CK

It can be the synchronous clock or USART Asynchronous transmit pin.

PIN 26: RC7/RX/DT

It can be the synchronous data pin or the USART receive pin.

PIN 19, 20,21,22,27,28,29,30:

All of these pins belong to PORTD which is again a bidirectional input and output port. When the microprocessor bus is to be interfaced, it can act as the parallel slave port.

PIN 33-40: PORT B

All these pins belong to PORTB. Out of which RB0 can be used as the external interrupt pin and RB6 and RB7 can be used as in-circuit debugger pins.

2.2.8 4V7 Zener Diode

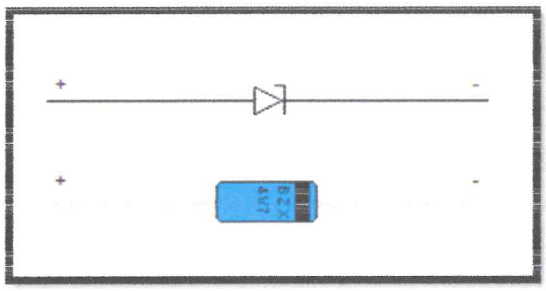


Figure 2.13

There are several key specifications for a Zener diode or voltage reference diode.

Parameters including the basic reference voltage to the power dissipation resistance and many more need to be specified to provide a complete view of the performance.

Zener IV characteristic

The IV characteristic of the Zener / voltage reference diode is the key to its operation. In the forward direction, the diode performs like any other, but it is in the reverse direction where its specific performance parameters can be utilized.

Major Zener diode specifications explained

When looking at the specification sheet for a Zener diode there are several parameters that will be included. Each details a different element of its performance and is required to ensure it operates correctly within any circuit.

Voltage Vz: The Zener voltage or reverse voltage specification of the diode is often designated by the letters Vz. Voltages are available over a wide range of values, often following the E24 ranges, although not all diodes are bound by this convention.

Values generally start at around 2.4 V although not all ranges extend as low as this. Values below this are not available. Ranges may extend top anywhere in the region of 47 V to 200 V, dependent upon the actual Zener diode range. Maximum voltages for SMD variants are often around 47 V.

Current: The current, IZM, of a Zener diode is the maximum current that can flow throughaZener diode at its rated voltage, VZ.

Typically there is also a minimum current required for the operation of the diode. As a rough rule of thumb, this can be around 5 to 10 mA for a typical leaded 400 mW device. Below this current level, the diode does not break down adequately to maintain its stated voltage.

Zener resistance Rz: The IV characteristic of the Zener diode is not completely vertical in the breakdown region. This means that for slight changes in current, there will be a small change in the voltage across the diode. The voltage change for a given change in current is the resistance of the diode. This value of resistance, often termed the resistance is designated Rz.

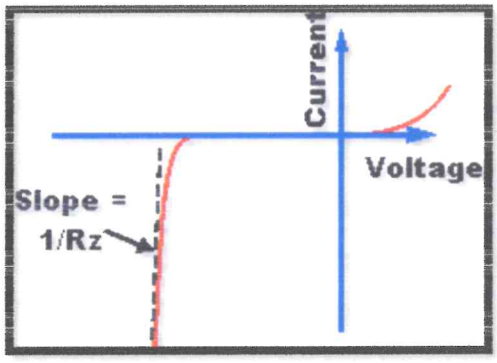


Figure 2.14: Zener diode resistance

The inverse of the slope shown is referred to as the dynamic resistance of the diode, and this parameter is often noted in the manufacturers' datasheets. Typically the slope does not vary much for different current levels, provided they are between about 0.1 and 1 times the rated current Izt.

- *Power rating:* All Zener diodes have a power rating that should not be exceeded. This defines the maximum power that can be dissipated by the package, and it is the product of the voltage across the diode multiplied by the current flowing through it.

For example many small leaded devices have a dissipation of 400mW at 20°C, but larger varieties are available with much higher dissipation levels. Surface mount varieties are also available, but generally have lower dissipation levels in view of the package size and their ability for heat removal.

- Common power ratings for leaded devices include 400mW (most common), 500 mW, 1W, 5W. Values for surface mount devices may be around 200, 350, 500 mW with occasional devices extending up to 1 W.

- *Voltage tolerance:* With diodes being marked and sorted to meet the E12 or E24 value ranges, typical tolerance specifications for the diode are ±5%. Some datasheets may specify the voltage as a typical voltage and then provide a maximum and minimum.

- *Temperature stability:* For many applications, the temperature stability of the Zener diode is important. It is well known that the voltage of the diode varies according to temperature. In fact the two mechanisms that are used to provide breakdown within these diodes have opposite temperature coefficients, and one effect dominates below about 5 Volts and the other above. Accordingly diodes with voltages around 5 V tend to provide the best temperature stability.

  https://en.m.wikipedia.org/wiki/zenerdiode

2.3 RELATED WORD

According to Rajeev Iochan Mishra and Preet Jain in this project has been used two electrode sensor for measuring water conductivity for the hydroponics system is presented. Besides that, to monitor the electrical conductivity (EC) one should use electronic meter to read the value and it's a time consuming process and in this manner there is a need of periodically monitoring. Other than that, Hydroponics is a method of growing crops and vegetables without soil with the help of nutrient solution. The system has few advantages such as, reduces the excess use of fertilizer, fosters the plant growth, reduces manpower, it improves product quality and high rate of production .As conclusion, automatic hydroponic system are presented in this paper are mainly focused on measurement of conductivity of nutrient solution. Moreover, designed system is very helpful for reducing the system cost and manpower. Thus, this system is useful in hydroponics cultivation and suitable for small space, low cost, low power and able to recycle the nutrient solution which is already used by plant. (Rajeev Iochan Mishra, Preet Jain, 2015)

Vijendra Sahare, Preet Jain forename hydroponic system is to investigate the convenience for application, to investigate the possible applications of the technology and functionality. However, they found that soil wasn't even a compulsory component of plant. To emphasize Automated Hydroponic systems that axiomatically delivers nutrients solution for tomato plants, once in a week. In addition, the mixture of water and nutrient solution is repeated distribute to the water pump. Besides that this system use less water and fertilizer compared to soil system. Due to, hydroponic plants can be grown outdoors, indoors or even in small space. Therefore this system is proper way to grow plant compared to growing plants in soil. Obviously, hydroponic plants provide more nutritional vegetables and fruits with the proficiency of water and fertilizer. In conclusion, hydroponics system acknowledge farmers to grow more vegetables and fruits by using less space instead to traditional soil gardening. (Vijendra Sahare, Preet Jain, 2015)

This project has used a robot for the automation of hydroponic farms by using Position Based Visual Feedback. However, hydroponics and robotics are proven areas that have afford to concentrate agricultural practices, but automating these hydroponics systems using current automation capability requires large capital expenditure. Otherwise, the designed system is not only low cost, but also a simple addition to existing Nutrient Film Technique infrastructures. However, this robot is manage to seedlings and plants without human arbitration and can be used as a monitoring system to give parameters of the crop and environment to the grower. In a nutshell, using a vision system, this robot system can be easily open at different farms with different layouts because of the hardware choices and the robot is a low cost alternative to existing hydroponic automation systems. It was demonstrated that by using a Microsoft Kinect the positioning is accurate enough to manipulate plants on a hydroponic system. (Niels F, Tanke, Guoming A. Long, Dhruv Arawal, Abhinav Valada, George A. Kantor)

Matthew Dileonardo, Justin Walker,Khalid Al Charif, James Loomis proved hydroponic gardening is a great way to grow plants to their full potential. First and foremost, will be able specify the plants wants to be grown through a web/mobile interface which is connected to the microcontroller running the system. Therefore, the microcontroller will control the PH level of the nutrient water in the System by adding Acids and Bases and also adding more nutrients when needed. Hence, the advantages of this system to make hydroponic gardening just as simple as soil gardening but able to produce better results.. The Objective of this project is the wireless updates with phone, solar powered and low maintenance. (Matthew Dileonardo, Justin Walker,Khalid Al Charif, James Loomis)

Anton Sundgren mentioned the constant monitoring and manipulation of pH and EC is essential for good plant growth. However, by the adjusting speed of the pump or the amount of the acid added during one pH correction cycle could be lowered to reduce the approaching concussion to the pH of the nutrient solution. Therefore, the unit was running for 21 days during which it was monitoring and controlling pH and EC levels fully autonomously. As a conclusion, the motor trigger level for pH and EC were adjusted, which adjusted the nutrient solution was changed to fresh one on eleventh day. This is due to the fact that this prototype could be also used for controlling some other systems like aquaponics, aquariums, small scale water treatment .Basically this prototype could be used to control any simple system where measurement and manipulation of pH and EC is required. (Anton Sundgren, 2015)

2.4 CONCLUSION

This project as a whole demonstrates the importance the Automated Hydroponic Monitoring System (AHMS) to watering the plant and starts to accumulate the moisture value. The transmission and reception of data from the moisture sensor to the input of PIC 16F877A, then the output of the PIC to input of LCD display requires careful construction so that data can be transmitted and received accordingly.

On theory, the AHMS should only operate when the moisture level decrease sensed by the moisture sensors. Then the data is transmitted to the LCD display output where it will alert the user about the condition.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

Methodology can be the 'analysis of the principles of methods, rules and postulates by a discipline', the systematic study of methods that are, can be, or have been applied within a discipline or a particular procedure or set of procedures.

Methodology includes a philosophically coherent collection of theories, concepts or ideas as they relate to a particular discipline of field of inquiry. Methodology refers to more than a simple set of methods, rather it refers to the rationale and the philosophical assumptions that underline a particular study relative to the scientific method. This is why scholarly literature often includes a section on the methodology of the researchers.

Each step of project is a process to complete the project. Every step must be followed one by one and must be done carefully. If some error occurs, it can make a project probably could not operate or do not look neat and perfect. Before the project finish, various process needs to be done according to proper procedures to ensure that projects do not have any problems.