POLITEKNIK SEBERANG PERAI

KEMENTERIAN PENGAJIAN TINGGI MALAYSIA

DEE 6092 – PROJECT 2

DEPARTMENT OF ELECTRICAL ENGINEERING

AUTOMATIC WATERING SYSTEM

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FINAL PROJECT REPORT

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This report is presented to Electrical Engineering Department to fulfill half of term and condition for be awarding Diploma in Electronic Engineering (Computer).

"We admit that this report is made by us except information and summary that we already explain the source".

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APPRECIATION

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ABSTRACT

Water content or moisture content is the quantity of water contained in a material, such as soil (called soil moisture), rock, ceramics, fruit, or wood. Water content is used in a wide range of scientific and technical areas, and is expressed as a ratio, which can range from 0 (completely dry) to the value of the materials' porosity at saturation. It can be given on a volumetric or mass (gravimetric) basis.Volumetric water content, θ, is defined mathematically as:where is the volume of water and is the total volume (that is soil volume + water volume + air space).Gravimetric water content[1] is expressed by mass (weight) as follows: where is the mass of water and is the bulk mass. The bulk mass is taken as the total mass, except for geotechnical and soil science applications where oven-dried soil (, see the diagram) is conventionally used as .To convert gravimetric water content to volumetric water, multiply the gravimetric water content by the bulk specific gravity of the material.In soil mechanics and petroleum engineering, the term water saturation or degree of saturation, is used, defined as where is the porosity and is the volume of void or pore space. Values of Sw can range from 0 (dry) to 1 (saturated). In reality, Sw never reaches 0 or 1 - these are idealizations for engineering use.The normalized water content, , (also called effective saturation or) is a dimensionless value defined by van Genuchten[2] as: where is the volumetric water content; is the residual water content, defined as the water content for which the gradient becomes zero; and, is the saturated water content, which is equivalent to porosity, so we designed Automatic Watering System which is a simple system, using Arduino to automate the irrigation and watering of small a simple system, using Arduino to automate the irrigation and watering of small potted plants or crops.This system does the control of soil moisture, doing indications via LEDs and in case of dry soil emitting a alarm beep. In case of dry soil it will activate the irrigation system pumping water for watering plants.The system uses a LCD display to notify all actions that are taking place and a real time clock. This system does the control of soil moisture, doing indications via

LEDs and in case of dry soil emitting a alarm beep. In case of dry soil it will activate the irrigation system pumping water for watering plants. The system uses a LCD display to notify all actions that are taking place and a real time clock.

ABSTRAK

kandungan air atau kandungan lembapan adalah kuantiti air yang terkandung dalam bahan, seperti tanah (dipanggil kelembapan tanah), batu, seramik, buah-buahan, atau kayu. kandungan air digunakan dalam pelbagai bidang saintifik dan teknikal, dan dinyatakan sebagai nisbah, yang boleh berkisar dari 0 (benar-benar kering) kepada nilai keliangan bahan 'di tepu. Ia boleh diberikan pada isipadu atau besar-besaran (gravimetrik) kandungan air basis.Volumetric, θ, ditakrifkan secara matematik sebagai: di mana isipadu air dan jumlah keseluruhan (iaitu tanah jumlah + jumlah air + ruang udara) .Gravimetric kandungan air [1] dinyatakan oleh massa (berat) seperti berikut: di mana jisim air dan jisim pukal. Jisim pukal diambil sebagai jumlah jisim, kecuali untuk aplikasi sains geoteknikal dan tanah di mana ketuhar-kering tanah (, lihat Rajah) lazimnya digunakan sebagai .Untuk menukar kandungan air gravimetrik air isipadu, darab kandungan air gravimetrik oleh sebahagian besar graviti tentu yang material.In mekanik tanah dan petroleum kejuruteraan, ketepuan air jangka atau darjah ketepuan, digunakan, yang ditakrifkan sebagai mana keliangan dan adalah jumlah ruang tidak sah atau liang. Nilai-nilai Sw boleh berkisar dari 0 (kering) kepada 1 (tepu). Pada hakikatnya, Sw tidak pernah mencapai 0 atau 1 - ini adalah idealizations untuk kejuruteraan use.The kandungan air normal,, (juga dipanggil tepu berkesan atau) adalah nilai berdimensi ditakrifkan oleh van Genuchten [2] sebagai: di mana kandungan air isipadu; adalah kandungan air sisa, ditakrifkan sebagai kandungan air yang mana kecerunan menjadi sifar; dan, adalah kandungan air tepu, yang bersamaan dengan keliangan, jadi kami direka Sistem Penyiraman Automatik yang merupakan sistem yang mudah, menggunakan Arduino untuk mengautomasikan pengairan dan air kecil sistem yang mudah, menggunakan Arduino untuk mengautomasikan pengairan dan air kecil tumbuh-tumbuhan pasu atau crops.This sistem tidak mengawal kelembapan tanah, melakukan tanda-tanda melalui LED dan dalam kes tanah kering mengeluarkan bunyi bip penggera. Dalam kes tanah kering ia akan mengaktifkan sistem pengairan mengepam air untuk menyiram sistem tumbuhan yang menggunakan paparan LCD untuk memberitahu semua tindakan yang mengambil tempat dan jam masa nyata.Sistem ini tidak

mengawal kelembapan tanah, melakukan tanda-tanda melalui LED dan dalam kes tanah kering mengeluarkan bunyi bip penggera. Sekiranya tanah kering ia akan mengaktifkan sistem pengairan pam air untuk menyiram tumbuh-tumbuhan.Sistem ini menggunakan paparan LCD untuk memberitahu semua tindakan yang mengambil tempat dan jam masa nyata.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Watering is the most important cultural practice and most labor intensive task in daily greenhouse operation. Watering systems ease the burden of getting water to plants when they need it. Knowing when and how much to water is two important aspects of watering process. To make the gardener works easily, the automatic plant watering system is created. It is programmed in such a way that it will sense the moisture level of the plants and supply the water if required. This type of system is often used for general plant care, as part of caring for small and large gardens. People enjoy plants, their benefits and the feeling related to nurturing them. However for most people it becomes challenging to keep them healthy and alive. To accommodate this challenge we have developed a prototype, which makes a plant more self-sufficient, watering itself from a large water tank and providing itself with

artificial sunlight. The prototype reports status of its current conditions and also reminds the user to refill the water tank.

1.2 Problem Statement

Like technology, gardening sector is also changing. People are now switching to this gardening technique, which allows you to reuse and conserve water. The function of the automatic watering system is to make the user easier to harvest in this type of gardening because it is automated.

1.3 Objective

The objectives of our project are:

- To make planter watering their plants in open field easily.
- To decrease fresh water supplies and water quality.
- To facilitate the planter to water the plants.

1.4 Scope

There are 2 parts involved in this project, and that are hardware and software. The hardware part involved the construction of the plant, a tank, water pump, soil sensor, water sensor and so on. The software used to program is Arduino UNO. The software part includes the programming of the sensors.

1.5 Importance of Research

The importance of this automatic watering system are to reduce the burden of the planter or the grower to do the watering each time the soil becomes starting to dry. Other than that, it can reduce the use of water resources, recycle and re-filter the water that has been used. Beside that, if the water in the tank has been reduced, water level sensor will detect and display it on the LCD. The same function as the soil sensor, if the soil becomes dry, soil sensors will detect and display on LCD.

CHAPTER 2

LITERATURE REVIEW

2.1 Background

Automatic watering systems are designed to help make garden watering easy. They help to reduce or completely remove the daily chore of manually walking around the garden with a spray gun watering plants individually. This can be essential if you are planning a short break and need to water your plants whilst away.Instead a series of pipes and drippers are laid out around the garden to take the water from the tap to your plants, this way you simply turn on the tap, or set a timer, and the water is distributed around the garden. The system can be set up to automatically water your beds, borders, pots, hanging baskets or your greenhouse.

2.2 Proposed system

Automatic Watering System has many components inside it.This watering system tool will give the output that will automatic watering the plank and detect the water in the tank. Another scope of this project is to implement Simple Language programming to make the circuit works. The software created with this implementation will send the data from input to the Arduino Uno R3.

2.2.1 Soil Moisture Sensor

Soil Moisture Sensor can be used to test the moisture of soil, when the soil is having water shortage, the module output is at high level,else the output is at low level.

Specification:

- Operating Voltage +5v dc regulated
- Soil moisture Digital value is indicated by out pin

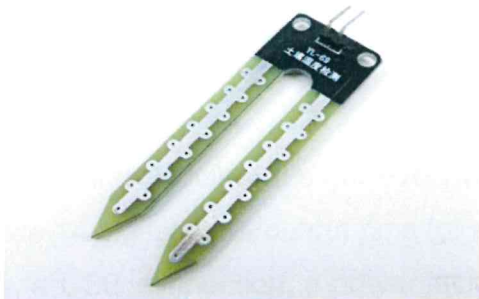


Figure 2.2.1 Soil Moisture Sensor

2.2.2 Water Level Sensor

Water Level Sensor is used as a level detector in a deposit have to install the sensor on the inside of the tank at the level where we want to control the water level.

Specification:

- Power supply 3,3V ~ 5V
- Current < 20mA
- Humidity sensitivity range 10% ~ 90%
- Pinout +: VCC
  -: GND
  S: Analog output

Figure 2.2.2 Water Level Sensor

2.2.3 Arduino Uno (R3)

The Uno is a great choice for your first Arduino. It's got everything you need to get started, and nothing you don't. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a USB connection, a power jack, a reset button and more. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

This is the new Arduino Uno R3. In addition to all the features of the previous board, the Uno now uses an ATmega16U2 instead of the 8U2 found on the Uno (or the FTDI found on previous generations). This allows for faster transfer rates and more memory. No drivers needed for Linux or Mac (inf file for Windows is needed and included in the Arduino IDE), and the ability to have the Uno show up as a keyboard, mouse, joystick, etc.

The Uno R3 also adds SDA and SCL pins next to the AREF. In addition, there are two new pins placed near the RESET pin. One is the IOREF that allow the shields to adapt to the voltage provided from the board. The other is a not connected and is reserved for future purposes. The Uno R3 works with all existing shields but can adapt to new shields which use these additional pins.

Arduino is an open-source physical computing platform based on a simple i/o board and a development environment that implements the Processing/Wiring language. Arduino can be used to develop stand-alone interactive objects or can be connected to software on your computer (e.g. Flash, Processing, MaxMSP). The open-source IDE can be downloaded for free (currently for Mac OS X, Windows, and Linux).

Pins (5V, 3.3V, GND, Analog, Digital, PWM, AREF)

a) **GND (3)**: Short for 'Ground'. There are several GND pins on the Arduino, any of which can be used to ground your circuit.
b) **5V (4) & 3.3V (5)**: As you might guess, the 5V pin supplies 5 volts of power, and the 3.3V pin supplies 3.3 volts of power. Most of the simple components used with the Arduino run happily off of 5 or 3.3 volts.
c) **Analog (6)**: The area of pins under the 'Analog In' label (A0 through A5 on the UNO) are Analog In pins. These pins can read the signal from an analog sensor (like a temperature sensor) and convert it into a digital value that we can read.

d) **Digital (7)**: Across from the analog pins are the digital pins (0 through 13 on the UNO). These pins can be used for both digital input (like telling if a button is pushed) and digital output (like powering an LED).

e) **PWM (8)**: You may have noticed the tilde (~) next to some of the digital pins (3, 5, 6, 9, 10, and 11 on the UNO). These pins act as normal digital pins, but can also be used for something called Pulse-Width Modulation (PWM). We have a tutorial on PWM, but for now, think of these pins as being able to simulate analog output (like fading an LED in and out).

f) **AREF (9)**: Stands for Analog Reference. Most of the time you can leave this pin alone. It is sometimes used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

Features:

a) ATmega328 microcontroller
b) Input voltage - 7-12V
c) 14 Digital I/O Pins (6 PWM outputs)
d) 6 Analog Inputs
e) 32k Flash Memory
f) 16Mhz Clock Speed

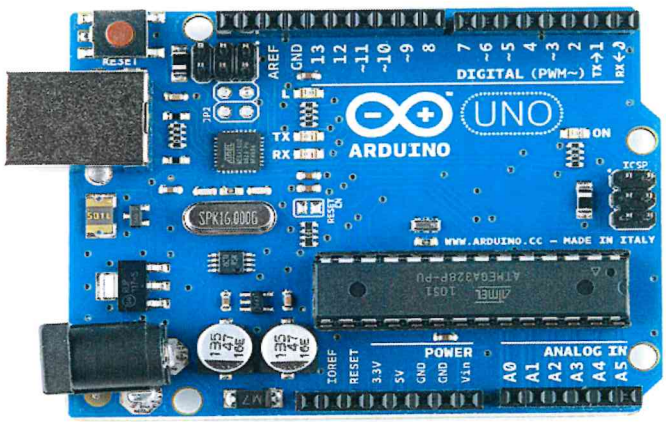


Figure 2.2.3: The Arduino Uno R3

2.2.4 Resistor

A resistor is a passive two-terminal component that implements electrical resistance as a circuit element. Resistors act to reduce current flow, and, at the same time, act to lower voltage levels within circuits. In electronic circuits, resistors are used to limit current flow, to adjust signal levels, bias active elements, and terminate transmission lines among other uses. High-power resistors, that can dissipate many watts of electrical power as heat, may be used as part of motor controls, in power distribution systems, or as test loads for generators.

Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity. Resistors are common elements of electrical networks and electronic circuits and are ubiquitous in electronic equipment.

Practical resistor as discrete components can be composed of various compounds and forms. Resistors are also implemented within integrated circuits. The electrical function of a resistor is specified by its resistance: common commercial resistors are manufactured over a range of more than nine orders of magnitude. The normal value of the resistance will fall within a manufacturing tolerance.

Figure 2.2.4: Resistors with different values

2.2.5 LED

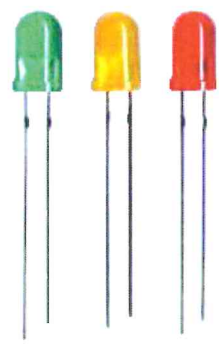


Figure 2.2.5 LED

A light-emitting diode (LED) is a semiconductor device that emits visible light when an electric current passes through it. We used this LED just want to make sure that when we operate our circuit the LED with let we know either our circuit are function or not. If the LED bright means our power supply are function if not bright our power supply may have problem.

2.2.6 **BUZZER**

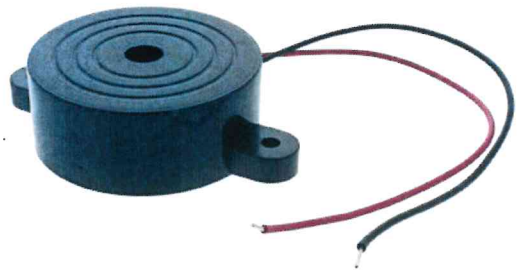


Figure 2.2.6 Piezo Buzzer

A piezoelectric buzzers, or piezo buzzers element may be driven by an oscillating electronic circuit or other audio signal source, driven with a piezoelectric audio amplifier. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep. The used of the buzzer in this project is, it will beep in case of dry soil emitting.

2.2.7 **RTC (Real Time Clock)**

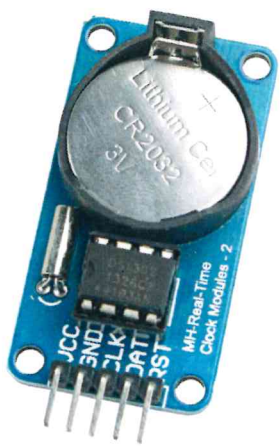


Figure 2.2.7 Real Time Clock

A real-time clock (RTC) is a computer clock (most often in the form of an integrated circuit) that keeps track of the current time. It allows the Arduino to keep track of time even if it is reprogrammed, or if the power is lost.

2.2.8 LCD I2C

Figure 2.2.8 LCD I2C

LCD (liquid crystal display) is the technology used for displays in notebook and other smaller computers. Like light-emitting diode (LED) and gas-plasma technologies, LCDs allow displays to be much thinner than cathode ray tube (CRT) technology. Our project uses LCD display to notify all action that are taking places.

CHAPTER 3

METHODOLOGY AND IMPLEMENTATION

3.1 Introduction

The development of Automatic Watering System can be divided into following major phases:

a) Project design
b) Analysis and, component level design and selection.
c) Assembly and hardware testing.
d) Simulation development and Verification.
e) Development for future implementation.

3.2 Project Design:

The Project design phase included mainly the determination of general layout and design of the Automatic Watering System. The first step in this phase was the identification of design goals. The following things were required:

a) Automate the irrigation and watering of small potted plants or crops
b) Does the control of soil moisture, doing indications via LEDs and in case of dry soil emitting a alarm beep. In case of dry soil it will activate the irrigation system pumping water for watering plants.
c) LCD display to notify all actions that are taking place and a real time clock.

3.3 Analysis, component level design and selection:

Software analysis are content about the program simulation that we have run to test the functioning output of this project. The program have been through analysis line by line to get the accurate output. To create the circuit we have use Live Wire, then we convert it to PCB layout using PCB Wizard software.

3.4 Assembly and hardware testing:

Once all components were selected and all major functional parts were designed, the major part of assembly and hardware testing of the different modules was done. In order to test the circuit, it was first simulated on Proteus in order to minimize the hardware and circuit failure risks.

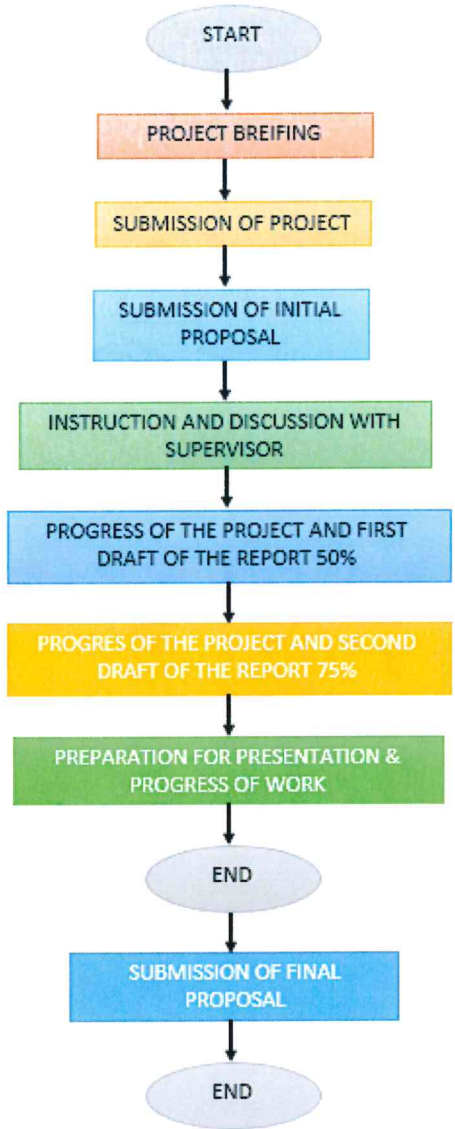
3.5 Simulation development and Verification:

Test results were simulated to achieve the desired goals and then they were verified to get the desired outcome.

3.6 Development for future implementation:

When all the steps which is design selection, components selection, components, modules and sensors testing, simulation and verification was done, the work remained to be done was to make our project for future implementation which included more advanced components, sensors, modules and many more.

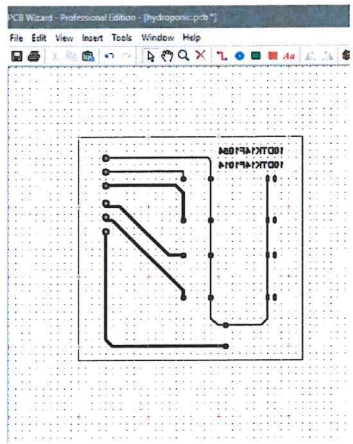
3.7 Flowchart plan of the Project



3.8 PCB layout Preparation

i. Schematic Circuit Design Using Software

- Use the software to build a schematic design for the circuit project. The following software that have been used to design the circuit is "PCB Wizard" , Proteus 8 and others.



3.8.1 Make a Programming/Coding for Simulation

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <RTClib.h>


// frequency musical notes
#define NOTE_C6  1047
#define NOTE_C3  131
#define NOTE_G3  196

// pins definition
intlevelSensorPin = 0;
intmoistureSensorPin = 1;
intaudioPin = 2;
intsoggyLEDPin = 3;
intmoistsoilLEDPin = 4;
intdrysoilLEDPin = 5;
intpumpLEDPin = 6;
intpumpPin = 7;
```

```
// variables
intlevelSensorValue;      // stores the level sensor values
intmoistureSensorValue;   // stores the moisture sensor values
int j = 0;

// system messages
const char *string_table[] =
{
  "   Welcome! ",
  "  Tank LOW level",
  "     Dry soil",
  "    Moist soil",
  "     Soggy soil",
  "The water pump is on",
  "Nabilah& Ku Nurin"
};

// objects definition
RTC_DS1307 RTC;
LiquidCrystal_I2C lcd(0x27,16,2);


void setup(){
  // serial initialization
  Serial.begin(9600);

  // LCD initialization
  lcd.init();
  lcd.backlight();     // with Backlight
  lcd.clear();         // clearscreen

  // Wire initialization
  Wire.begin();

  // RTC initialization
  RTC.begin();
  if (!RTC.isrunning()){
    // date and time adjust as the PC computer date and time
    RTC.adjust(DateTime(__DATE__, __TIME__));
  }

  // Arduino pins initalization
  pinMode(audioPin, OUTPUT);
  pinMode(soggyLEDPin, OUTPUT);
  pinMode(moistsoilLEDPin,OUTPUT);
```