DESIGN AND DEVELOPMENT OF ARDUINO BASED AUTOMATIC SOIL MOISTURE MONITORING SYSTEM FOR OPTIMUM USE OF WATER IN AGRICULTURAL FIELDS

PROJECT REPORT

Submitted in partial fulfilment of the Requirements for the degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRICAL AND ELECTRONICS ENGINEERING

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ELECTRICAL AND ELECTRONICS ENGINEERING

SRI VENKATESWARA UNIVERSITY COLLEGE OF ENGINEERING TIRUPATI

2018-2022

SRI VENKATESWARA UNIVERSITY

COLLEGE OF ENGINEERING,TIRUPATI

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify that the project entitled "**Design and Development of Arduino based Automatic Soil Moisture Monitoring System for Optimum use of Water in Agricultural Fields"** has been carried out under my supervision in the **Department of Electrical and electronics Engineering**, **Sri Venkateswara University College of Engineering.**

The work is comprehensive, complete and fit for evaluation carried out in partial fulfilment of the requirements for the award of **Bachelor of Technology** in **Electrical and electronics Engineering** during the academic year 2021-22.

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BONAFIDE CERTIFICATE

This project bonified work titled i.e. "**Design and Development of Arduino based Automatic Soil Moisture Monitoring System for Optimum use of Water in Agricultural Fields"** was carried out by our project member under the guidance of

Shri. M. Vijay Kumar Naik Faculty in Electrical and Electronics Engineering.

This is done to the best of my knowledge. The work reported here in does not form part of any other project report or dissertation on the basis of which degree or award was conferred on an earlier occasion or any other candidate.

We do not copy from any other sources for the implementation of this project and to make this project report.

ACKNOWLEDGMENT

I would like to express my profound gratitude to my esteemed guide **Shri. M. Vijay Kumar Naik** Faculty, Department of electrical and electronics engineering, Sri Venkateswara University college of engineering Tirupati , for this valuable advice and inspiring guidance for successful completion of this work

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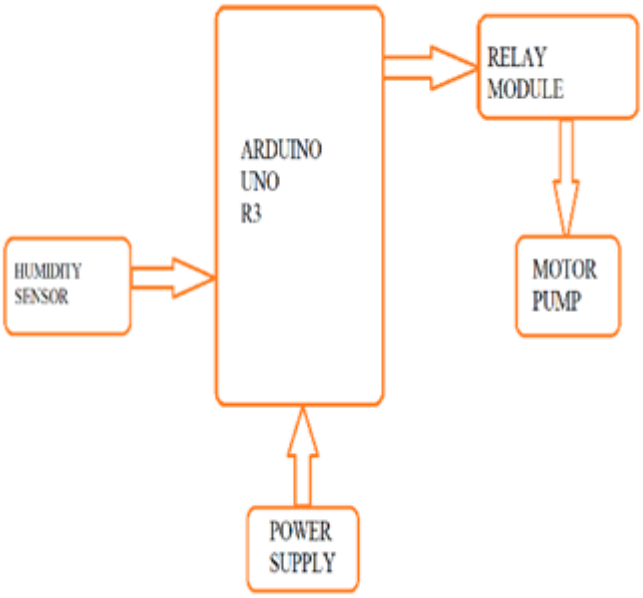
ABSTRACT

Agriculture is a field where a lot of human physical effort is needed in order to cultivate land. It is high time that we made devices that can help farmers in reducing the human effort involved in agriculture. One such device is a smart irrigation system using Arduino. This is very simple to build and also works very effectively and its manufacturing cost is also low. Smart irrigation systems are revolutionary devices that can minimize the work and produce great results. The problem with traditional irrigation systems is that they cannot utilize the water available completely and it needs workers to look over it all the time. This Project is made using Arduino board, soil moisture sensor, motors, Arduino software for programming the Arduino board. An Arduino is a microcontroller which is used as a computing device in the project. It takes the input value from the soil moisture sensor. The value from the sensor is the moisture content present in the soil.

INTRODUCTION

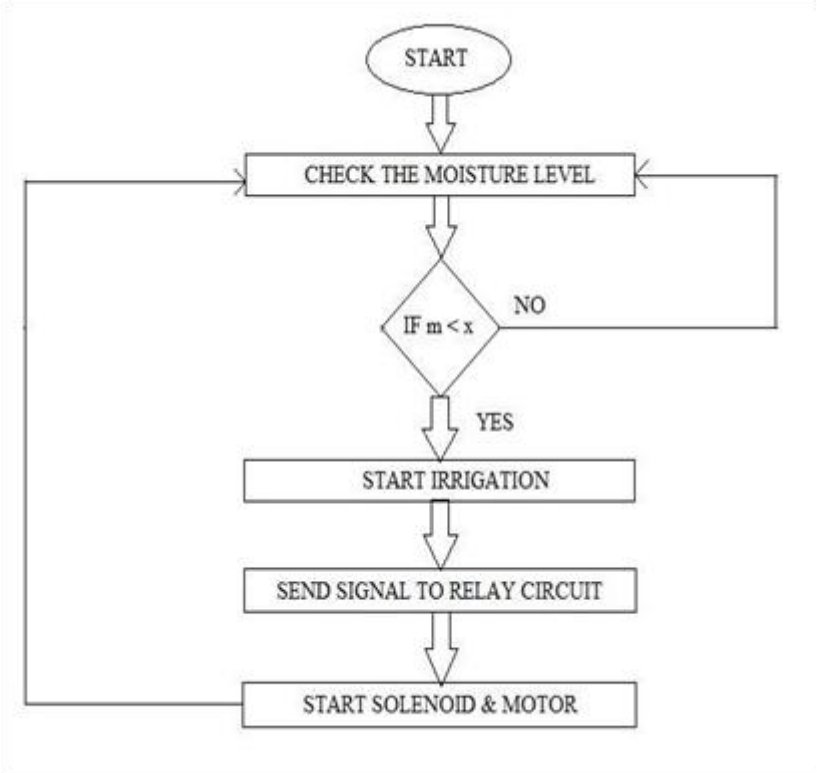
The main objective of this project is to build a simple and low-cost device that can be affordable and easy to build so that it can be implemented all over the country even in remote villages. The biggest advantage of this project is its reliability. One can use this device and gain the benefits of having less human intervention as it works with detailed data about the soil.

In this project the value from soil moisture sensor is given as an input to the Arduino and the Arduino performs necessary calculations through the if condition program given by us and alters the motor accordingly so the soil gets enough moisture.



The Arduino is programmed through an Arduino IDE software in which we make a reference value for the soil moisture content and we perform the action motors accordingly.

This project has two motors one motor is for watering the land and the other one is for filling the backup water tank.



AN ultrasonic sensor is used to measure the water level of tank so that when the tank level is low the motor to fill water in the tank will get running and water gets filled in the tank.

Arduino Board:

It is a microcontroller based on Atmega 328P. It has 14 digital input and output pins. A reset pin, Rx and Tx for serial data transfer two interrupts, and several other pins.its clock speed is 16 MHz.

Soil moisture sensor:

Soil moisture sensor finds the moisture content in soil with the help of the two probes in it. Its working is very basic and simple. When the two probes are placed inside soil with moisture as electricity conduction is good in moist areas more current passes through the probes and its resistance value decreases. If the sensor is placed in dry place very less current passes through the sensor and resistance increases as a result we can use this property of the sensor in this project.

Motors:

Here the motors are used for pumping water to land and for filling the tank. These motors working is controlled by the program and in the water tank an ultrasonic sensor detects the water level and send it as an input to the arduino and according to that the motor for pumping water into tank will get on and off.

•Arduino IDE:

The program for controlling the motors and watering the plants according to the moisture level of soil is written on this software and uploaded to the Arduino. This software is used widely for Arduino even though it supports other programming languages because it is simple to write and easy to upload into the Arduino.

LITERATURE SURVEY

[1] Alberto Pardossi , Luca Incrocci (2009) published a paper on Root Zone Sensors for Irrigation Management in Intensive Agriculture which dealt with sensors in different root zones for different crops.

[2] Archana and Priya (2016) proposed a paper in which the humidity and soil moisture sensors are placed in the root zone of the plant. Based on the sensed values the microcontroller is used to control the supply of water to the field. This system doesn't intimate the farmer about the field status.

[3] G. Parameswaran and K. Sivaprasath (2016) proposed a smart drip irrigation system using IOT in which humidity, temperature and pH sensors are used. Irrigation status is updated to the server or local host using personal computer.

[4] Ray-Shyan Wu, Jih-Shun Liu, Sheng-Yu Chang and Fiaz Hussain (2017) proposed a paper for Modelling of Mixed Crop Field Water Demand and a Smart Irrigation System which indicated that the field storage in the end block of the study area was lower than the wilting point under the 50% reduced irrigation water scenario. The original irrigation plan can be reduced to be more efficient in water usage, and a 50% reduction of irrigation can be applied as a solution of water shortage when drought occurs.

[5] Sonali D. Gainwar and Dinesh V. Rojatkar (2015) proposed a paper in which soil parameters such as pH, humidity, moisture and temperature are measured for getting high yield from soil. This system is fully automated which turns the motor pump ON/OFF as per the level of moisture in the soil.

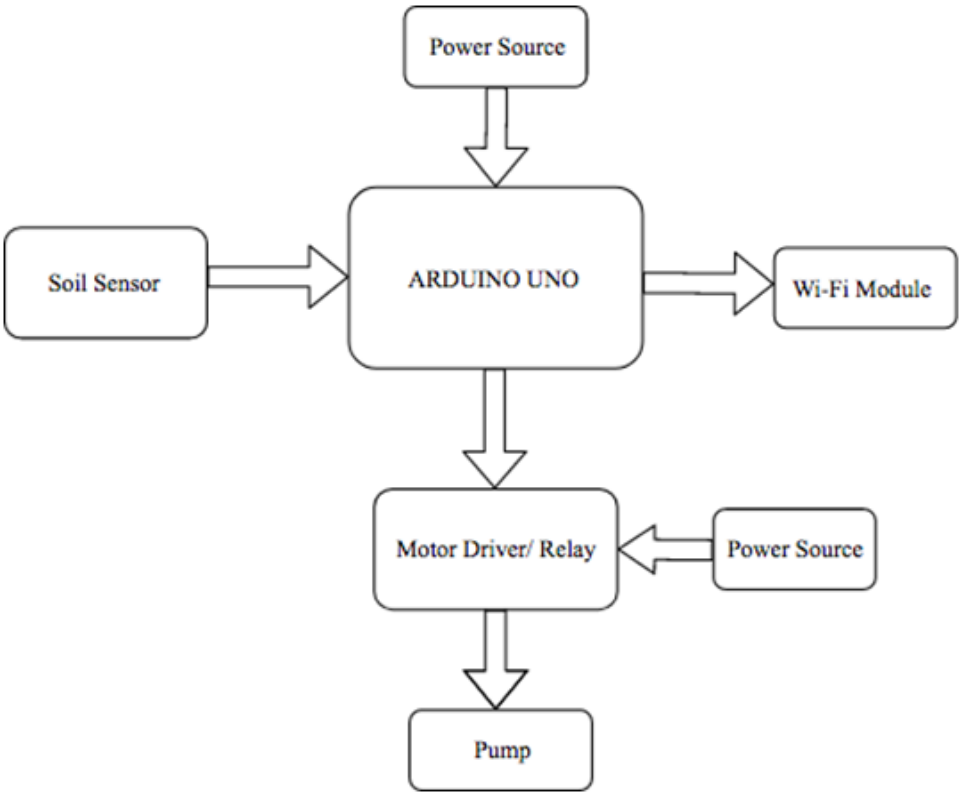
PROBLEM IDENTIFICATION

The prototype works in real time and depends on soil sensor. The soil sensor detects the moisture present in the soil. A threshold is pre-set in the prototype depending on the soil and crop type. When the moisture falls below the set threshold the system turns the pump ON, thereby supplying water to the

crops, as soon as the moisture in the soil reaches above the threshold the water supply will stop. The entire system is automated therefore no human intervention is required. The system will automatically supply the water depending on the moisture present in the soil. The complete process can be overviewed through an application on our smart phone.

PROPOSED METHODOLOGY

Design of Smart Irrigation System:



First of all, the connections have to be made correctly. LCD, Ultrasonic sensor, motors, potentiometers, transistors, soil moisture sensor have to be connected to either input or output according to their functioning. Here value from moisture sensor is given as an input to the Arduino.

Arduino receives the soil moisture value from the sensor and puts it in the program. In the program there is an if loop which turns on the motor for pumping water to the land if the

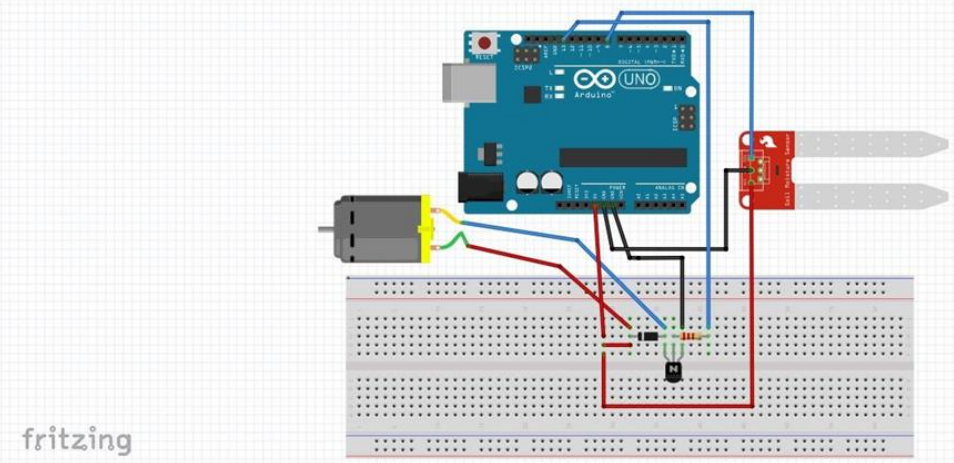
moisture value is less than a given reference value and if the moisture value is greater than given reference value then it turns off the motor.

The ultrasonic sensor sends the level of water in the water tank by measuring the distance from the top of the tank to the water level by sending rays and calculating distance by using the time taken by the rays to hit the water level and return back. From this value the Arduino's if loop program turns the motor for tank according to the reference water level specified in the program.

The program written for Arduino contains if loops for performing the actions specified accordingly like controlling the actions of motors and it has several messages written which will be displayed on the lcd. It displays messages like water pump is on, soil moisture level is 50% and some other messages.

Automatic Plant Watering System Using Arduino:

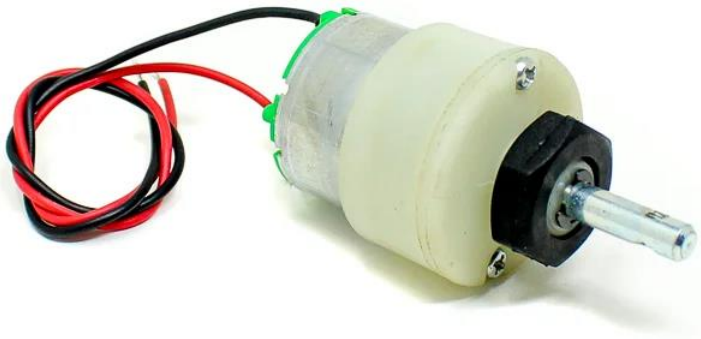
In this system, soil moisture sensor senses the moisture level of the soil. If soil will get dry then sensor senses low moisture level and automatically switches on the water pump to supply water to the plant. As plant get sufficient water and soil get wet then sensor senses enough moisture in soil. After which the water pump will automatically get stopped.



I have used a self-made water pump in this system using 5-volt DC motor. I could use 12-volt water pump in the system but to operate this, it will require a relay module. So, to reduce all these hardware complexities,

I made DC motor-based water pump using diode, transistor and registers combined circuit which operates DC motor according to the Arduino code

- DC motor using water pump:



I use DC motor to make water pump. DC motor has two leads one is positive and another one is negative. If we connect them directly to the Arduino board then it will damage the board. To overcome this problem, NPN transistor is used to control the switching activity of the motor according to the code.

Arduino pin 13 (named as WATERPUMP in code) is used to turn on and off the transistor. According to the code to control the speed of the motor we need to

enter a value between 0 and 255 in the Serial Monitor. I used 200 value for the speed of the motor.

- Soil moisture sensor:

The soil moisture sensor consists of two leads that are used to measure volume of water content in soil. These leads allow the current to pass through the soil and in return calculates the resistance value to measure the moisture level.

If there is more water in soil then soil will conduct more electricity, means less resistance value along with high level of moisture. In the same manner if there is less water in soil then soil will conduct less electricity, means high resistance value along with low level of moisture.

SCOPE FOR FUTURE DEVELOPMENT

MIT app inventor:

It is an open-source web application provided by Google and maintained by Massachusetts Institute of Technology.

It allows us to create software application for the android operating system. We use it to develop application to which transmits the data from smart irrigation system to the Smartphone through wireless network.

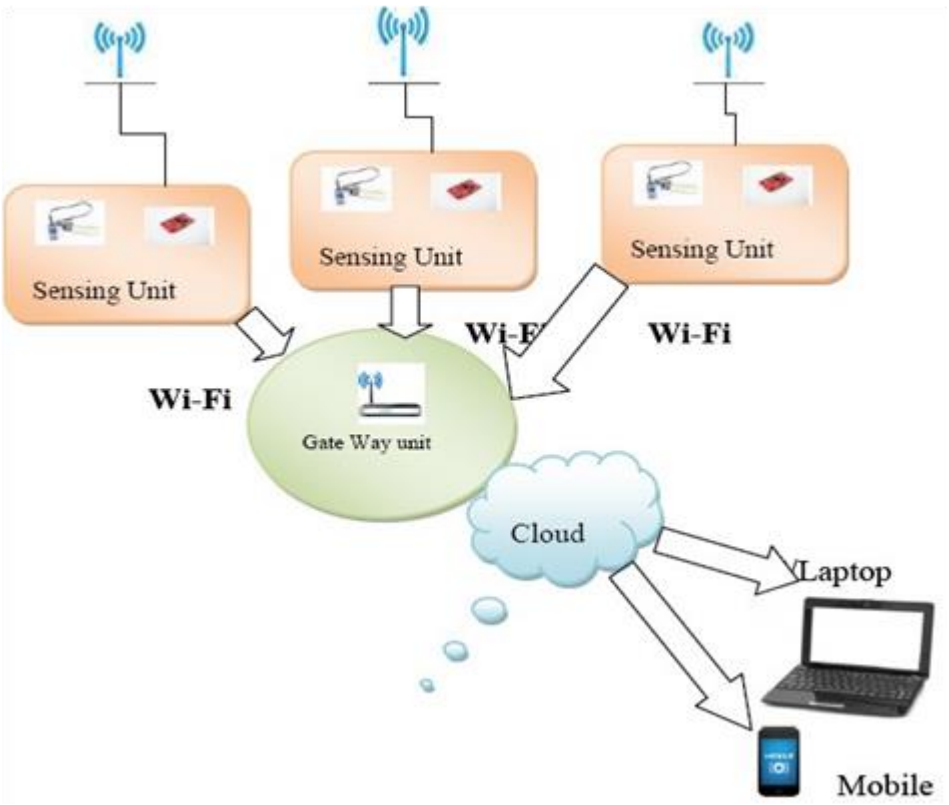
Integration of Sensor with Cloud :

The sensor is interfaced with CC3200 LaunchPad will be collecting the data from the sensor continuously. Using on-chip Wi-Fi the values are uploaded into the Cloud.

The Cloud technology is used in this work is AT&T'sM2X Cloud technology. In the present work our M2X device name is: CC3200 with device

ID: f2e62e729bda20e8b692e96325e48627 and

API key: 3a06aa40bf67fc5ffbd4d74cf2a9ee46.



ADVANTAGES

This system has so many advantages over the traditional irrigation systems.

i. It saves water and uses the water available very effectively

ii. It helps in decreasing human effort

iii. It saves money as hiring people for irrigation is way more costly iv. Once it is implemented it works for years and also it is easy to replace v. It improves the productivity

vi. It can be programmed as we want according to the water requirement of the crop

vii. It helps with the problem of shortage of irrigation water in traditional irrigation methods

viii. It is reliable

ix. Cost effectiveness

x. System cannot be damaged by bad weather

xi. High quality crop production xii. It reduces soil erosion to a considerable extent

CONCLUSION

After observing the system from several perspectives and observing its working and effectiveness it is clear that this system is very helpful for the farmers. Farmers no longer need to spend hours every two days in monitoring their fields as this system does the same thing for them in much better way. Farmers can increase the productivity of their land and use the available water resources effectively with minimum wastage of water. Some other features can also be added to this system like using gsm modules to send message to the farmers mobile about the status of the motors and soil moisture level so that he knows whatever is happening in his land. This project will come in handy to them and assists them very well by saving a lot of time, money and effort.

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