SMART AUTOMATED IRRIGATION SYSTEM

A PROJECT REPORT

submitted by

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in

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(Deemed to be University under section 3 of UGC Act, 1956)

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DECLARATION BY THE CANDIDATE

We hereby declare that the Project Report entitled "**SMART AUTOMATED IRRIGATION SYSTEM"**submitted by us to VIT University, Chennai in partial fulfillment of the requirement for the award of the degree of **Bachelor of Technology** in **Computer Science and Engineering** is a record of the bonafide undertaken by us under the supervision of **Prof. Dr. Geetha S.** We further declare that the work reported in this report has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

Chennai: Signature of the Candidates

Date:

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School of Computing Sciences and Engineering

BONAFIDE CERTIFICATE

This is to certify that the Project Report entitled **"SMART AUTOMATED IRRIGATION SYSTEM"** submitted by **DHINESH BABU (16BCE1008), SANDEEP KIRAN (16BCE1041), SUDHARSHAN N (16BCE1050), ABHISHEK C S (16BCE1211), AKSHAYANAT C S (16BCE1066), AVS KASTURI KARTHIK (16BCE1225)** and **GAUTHAM V (16BCE1378)** to VIT University, Chennai in partial fulfillment of the requirement for the award of the degree of **Bachelor of Technology** in **Computer Science and Engineering** is a record of the bonafideundertaken by them which fulfills the requirements as per the regulations of this institute and in my opinion meets the necessary standards for submission. The contents of this report have not been submitted and will not be submitted either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

Date:03/04/2019

Prof. Dr. Geetha S

Faculty

(B.Tech CSE)

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ABSTRACT

Agriculture is the primary occupation in India and is called India's backbone. But of late, a lot of problems are being faced in agriculture by the farmers. One of the major problem being water scarcity. As per surveys, almost 20 percent of the agricultural land is wasted due to water scarcity and becomes a barren land. Thus, this project gives an idea of smart irrigation system. This irrigation system uses three sensors namely temperature sensor, humidity sensor and soil moisture sensor and fuzzy logic is used to operate the solenoid valve. All the operations are governed by an Arduino and the power supply for the Arduino is given by a solar panel which uses LDR (Light Detection Ratio) and makes it into an automatic tracking system. The crops are grown in two tubs and comparison of growth of plant with automated irrigation and normal irrigation is carried out.

CHAPTER 1

INTRODUCTION

Agriculture is the major backbone of India as it satisfies the need of food for the people. Though many agricultural lands are being destroyed, there are still many who are not willing to sacrifice agriculture as they provide basic requirement for the people. Agriculture is facing many problem as of today and many researches are being carried out in order to improve the agricultural practices. Some researchers have made a Zigbee module to control three sensors to give right amount of water to the plant which also incorporated by transfer of feedback to the user through the mobile app and some have used only a soil moisture sensor for automatic drip irrigation. Then a three level moisture sensor which detects moisture at three different depths and accordingly the water is allowed to the crop. The soil pH was also read using image processing. An attempt to detect water requirement by moisture sensor and used solar panel to pump the motors. Then later fuzzy logic was used which had three sensors (soil moisture, humidity and temperature sensors) and the solar panels are connect to run the pumps.

The automated irrigation is done by using fuzzy logic and the basic controller of all is Arduino as it controls the sensors and the solenoid valve. As per the survey taken, we came to know that the voltage from the solar panel is insufficient to power the pump and it is expensive to buy batteries to store power from solar panel. Thus, we use the solar panel to power the Arduino. The solar panel is an auto tracking system which is made by LDR (Light Detection Ratio). The plants are grown in both tubs and separation is shown in order give a view on two

different lands and the plants are grown using automated irrigation system in one and the normal irrigation on the other. The quality of crops and the amount of water used to grow are compared.

CHAPTER 2

COMPONENTS

1. Solar Panel

Usage

- Solar panel is the main component in powering up the smart devices such as Arduinos, motors, and sensors for the project.
- It converts light falling on its surface into electrical energy which would then be stored in a battery device to power the components.

Hardware Specifications

- Voltage Output:
  a) Max Voltage Output – 12 V
  b) Min Voltage Output – 3V
- Output Watts: Max Watt Output – 6W
- Panel Cell: Polycrystalline Silicon Cells
- Convertor: A 12V TO 5V step-down convertor is used to convert the 12V Output the solar panel provides to 5V that is required for charging the battery
- Efficiency: 95 % Efficiency

2. Power Bank (Battery Device)

Usage

- Battery (Power Bank) is a device that is used to supply electric current to devices connected to it by a series of chemical reactions that happen inside it.
- The battery is a crucial component alongside the solar panel since it is used for powering the smart components even when there is no sunlight and hence provides stable electric energy for the smooth functioning of the system.
- The solar panel charges the battery and provides electricity to the smart components when there is enough sunlight.
- The absence of sunlight would make the battery discharge and power the components.

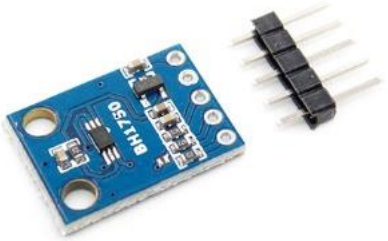
Hardware Specifications

- Voltage Input:
    a) Max Voltage Input – 5.2 V
    b) Min Voltage Input – 4.3 V
- Voltage Output:
    a) Max Voltage Output – 5 V
    b) Min Voltage Output – 4.5 V
- Battery Pack: Lithium Polymer (Li-Po)
- Capacity: 10000 mAh

- Backup time: 16 Hours backup time for low power drawing devices such as Arduinos

3. BH1750 Light Sensor

Usage



- The BH1750 is a light sensor that is used for measuring the amount of light (in luminous flux in one metre of area, lux).
- These sensors are attached on two sides of the solar panel and provides the Arduino with the information on1 the amount of light falling on either of the sides, which then gives signal to the motor to rotate the panel in the direction in which maximum light is falling to get the best output from the solar panel.

Hardware Specifications

- Voltage Input:
  a) Max Voltage Input – 5 V
  b) Min Voltage Input – 3 V
- Sensor Output: 0-65535 lux

Software Specifications

- Arduino IDE
- Wire.h library from Arduino Libraries

4. TowerPro MG945 Servo

Usage

- The Servo motor is a motor that is used to rotate the solar panel in the direction in which the Arduino specifies.
- The motor based on information from the Arduino moves the solar panel attached on its blade either clockwise or anticlockwise.
- The rotation is done for maximizing the amount of sunlight falling on the solar panel which is required for maximizing the power output from the panel.

Hardware Specifications

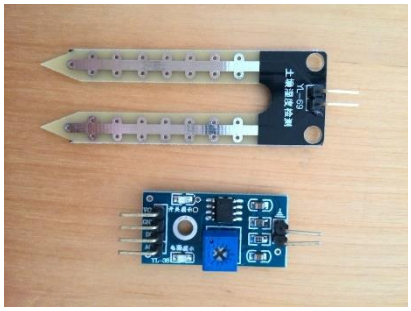
- Voltage Input: Min Voltage Input – 5 V
- Rotation Degrees: 0-180^{o}
- Rotation Direction: Clockwise and Anticlockwise

Software Specifications

- Arduino IDE
- Servo.h library from Arduino Libraries

5. YL – 69 Soil Moisture Sensor

Usage



- The soil moisture sensor is used to detect the amount of water content present in the soil. The voltage that the sensors gives change accordingly to the water content in the soil.
- When the soil is wet the output voltage decreases and when it is dry the output voltage increases.
- This sensor is connected to the Arduino and the values are sent to it. This Arduino also acts as a power source for the sensor.

Hardware Specifications:

- Operating voltage: DC 3.3V - 5V
- Output voltage signa**l:** 0 ~ 4.2V
- Current: 35mA
- LED: Power indicator (Red) and Digital switching output indicator (Green)

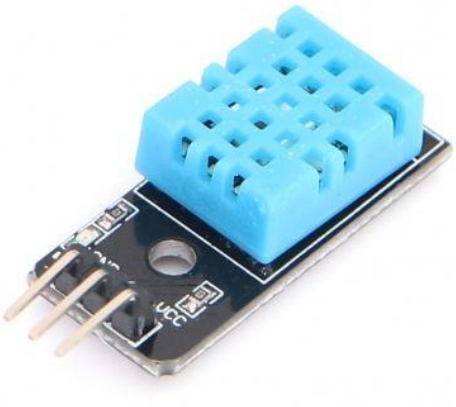
Software Specifications:

- Arduino IDE
- Servo.h library from Arduino Libraries

6. DHT – 11 Temperature and Humidity sensor

Usage:

- This sensor is used to find the temperature and the humidity of the soil.
- These sensor values are powered by Arduino as well as the values of this sensor is sent to the Arduino.
- The humidity values are recorded by changing in the resistance of the sensor and the temperature is measured by a thermistor.



Hardware Specifications:

- Supply Voltage: +5 V
- Temperature range :0-50 °C error of ± 2 °C
- Humidity :20-90% RH ± 5% RH error
- Interface: Digital

Software Specifications:

- Arduino IDE
- Servo.h library from Arduino Libraries

7. Solenoid Valve

Usage:

- Solenoid valve is and electromechanical actuated valve that is used to control flow of water to the plant. There are total of two solenoid valves that are being used.
- The solenoid value is connected to the Arduino and when the data processed by Arduino is true then the current will be given
- The valve opens when the current is given and remaining time valve will be closed thereby controlling the flow of water.

Hardware specifications:

- Operating pressure: 7 – 232 Psi
- Operating temperature: -5 – 180^{o}C
- Body material: Brass
- Coil power: 30-40 kW
- Voltages: 12VDC, 24VDC, 24VAC, 110VAC, 220-230VAC (50-60Hz)

8. Arduino Uno

Usage:

- Arduino is the processing unit in the whole system. The fuzzy logic code is uploaded into Arduino.
- It gets the input values from DHT sensor and soil moisture sensor. Arduino process the values and the output is sent to solenoid valve which acts as a flow control of water.

- The Arduino is powered by a solar panel by means of a power bank.

Hardware Specifications:

- Operating voltage: 5V
- Input voltage: 7-12V
- Cloak speed: 16MHz
- DC Current per I/O Pin: 20 mA
- DC current for 3.3V Pin: 50 mA

9. 12V to 5V converter

Usage:

- The output of the solar panel is 12V which is too high so we cannot connect it to the battery (power bank) which is generally 5V.
- Thus this converter is used to convert the 12V to 5V so that the power bank could be charged.

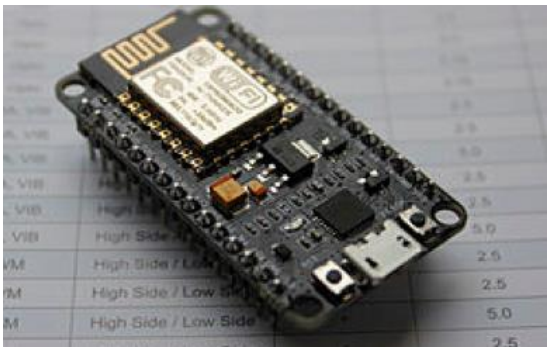
Hardware Specifications:

- Input voltage: DC 6-24V
- Output voltage: 5.1-5.2V
- Output current: 3A

10.NodeMCU

Usage:

- Open source IoT platform.
- Firmware on ESP8266.ESP8266 is a low-cost, WiFi Module chip that can be configured to connect to the Internet for Internet of Things(IoT) and similar Technology Projects. It is basically an SoC (System on Chip)

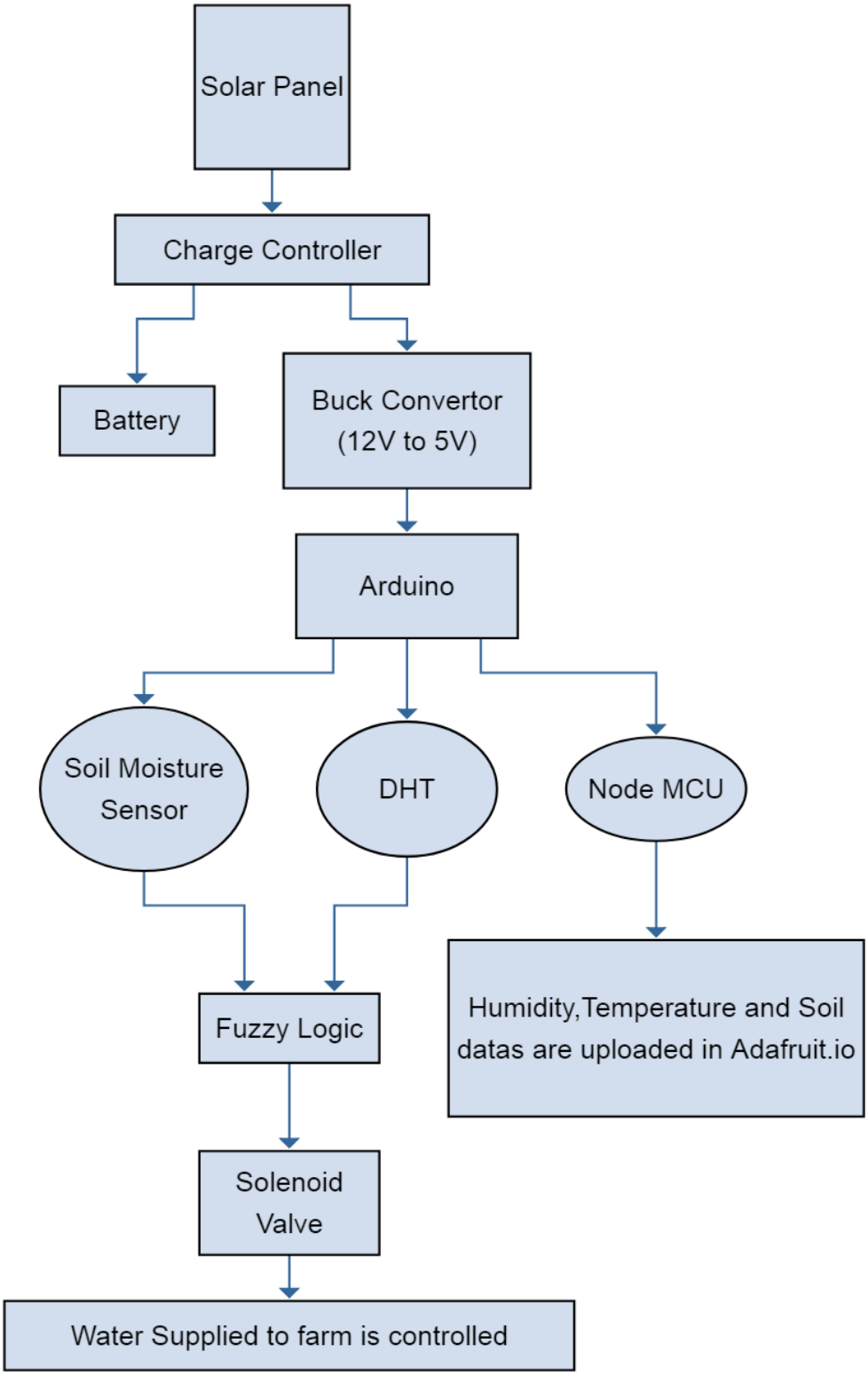


- As an integrated circuit that integrates all components of a computer or other electronic systems.

Hardware Specifications:

- Input voltage: DC 6-24V
- Output voltage: 5.1-5.2V
- Output current: 3A
- Type : Single-board microcontroller
- Operating system : XTOS
- CPU : ESP8266
- Memory : 128kBytes
- Storage : 4Mbytes
- Power By : USB
- Power Voltage : 3v ,5v (used with 3.3v Regulator which inbuilt on Board using Pin VIN)
- Code : Arduino Cpp
- IDE Used : Arduino IDE
- GPIO : 10

2.1 SYSTEM DESIGN



CHAPTER 3

METHODOLOGY

a. **Solar panel assembly:**The automatic solar tracking system using the LDR was made in this assembly. The solar panels are connected to Arduino which act as a power source for sensors and the solenoid valve.

b. **Arduino Assembly:** The Arduino is connected to the solar panel which acts as the power source and it is connected to the three sensors namely soil moisture, temperature and humidity sensor. The Fuzzy logic code is written and uploaded into the Arduino. ThisArduino is connected to the solenoid value. The input values are taken from the three sensors and output is given to the solenoid valve. Solenoid valve works on the principle of electromagnetic induction. When the current is applied the solenoid valve allows the valve to open and remains closed at remaining time.

c. **Fuzzy logic:** The humidity, temperature and soil moisture sensors are the input values. Four functions of temperature namely “Very Hot”, “Hot”, “Cold” and “Very cold” are taken. For soil moisture and humidity sensors three functions are taken namely “High”, “Medium” and “Low”. Fuzzy logic uses “if” and “else” condition for operating the solenoid valve. There are total of 36 combinations possible from the above three sensors. Based on these conditions, the output value is either “True” or “False”. “True” indicates the current to the solenoid valve and thus water is given to the crops and “False”

indicates no current to the solenoid value and thus the valve remain closed.

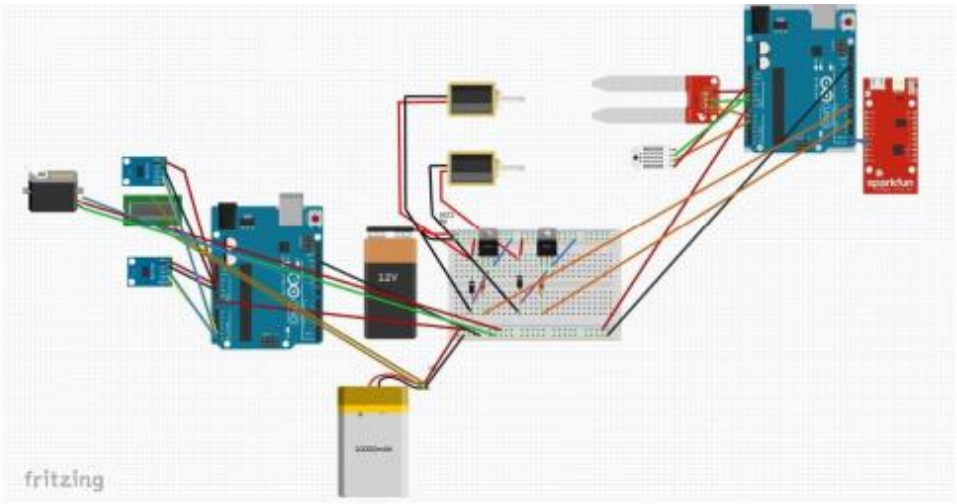
d. **Crop planting:** The crops are planted in two tubs and are grown. The crop in one tub is grown using automated irrigation system and the other one is grown using normal irrigation. The amount of water given to the crops are noted and the quality of the crop are compared after growing. The growing time of plant is one week. A single tube is separated into two regions in order to have two fields of land. So we use two solenoid valve and the power is given to the respective solenoid valve using the fuzzy logic.

e. **Cloud Module:** This is an Arduino like hardware IO and can be used as an event driven API for networking applications. It is used for Wi-Fi networking (can be used as access point and/or station, host a webserver) and connects to internet to fetch or upload data. This is anexcellent system on board for Internet of Things (IoT) projects and can be used for sending sensor data of soil moisture,DHT Sensor and was able to run analytics on the data.Adafruit IO is used as an API Provider for uploading the data. It is a cloud service to display our data in real-time, online and make our project internetconnected.

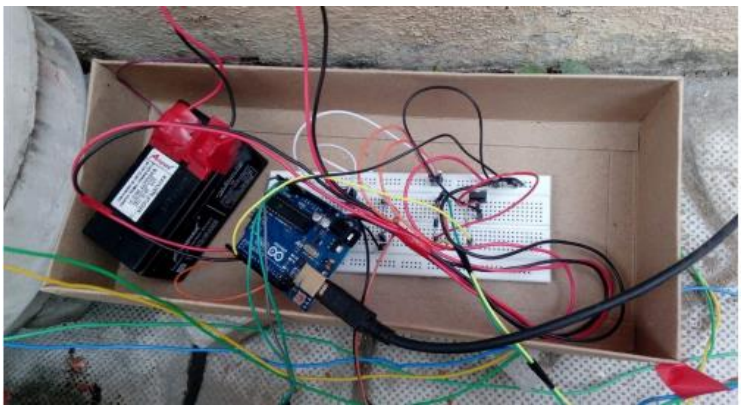
CHAPTER 4

RESULTS

CIRCUIT DESIGN



PROJECT IMPLEMENTATION



CHAPTER 5

CONCLUSION

An automated smart irrigation system was successfully developed that can use fuzzy logic and various sensors like soil moisture and DHT(Humidity and Temperature) Sensor to analyze conditions of the soil and decide whether it should irrigate the farm or not . We also deployed the system without the need of electricity as we used solar energy to power all the arduino and the sensors .This design can in future be scaled up to suit actual farm sizes, and support the operation without requiring human intervention and man power for irrigation.

CHAPTER 6

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