PLANT MONITOR

Submitted by

SHREYA VAIDYANATHAN
TEJAL SATISH

SOCIALLY RELEVANT PROJECT REPORT

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CERTIFICATE

The research work embodied in the present Thesis entitled PLANT MONITOR has been carried out in the Information Science and Technology Department, College of Engineering, Guindy, Anna University , Chennai. The work reported herein is original and does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion or to any other scholar.

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SHREYA VAIDYANATHAN
TEJAL SATISH

Dr. E.Uma
Dr. S.Bama
ASSISTANT PROFESSOR
ISTA
CEG
ANNA UNIVERSITY , CHENNAI

ABSTRACT

As technology seems to sweep each day away, we have to still upkeep our day to day actitivies in this fast paced world. In a situation where your indoor plants strive to survive, this plant monitor comes to your rescue.

This Arduino-based monitor lets you know if your indoor plants are getting enough water and light. The Leaf Light consists of a soil moisture sensor, light sensor, and multicolored LED connected to an Arduino that sits in or near a plant. It's surrounded by a container, which makes it an attractive light, and glows different colors based on the status of your garden.

ACKNOWLEDGEMENT

I wish to record my deep sense of gratitude and profound thanks to my research supervisor **Dr.E.Uma**, Assisstant Professor, Information Science and Technology, College of Engineering, Guindy, Anna University, Chennai, for her keen interest, inspiring guidance, constant encouragement with my work during all stages, to bring this thesis into fruition.

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SHREYA VAIDYANATHAN **TEJAL SATISH**

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CHAPTER 1

INTRODUCTION

This chapter provides the basis of concepts involved in our project, highlighting the working and outcome of the project as a whole. A brief review of literature pertaining to embedded systems, the principle concepts involved in the project and so on is also presented.

1.1 INTRODUCTION

Our plant monitor set-up primarily consists of a soil moisture sensor, light sensor, and multicolored LED connected to an Arduino that is designed to sit in or near the plant. This forms the total kit involved in our project, and the LED which is present on the bread board glows different colors and acts as the visual indicator based on the status of your garden.

Translating the Light :-

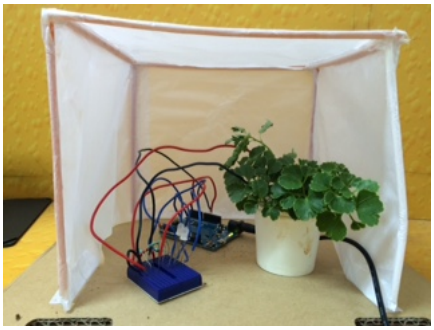
Green-green: Soil moisture and light are at or above desired levels

Green-Red: Your plant needs more light.

Red-Green: Your plant needs water.

Red-Red: Your plant is in need of both light and water.

White: Error. Check your connections!



1.2 LITERATURE

A computer system with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints forms an embedded system. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today.

Our main motivation to take up an arduino project stimulated from the want to learn more about embedded systems and hardware related applications.

Arduino is a rapid electronic prototyping platform composed by the Arduino board and the Arduino IDE. It is an open-source project, software/hardware is extremely accessible and very flexible to be customized and extended It is flexible, offers a variety of digital and analog inputs, SPI and serial interface and digital and PWM outputs. Arduino is a great tool for developing interactive objects, taking inputs from a variety of switches or sensors and controlling a variety of lights, motors and other outputs. Arduino projects can be stand-alone or they can be connected to a computer using USB. The Arduino will be seen by the computer as a standard serial interface (do you remember the COM1 on Windows?). There are serial communication APIs on most programming languages so interfacing Arduino with a software program

running on the computer should be pretty straightforward. The Arduino board is a microcontroller board, which is a small circuit (the board) that contains a whole computer on a small chip (the microcontroller). There are different versions of the Arduino board: they are different in components, aim and size, etc. Some examples of Arduino boards are: Arduino Diecimila, Arduino Duemilanove, Freeduino, Arduino NG and lot more. Arduino schematics are distribute using an open licese so anyone is free to build his own Arduino compatible board. The Arduino name is a registered trademark so you won't be able to call your hacked board Arduino.

In our project work, we began with using an Intel Galileo arduino board, but later switched to use a 'Leonardo' arduino.

CHAPTER 2

OUR WORK

The specifics of procedure adopted in this project is presented in this chapter. The basis of arduino computing and its application adopted are also discussed.

2.1 SCOPE AND OBJECTIVE

The experimental techniques adopted in the present work for the measurement of soil moisture levels, intensity of light and other parameters using arduino are presented in this chapter.

2.2 MATERIALS REQUIRED

Main pieces:

Arduino Mini breadboard Digital Light Sensor LEDs

For the soil moisture sensor: galvanized steel screws or galvanized nails 10K ohm resistor 22-Gauge, solid core wire (in 4 colors)

Other:

Containers of dirt (used to test different soil moistures and calibrate your sensor) An indoor plant Laptop + Arduino IDE

2.3 PROCEDURE

There are three main sub components in the making of this project: (i) Soil Moisture Sensor, (ii) Light Sensor and (iii) the combining of this culmination which exists at the Arduino IDE. The different components on assembly and completion, are attached to the Arduino. All three have some sort of assembly or set up needed before they can be connected.

2.4 STEPS

2.4.1 Description

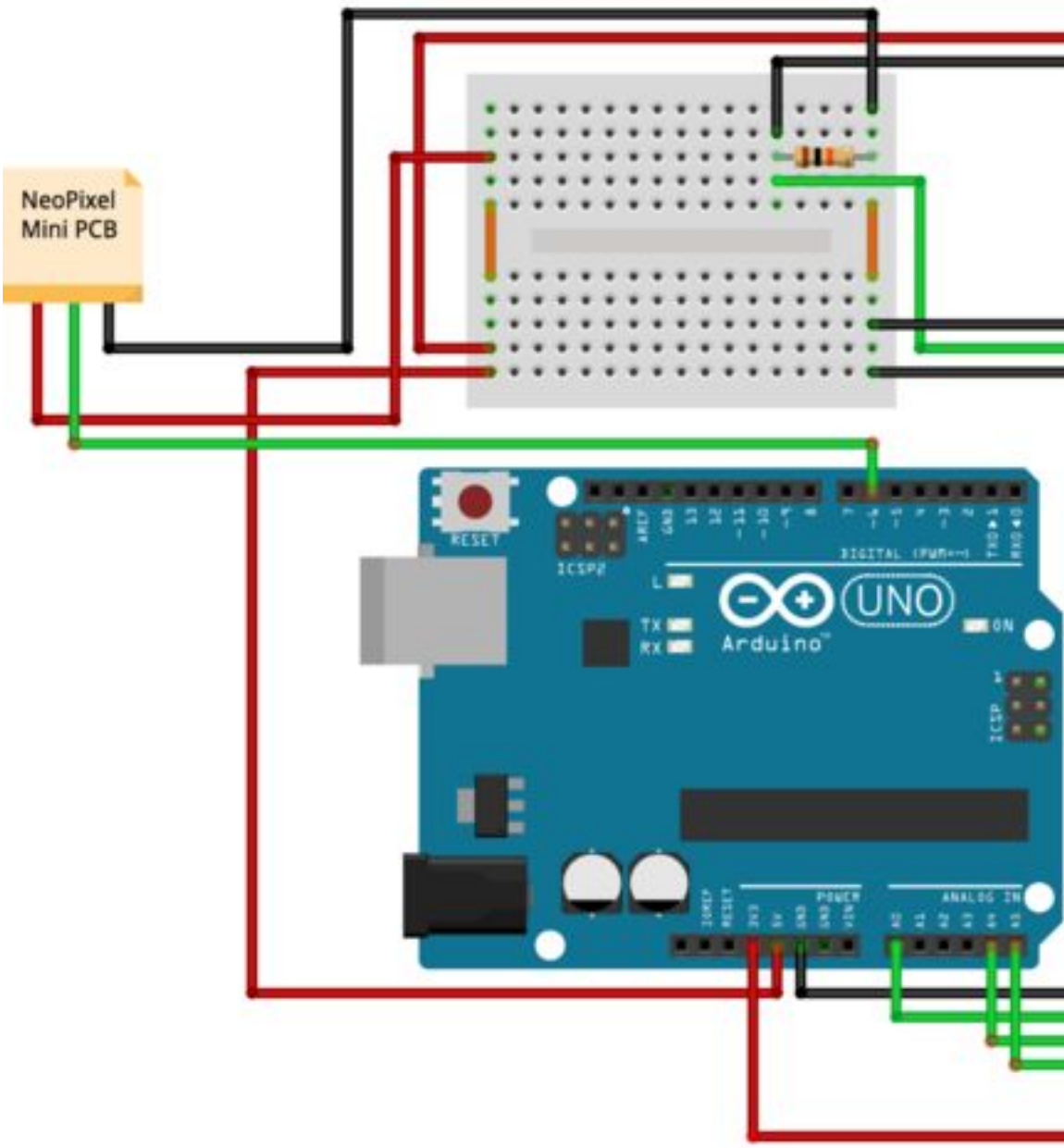
The plant monitor contains the following main parts viz.,

i) Soil moisture sensor,

ii) Light sensor,

iii) Complete circuit

Here we explain each component and how they have been integrated to form the whole set-up.



2.4.1.1 Soil Moisture Measurement

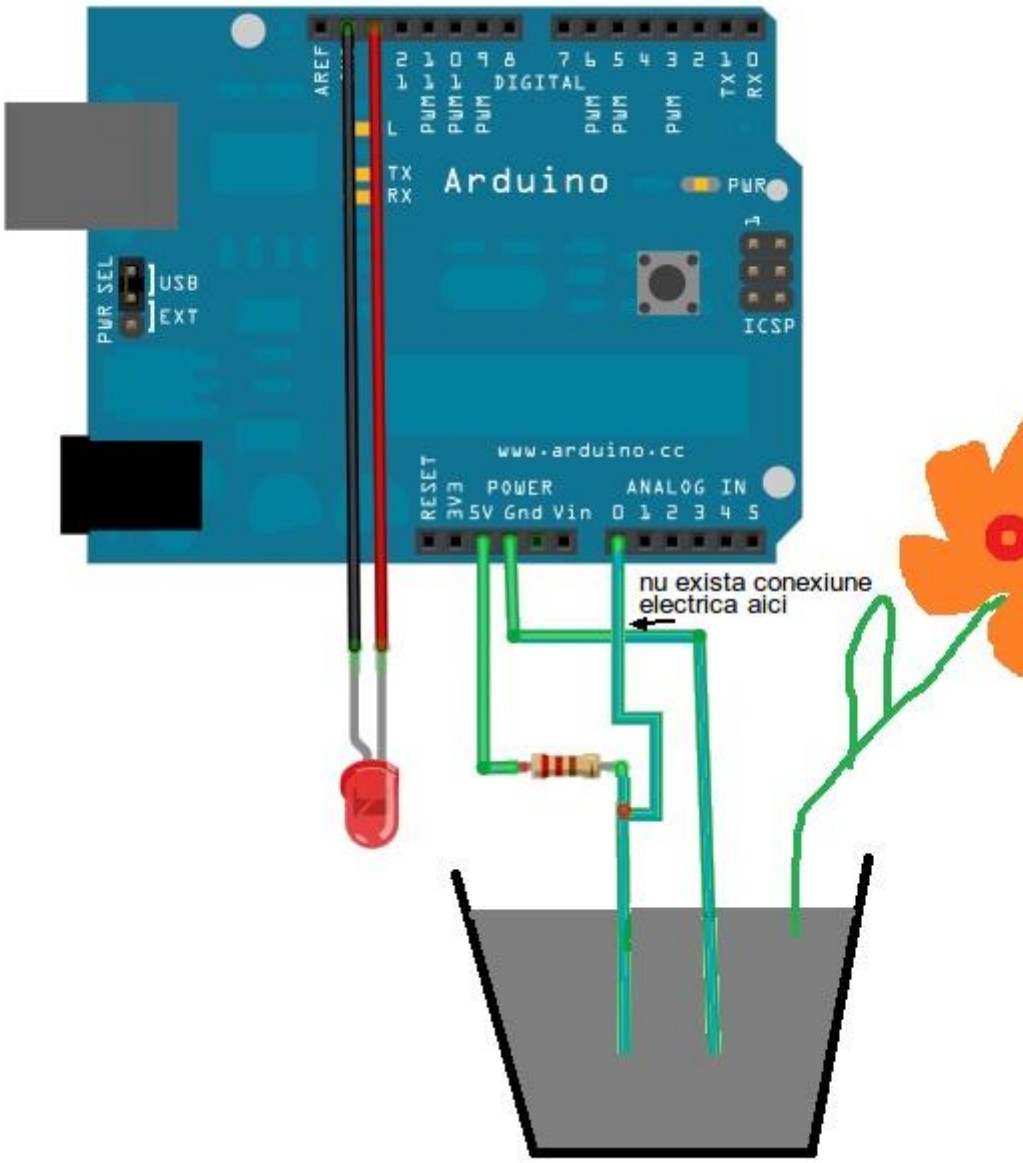
Techniques used for the measurement of soil moisture are classified below.

1. Cut two pieces of 22-gauge, solid core wire. Using red and black to keep track of which wire will be connected where (red will be connected to 5V/the power source and black to ground). Approximately estimate the length the sensor will need to travel from the Arduino, while measuring the wire length prior to cutting strips.

2. Strip the coating off of both ends of using the wire stripper. One side should be long enough to wrap several times around your screw/nail and the other long enough to fit into a pin in your Arduino or breadboard.

3. Wrap the long end of uncovered wire just under the head of the screw or nail. To maintain a connection with the wire, the wire around the nails must be wrapped precisely and tightly.

4. The two nails cannot touch and need to maintain a stable distance from each other. To maintain a constant distance between the nails, a small block of styrofoam is put in place.



2.4.1.2 Assembling the light sensor

The steps and techniques involved in assembling the light sensor is as follows:

1. Cut four pieces of 22gauge, solid core wire.

2. Strip both ends of each wire using the wire stripper, enough for one end to go into the Arduino/breadboard and the other end to go through the spots on the sensor.

3. Poke the end of each wire through the hole you will be soldering it to). Once the wire is through, bend it at a 90degree angle under the sensor so the remaining wire is parallel to the face of the sensor.

4. Solder the end of each wire to the sensor.

5. Use the flush diagonal cutter to cut off the excess wire flush to your solder joints.

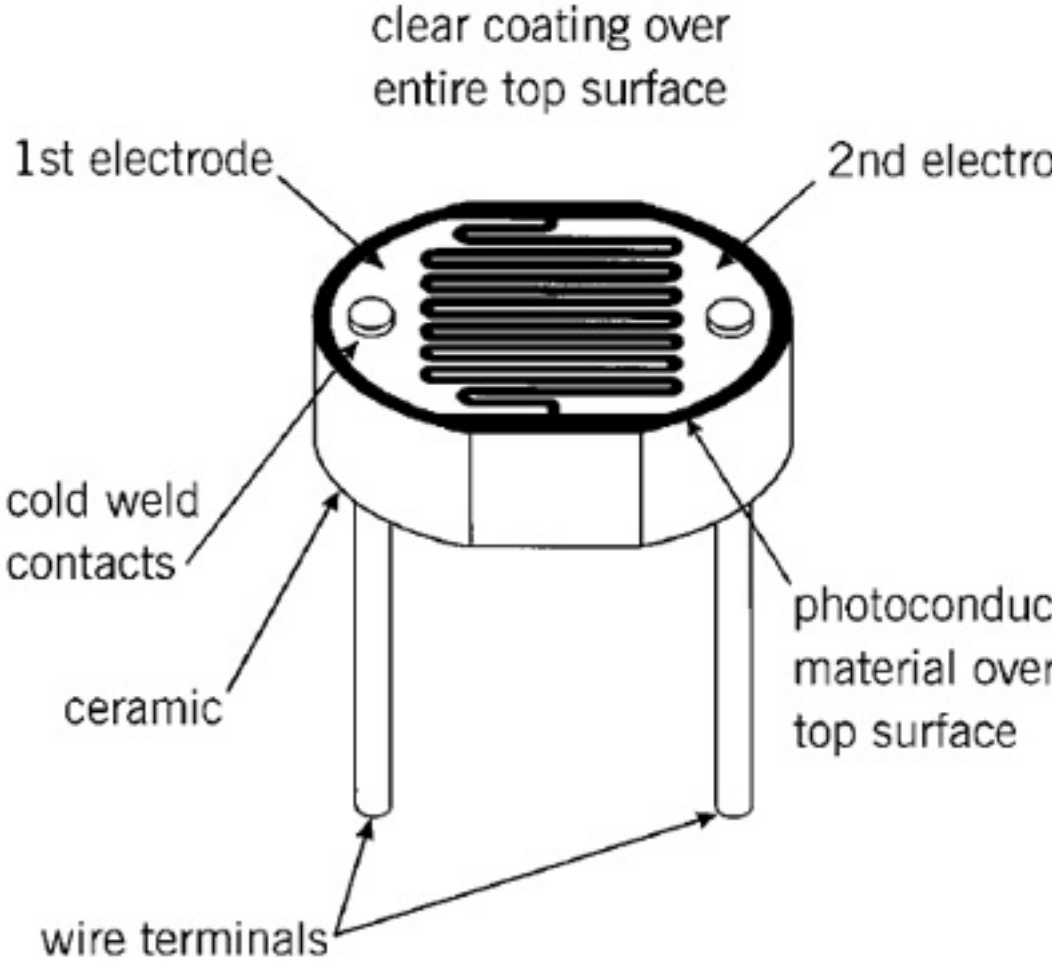


Figure 3
Typical Construction of a Plastic Coated Photocell

2.5 Measurement

We began with the set-up by sourcing all the necessary materials and built up each component to finally assemble the circuit as specified. The light sensor is an important device which helps detect the presence of light and is synced with our arduino board to produce effective measures of light falling on the set-up itself. The arduino microcontroller remains at the heart of

measurement in this set-up. The arduino board is employed to measure the soil moisture and detect light rays on the light sensor.

Its basic principle is involved in 'converting current into voltage'. The Arduino's analogue input pins measure voltage (generally between 0 and 5 volts) using the basis of ohm's law. Thanks to which, there's a very simple linear relationship between the current flowing through a circuit and the voltage applied to the circuit.

Ohm's Law states that the current flowing through a conductor between two points is proportional to the volage difference across those points. The 'constant of proportionality' is known as the resistance and is measured in Ohms. This measurement is taken from the pins on the board and incorporated to calibarate our sensors.

2.5.1 Precautions

The following are precautions that are to be taken during set-up:

i. Do not put your Ardunio on a metal surface it will damage your board by conducting small currents beneath it.

ii. Do not apply voltage greater than 12volts to your board.

iii. Apply only direct current. Ardunio works only at DC.

iv. Do not remove the usb conector from PC when sketch is uploading.

v. When using serial communication digital pin 0 TX and 1 RX can not be used simultaneously.

vi. Using analog.read uses analog INPUT pins only A0,A1,A2,A3,A4,A5.

vii. where as Serial communication uses Serial.println(); statement.

2.5.2 Salient Features

i. It is simple in design and gives reproductive results.

ii. Experiments may be performed over a wide range of plantation, in horticulture environment using serial connection.

iii. Materials used are readily available even in large-scale commercial set-up.

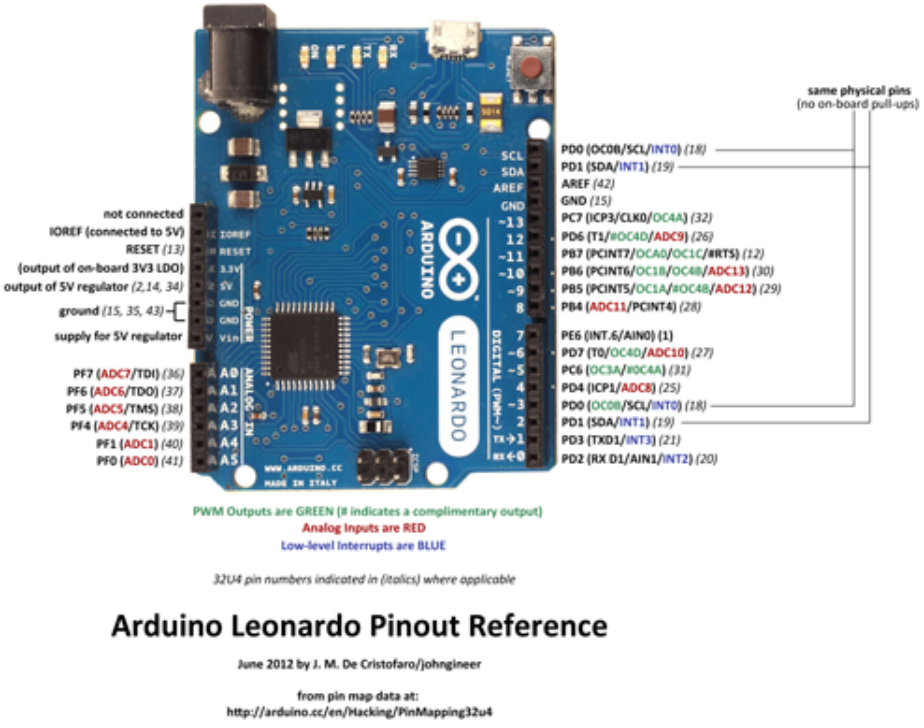
iv. Readings can be viewed directly with the help of the LED indicator.

CHAPTER 3

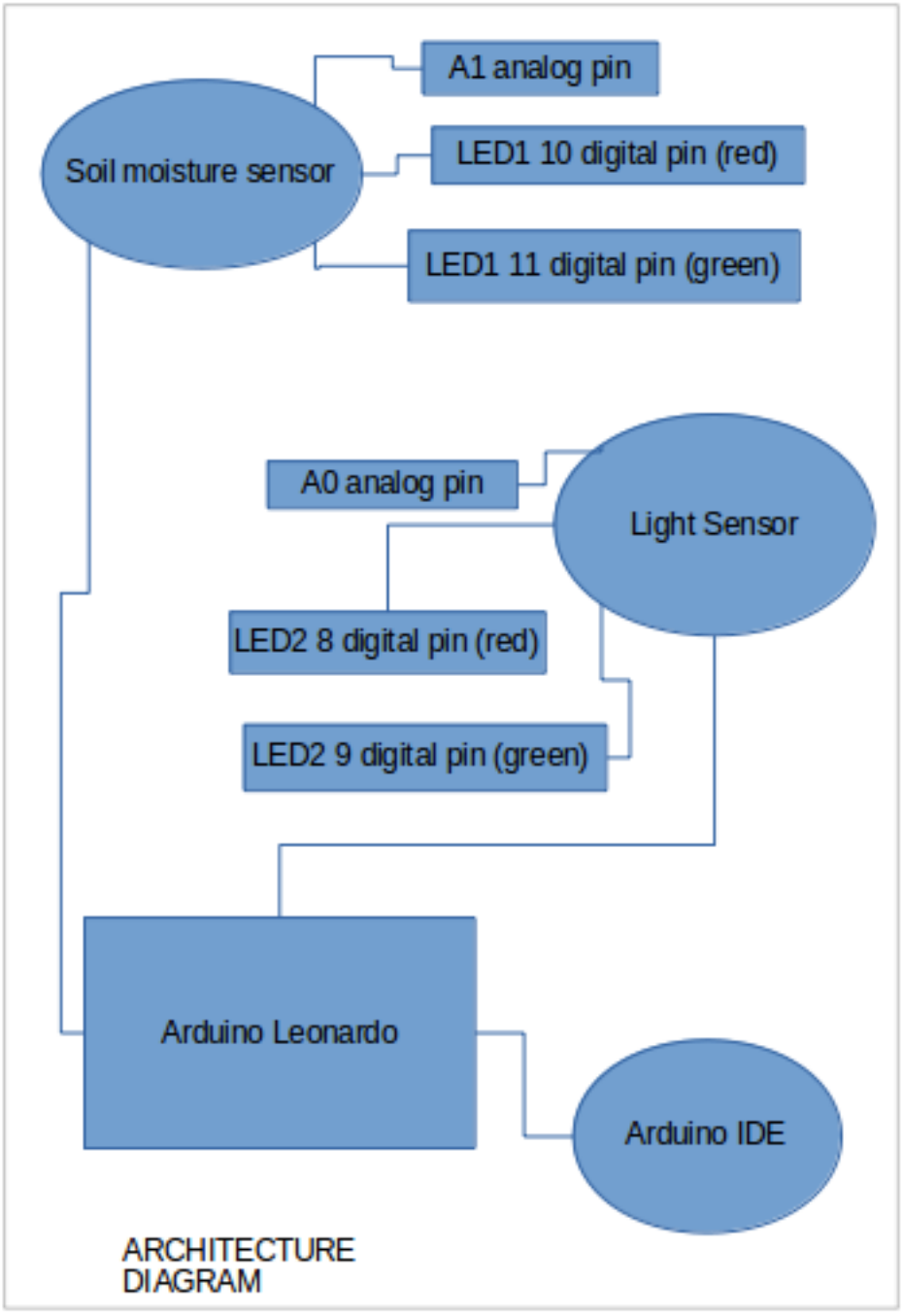
DESIGN

The design, architecture diagram and sequence diagrams are enclosed in this chapter.

The arduino board incorporated in our project is the Leonardo. The schematic pinout diagram is presented below, which highlights its ports and consequently the usage.



Our project is based on the control block diagram below..


A1 analog pin
Soil moisture sensor
LED1 10 digital pin (red)
LED1 11 digital pin (green)
A0 analog pin
Light Sensor
LED2 8 digital pin (red)
LED2 9 digital pin (green)
Arduino Leonardo
Arduino IDE
ARCHITECTURE
DIAGRAM

CHAPTER 4

EXISTING PROJECT REFERENCES

The principle idea and basis of our project was initially designed by 'Making and Makerspaces' which is part of the master of library and Information Science Program at Saint Catherine University. For our socially relevant project, we have adopted ideas from them and tried to improvise the implementation. Their project had made use of a microcontroller, but we chose to incorporate the arduino in ours.

These were several projects from which we have studied extensively and borrowed from to create this project :

- Erbbie Desktop Smart Garden by zacharyianhoward.
- Garduino Gardening + Arduino and potted plant protector
- Moisture detection with two nails and Soil/Moisture detection system by ronnietucker.
- Twitter mood light (used for light box design ideas)

CHAPTER 5

CONCLUSION

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