A Project Report

on

Automatic Irrigation Facility

Submitted in partial fulfillment of the requirement

for the award of the degree of

Bachelor of Technology in Computer Science andEngineering

Under The Supervision of
Ms. Vaishali Gupta
Assistant Professor
Department of Computer Science and Engineering

Submitted By

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SCHOOL OF COMPUTING SCIENCE AND ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

GALGOTIAS UNIVERSITY, GREATER NOIDA, INDIA DECEMBER - 2021

SCHOOL OF COMPUTING SCIENCE AND ENGINEERING
GALGOTIAS UNIVERSITY, GREATER NOIDA

CANDIDATE'S DECLARATION

I/We hereby certify that the work which is being presented in the project, entitled **"AUTOMATIC IRRIGATION FACILITY"** in partial fulfillment of the requirements for the award of the **BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING** submitted in the **School of Computing Science and Engineering** of Galgotias University, Greater Noida, is an original work carried out during of **JULY-2021 TO DECEMBER-2021**, under the supervision of **Ms. Vaishali Gupta,assistant professor, Department of Computer Science and Engineering** of School of Computing Science and Engineering , Galgotias University, Greater Noida

The matter presented in the project has not been submitted by us for the award of any other degree of this or any other places.

19SCSE1010650-ANURAG VERMA

19SCSE1010094-ANUJ KUMAR SINGH

This is to certify that the above statement made by the candidates is correct to the best of my knowledge.

Supervisor

(MS. VAISHALI GUPTA, Assistant professor)

CERTIFICATE

Final The Thesis/Project/ Dissertation Viva-Voce examination of Anurag verma-19scse1010650 and Anuj kumar singh-19scse1010094 been held on _____ and his/her work is recommended for the award of **BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING**

Signature of Examiner(s) **Signature of Supervisor(s)**

Signature of Project Coordinator **Signature of Dean**

Date:
Place: Greater Noida

Acknowledgement

We express our sincere gratitude to and thanks to our University i.e. Galgotias University for providing us the opportunity to work on "**Automatic Irrigation Facility**". We take this opportunity to acknowledge all the people who have helped us whole heartedly in every stage of thisproject.

No project is created by an individual. Many people have helped us to create this project and each of their contribution has been valuable. We respect and thank Ms. Vaishali Gupta**,** Assistant Professor, School of Computing Science and Engineering, Galgotias University, for giving us an opportunity to do the project work and providing usall support and guidance which made us complete the project on time. We are extremely grateful to him for providing such a nice supportand guidance.

We are thankful and fortunate enough to get constant encouragement and support from our teachers, friends and parents.

ABSTRACT

The idea aims for a step in automation in Agriculture. It is an integration of IoT with agriculture. The irrigation of farms can be done automatically, by taking two important factors in consideration, i.e. soil moisture level and weather forecast to check for rain probability. The project consists of two parts software and hardware, The hardware part is a microcontroller system for sensing the physical factors and the other part is for automated irrigation (output unit of the project). The Software part consist of app where the data's will be taken in consideration and clubbed with other factors like weather API and forecast. The resultant decision by overall computation will make the decision of irrigation of fields, in an automated manner also with user access to alter it.

This project can reduce one of the biggest work load in agriculture and drive it towards the automation.

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Introduction

The proposed system is an automated irrigation system, with semi interruptions by user. The main unit of project is the microcontroller, which will take in all inputs from the environment and accordingly process it with user per- mission and irrigate the farms with automatic pump control and stop when done. This can be also be good for the irrigation facility that will save water and also very friendly for farmers who can remotely do all these task using a mobile app. The project can be further added up with weather API interference, which can be used for rain and other predictions.

The Sensors attached to Arduino such as Soil Moisture, Humidity, Temperature will measure all the parameters and provide all to the user with best recommended action. Also this can be clubbed with weather APIs and then User can give the final command of irrigation to Arduino and the pump system will work next. The following can work in automatic manner too if works perfectly without user interruptions. All these data collected form sensors and API will be sent to the user using internet by using NearBus or rele- vant cloud API, and further to the the users smartphone. The user can send the command back in similar manner and desired work will be done.

Formulation of problem

There is an urgent need for a system that makes the agricultural process easier and burden free from the farmer's side. With the recent advancement of technology it has become necessary to increase the annual crop production output entirely agro-centric economy.

The ability to conserve the natural resources as well as giving a splendid boost to the production of the crops is one of the main aims of incorporating such technology into the agricultural domain of the country.

To save farmers effort, water and time. Irrigation management is a complex decision making process to determine when and how much water to apply to a growing crop to meet specific management objectives.

If the farmer is far from the agricultural land he will not be noticed of current conditions. So, efficient water management plays an important role in the Irrigated agricultural cropping systems.

By developing a Smart Wireless Sensor and by using upcoming techniques a farmer can increase his profit by solving different problems that are faced by the farmer in his routine life

Feasibility Analysis

Given project can be a very great implementation in agriculture sector. Project proposed is very feasible and is expected to work perfectly. The integration of sensors with the Arduino can be done easily, and the further output unit that is pump can be operated in the similar way. This process will not only records values of temperature and humidity, it will also control the motor accordingly. Analysing the weather condition motor will automatically maintain water supply making it possible to maintain greenery without human intervention. ,the system can be expanded to include various other options which could include mobile application control of motor and wi fi controlled monitoring. These will expand the working capability and efficiency of this prototype. Arduino systems are relatively simple to design and install. It is safest system and no manpower is required.

Literature Reviews / Comparative study

- In *Australian Journal of Agricultural Research* 59(7) 589-598, the project only considered the soil moisture and not other factors like humidity, or rainfall prediction in upcoming days. The system also lacked with user interruption, i.e. the user cannot control or adjust the water supply remotely with internet. This project automated the water supply by only considering the soil moisture. And follow a very strict pattern on true or false system at a fixed specific value. This needs to consider a range of inputs in consideration.
- *Souparno Sarkar propose a project AUTOMATIC IRRIGATION SYSTEM* with consideration of wide range of factors but didn't added the wifi module or any other connectivity module for user to remotely access and intrude into the system. Automation will get a new dimension through this.
- *Journal of Application of automatic irrigation control system(Hydraulic Research Institute,Beijing,100048,China)* described the irrigation process without considering the climate and weather of the place. Neither it can change accordingly from crop to crop or plant to plant requirement.

Proposed Working

The Sensors attached to Arduino such as Soil Moisture, Humidity, Temperature will measure all the parameters and provide all to the user with best recommended action. Also this can be clubbed with weather APIs and then User can give the final command of irrigation to Arduino and the pump system will work next. The following can work in automatic manner too if works perfectly without user

interruptions. All these data collected form sensors and api will be sent to the user using internet by using NearBus or relevant cloud API, and further to the the users smartphone. The user can send the command back in similar manner and desired work will be done.

Proposed System Design

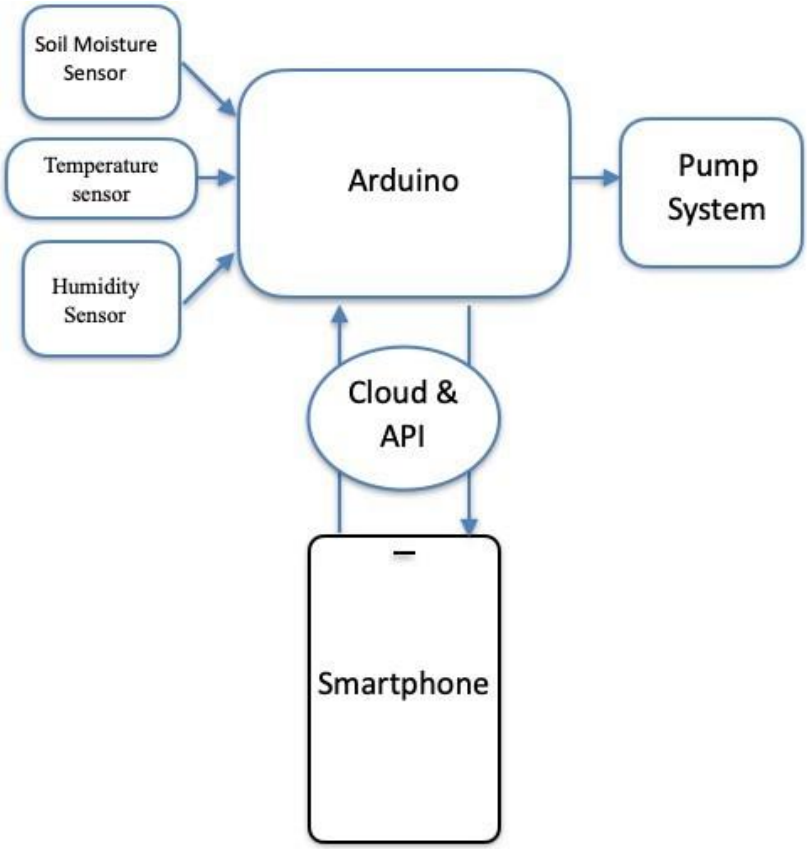
1. The Sensors attached to Arduino such as Soil Moisture, Humidity, Temperature will measure all the parameters and provide all to the user with best recommended action.

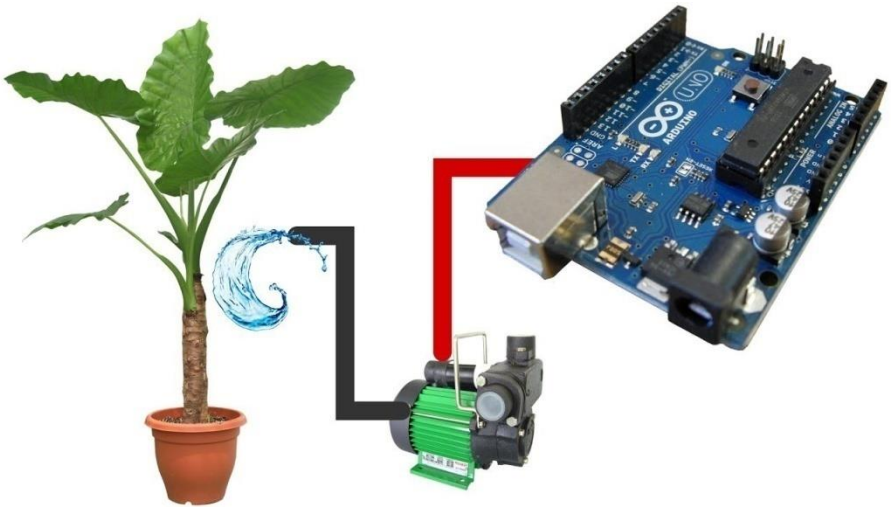
2. Also this can be clubbed with weather APIs and then User can give the final command of irrigation to Arduino and the pump system will work next.

3. The following can work in automatic manner too if works perfectly without user interruptions.

4. All these data collected form sensors and api will be sent to the user using internet by using NearBus or relevant cloud API, and further to the the users smartphone.

5. The user can send the command back in similar manner and desired work will be done.


Soil Moisture Sensor
Temperature sensor
Humidity Sensor
Arduino
Pump System
Cloud & API
Smartphone



Activity Plan (PERT)

First Phase of Work: (Sem - 3, 8-10 weeks) The first phase of work includes analysis of existing systems, problems. Then we have to plan accordingly. A dedicated algorithm for working of all hardwares and softwares has to be framed. Later the hardware assembly and code for hardware for Arduino unit has to be developed.	• Analysis of existing systems and problems. • Understanding about various sensor available according to our need.
	• Algorithm design Based on Software and Hardware Integration
	• Code • Circuit Design
Second Phase of Work: (Sem - 4, 8-10 weeks) The second phase is the integration of Arduino unit with Wifi module and cloud to remotely control from smartphone. Later the testing and troubleshooting has to be done and final prototype will be developed.	Implementation -1 of Basic Setup (Prototype)
	Extension Of Implementation -1 With added features and wifi modules

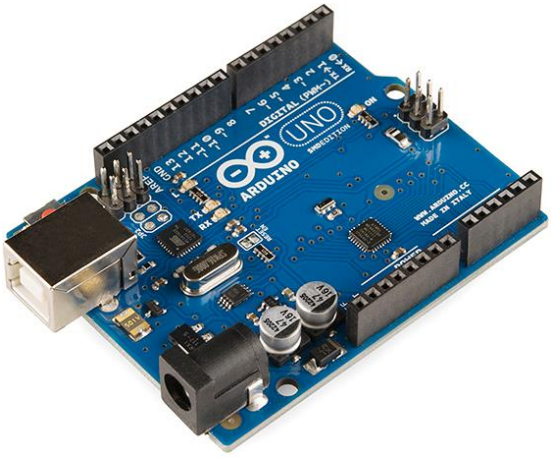
Requirements

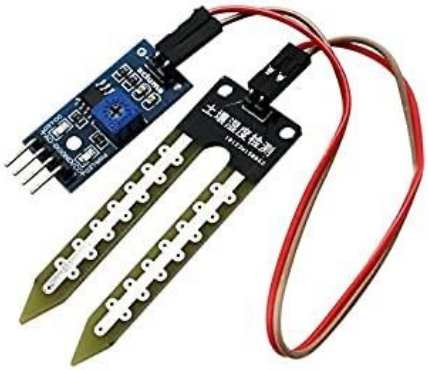
Hardware

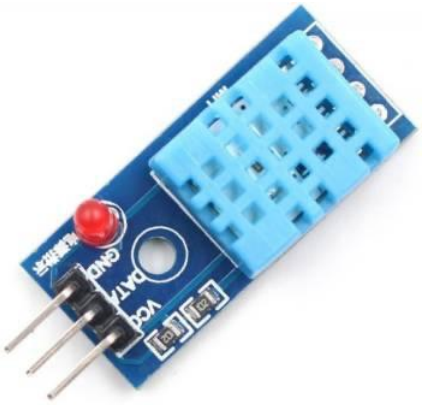
1	Arduino
2	Soil Moisture Sensor
3	Humidity Sensor
4	Temperature Sensor
5	Driver Module / Rellay
6	LCD Display
7	WiFi Module (Node MCU)
6	Other basic Circuit Components

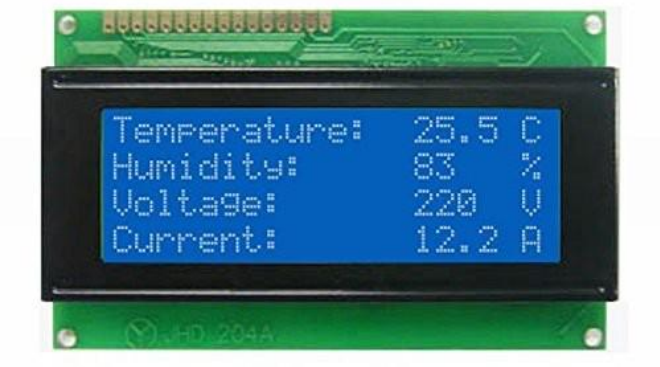
Software

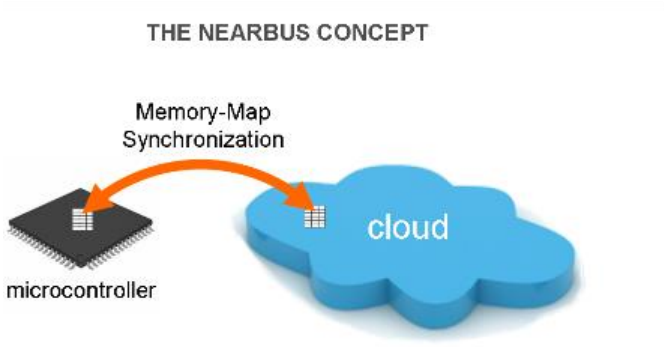
1	Arduino IDE
2	Android App (or Browser for Node MCU)

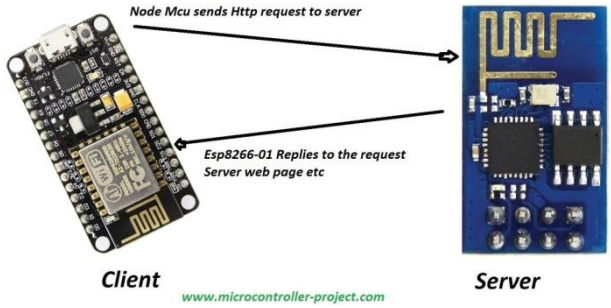

UNO
ARDUINO




GND
DATA
VCC


Temperature: 25.5 C
Humidity: 83 %
Voltage: 220 V
Current: 12.2 A


THE NEARBUS CONCEPT
Memory-Map
Synchronization
cloud
microcontroller


Node Mcu sends Http request to server
Esp8266-01 Replies to the request
Server web page etc
Client
Server
www.microcontroller-project.com

Hardware Specifications

The automatic irrigation system consists of a control unit and a sensing unit containing two units. The control unit consists of a microcontroller that controls the process and the sensing unit consists of various sensors, such as the soil moisture sen
sor and the DHT11 sensor. In this project, the microcontrolle r used was the ATMEGA328 microcontroller.The Arduino bo ard is made up of an integrated ATMEGA 328 microcontrolle r unit. Linked to the ARDUINO board are the DHT11 sensor and soil moisture sensors. The sensing units send the corresp onding data values to the ARDUINO board on a continuous basis every 5 minutes. By using an LCD display that is also c onnected to the board, the board shows the current temperatu re and humidity of a specific root region.The data values fro m the sensing units are collected by the ARDUINO board an d these values are compared with the predefined threshold pr ogrammed in the microcontroller device. If the data values of
the sensors are greater than the threshold, the ARDUINO bo ard sends an SMS message to the owner's mobile phone, who is in a remote area. An SMS is sent via the SIM900A modul e, which is connected to the ARDUINO board. This module
communicates with microcontroller by AT commands.

Soil Moisture Sensor

The sensor device for soil moisture consists of a soil moi sture sensor and a comparator chip for LM393. The soil humidity sensor is used to detect moisture in the soil. Th e soil probe is dipped into the soil so that the module per formance is HIGH indicated by using RED lead on the c omparator chip when the soil moisture is Poor. By using transmission line techniques, this sensor measures the di electric constant of the soil. There are four pins in this ci rcuit, such as the power supply pin, ground pin, analogu e and digital pins.The analog pin A0 connected to the analog pin of ARDUINO board and digital D0 pin connected to the digital pin of ARDUINO board. This

DHT11 sensor

The sensor DHT11 tests both the temperature and humi dity of the plant's root region. This sensor consists of th ree pins called the power supply, the ground, and anothe r is the data pin used to calculate the sensor data. This s ensor has a protective shield over the shield that can wit hstand any environmental conditions. This sensor has hi gh reliability and excellent stability over the long term. In the root zones of the plants, this sensor is used to mo nitor both temperature and humidity at a time. The measured data is send to the analog pins of an ARDUINO board such that it coverts in to the digital output and displays both values using the LCD.The sensor is shown in figure2.

ARDUINO board

ARDUINO is an open source physical computing frame work based on a simple microcontroller board and a bo ard software writing development environment. As sho wn in Figure 3, it has 14 digital pins, 6 analogue pins, a 16 MHZ crystal oscillator, a USB connection, a power s ource jack and a reset button.

SIM900A Module

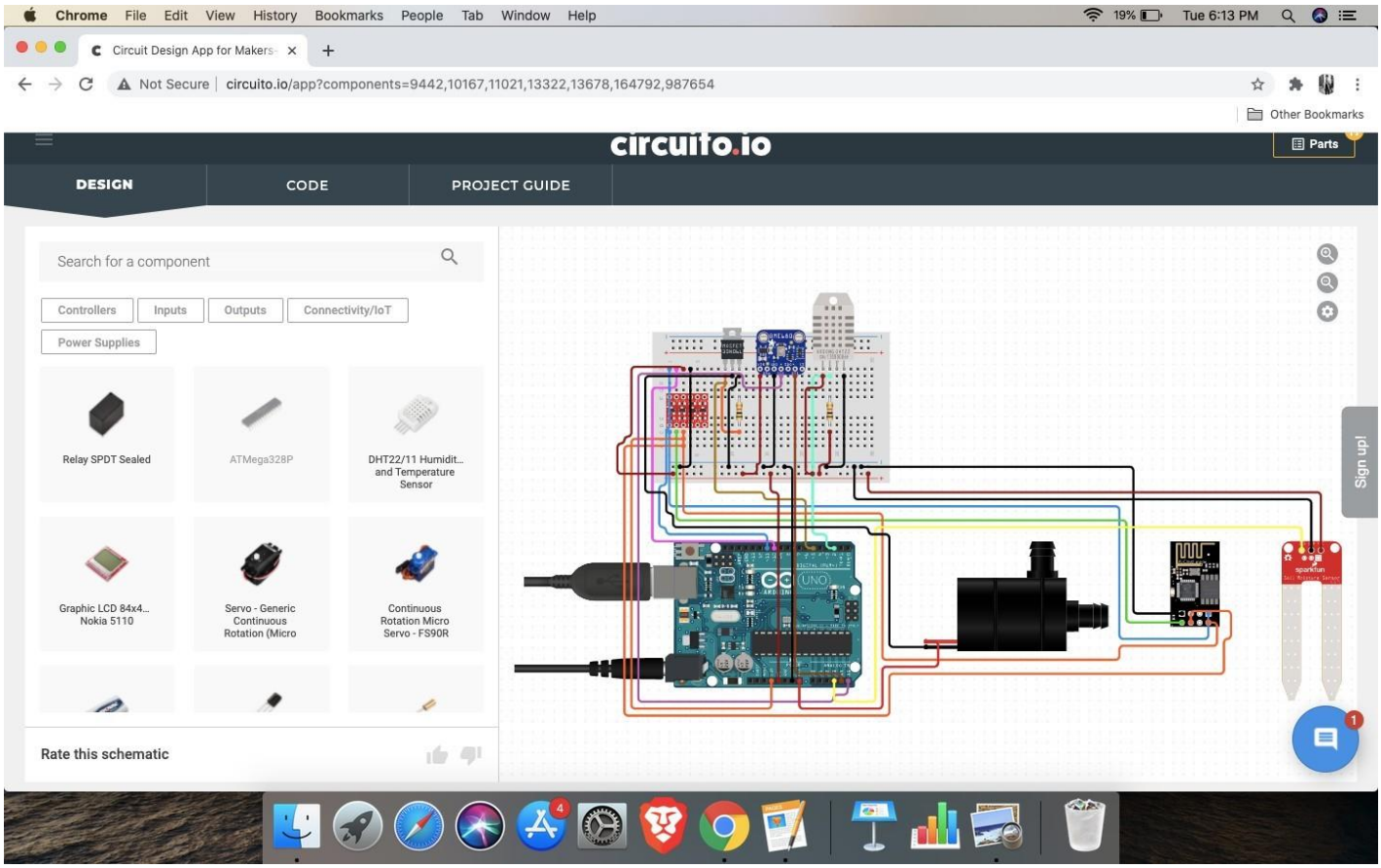
SIM900A module is used to send the data from the microcontroller unit to the mobile phone by using AT commands. First put the SIM card in the SIM slot given in the SIM900A module. The receiver and transmitter pins of this module is connected to the transmitter and receiver pins of the ARDUINO board and also connect the ground and VCC pins of both ARDUINO and SIM900A modules.

Implementation & Testing

Implementation (Module : 1)

- Analysis of existing systems and problems.
  - Understanding about various sensor available according to our need.

6. Considering more ground factors for better performance, such as soil moisture, temperature, humidity and club all together.
7. Adding up the partial user-involvement in system.
8. Selection of sensor and understanding the working.
9. Circuit design
10. Introducing WiFi module.



Implementation (module 2):

Step1: Connect the water pump and sensor to 13 and 8 respec1vely Step2: Call a func1on setup
Step3: Call a func1on loop

FUNCTION setup():
Step 1: set the pin mode for 13 as the output pin
Step 2: set the pin mode for pin 8 as input pin
Step 3: open the serial port and set the data rate to 9600 bps Step 4: while(! Serial)

Serial.println("Speed 0 to 255");

FUCTION loop()
Step 1: if (Serial.available()) {

input the speed of the motor in a variable speed Step 2: if (speed >= 0 && speed <= 255){

set the speed of the motor }

read data from the soil moisture sensor in val Step 3: if(val == LOW)

get a confirma1on from user, then send the signal to the motor pump to start

Step 4: else
send the signal to the motor pump to stop

wait for 400s and then start the loop again.

ARDUINO CODE:

```
#include <Wire.h> // Wire library, used by RTC library
#include "RTClib.h" // RTC library
#include "DHT.h" // DHT temperature/humidity sensor library
// Analog pin usage
const int RTC_5V_PIN = A3;
const int RTC_GND_PIN = A2;
// Digital pin usage
const int DHT_PIN = 2; // temperature/humidity sensor
const int NUMBEROFTIMES = 2;
int onOffTimes[NUMBEROFTIMES];
const int ONTIME = 0;
const int OFFTIME = 1;
#define DHTTYPE DHT11
DHT dht(DHT_PIN, DHTTYPE); // Create a DHT object
RTC_DS1307 rtc; // Create an RTC object
DateTime dateTimeNow; // to store results from the RTC
// to store humidity result from the DHT11 sensor
float humidityNow;
void setup(){
// Power and ground to RTC
pinMode(RTC_5V_PIN, OUTPUT);
pinMode(RTC_GND_PIN, OUTPUT);
digitalWrite(RTC_5V_PIN, HIGH);
digitalWrite(RTC_GND_PIN, LOW);
```

```
// Initialize the wire library
#ifdef AVR
Wire.begin();
#else
// Shield I2C pins connect to alt I2C bus on Arduino Due
Wire1.begin();
#endif
rtc.begin(); // Initialize the RTC object
dht.begin(); // Initialize the DHT object
Serial.begin(9600); // Initialize the Serial object
// Set the water valve pin numbers into the array
// and set those pins all to outputs
pinMode(8, OUTPUT);
};
void loop() {
// Remind user briefly of possible commands
Serial.print("Type 'P' to print settings or ");
getTimeTempHumidity();
// Check for request from the user
checkUserInteraction();
// Check to see whether it's time to turn any valve ON or OFF
checkTimeControlValves();
// No need to do this too frequently
delay(5000)
}
```

```
void getTimeTempHumidity() {
// Get and print the current time
dateTimeNow = rtc.now();
if (! rtc.isrunning()) {
Serial.println("RTC is NOT running!");
rtc.adjust(DateTime(_DATE, __TIME_));
return;
}
Serial.print(dateTimeNow.hour(), DEC);
Serial.print(':');
Serial.print(dateTimeNow.minute(), DEC);
Serial.print(':');
Serial.print(dateTimeNow.second(), DEC);
humidityNow = dht.readHumidity();
// Read temperature as Celsius
float t = dht.readTemperature();
// Read temperature as Fahrenheit
float f = dht.readTemperature(true).
if (isnan(humidityNow) || isnan(t) || isnan(f)) {
Serial.println("Failed to read from DHT sensor!");
return; // if the DHT is not running don't continue;
}
Serial.print(" Humidity ");
Serial.print(humidityNow);
Serial.print("% ");
```

```
Serial.print("Temp ");
Serial.print(t);
Serial.print("C ");
Serial.print(f);
Serial.print("F");
Serial.println();
} // end of getTimeTempHumidity:
void checkUserInteraction() {
// Check for user interaction
while (Serial.available() > 0) {
char temp = Serial.read();
if ( temp == 'P') {
printSettings();
Serial.flush();
break;
}
// If first character is 'S' then the rest will be a setting
else if ( temp == 'S') {
expectValveSetting();
}
else
{
printMenu();
Serial.flush();
break;
```

```
void expectValveSetting() {
char onOff = Serial.read();
int desiredHour = Serial.parseInt();
if (Serial.read() != ':') {
Serial.println("no : found"); // Sanity check
Serial.flush();
return;
}
int desiredMinutes = Serial.parseInt();
int desiredMinutesSinceMidnight
= (desiredHour*60 + desiredMinutes);
if ( onOff == 'N') { // it's an ON time
onOffTimes[ONTIME]
= desiredMinutesSinceMidnight;
}
else if ( onOff == 'F') { // it's an OFF time
onOffTimes[OFFTIME]
= desiredMinutesSinceMidnight;
}
else { // user didn't use N or F
Serial.print("You must use upper case N or F ");
Serial.println("to indicate ON time or OFF time");
Serial.flush();
return;
}
```

```
printSettings();
}
void checkTimeControlValves() {
int nowMinutesSinceMidnight =
(dateTimeNow.hour() * 60) + dateTimeNow.minute();
// Now check the array for each valve
Serial.print("Valve ");
Serial.print(" is now ");
if ( ( nowMinutesSinceMidnight >=
onOffTimes[ONTIME]) &&
 ( nowMinutesSinceMidnight <
onOffTimes[OFFTIME]) ) {
// Before we turn a valve on make sure it's not raining
if ( humidityNow > 80 ) {
// It's raining; turn the valve OFF
Serial.print(" OFF ");
digitalWrite(8, LOW);
}
else {
// No rain and it's time to turn the valve ON
Serial.print(" ON ");
digitalWrite(8, HIGH);
} // end of checking for rain
}
else {
```

```
Serial.print(" OFF ");
digitalWrite(8, LOW);
}
Serial.println();
// end of looping over each valve
Serial.println();
}
void printMenu() {
Serial.println(
"Please enter P to print the current settings");
}
void printSettings(){
Serial.println(); {
Serial.print("Valve ");
Serial.print(" will turn ON at ");
Serial.print((onOffTimes[ONTIME])/60);
Serial.print(":");
Serial.print((onOffTimes[ONTIME])%(60));
Serial.print(" and will turn OFF at ");
Serial.print((onOffTimes[OFFTIME])/60); // hours
Serial.print(":");
Serial.print((onOffTimes[OFFTIME])%(60)); // minutes
Serial.println();
}
```

Result and Discussion

Using the ATMEGA 328 microcontroller and sensors suc h as the temperature and humidity sensor and the soil moistur e sensor, an automatic irrigation system is carried out. The D HT11 sensor is used in dry and wet environments to measure

the temperature and humidity of the root zone of a plant. Th e threshold can be set so that the microcontroller device send s an SMS to the owner's mobile phone, according to the resul ts obtained.

Analysing the weather condition motor will automatically maintain water supply making it possible to maintain greenery without human intervention. ,the system can be expanded to include various other options which could include mobile application control of motor and wi fi controlled monitoring. These will expand the working capability and efficiency of this prototype. Arduino systems are relatively simple to design and install. It is safest system and no manpower is required.

Merits

To make the agricultural process easier and burden free from the farmer.
Conservation of natural resources like water, saving electricity and many more directly or indirectly.
Better production at lower investment of time, money, efforts and other resources.
If the farmer is far from the agricultural land then he will not be able to notice the current conditions. So, efficient water management plays an important role in the Irrigated agricultural cropping systems.
Can bring up much more advancements further in agriculture.

EASE OF USE

There is an urgent need for a system that makes the agricultural process easier and burden free from the farmer‟s side. With the recent advancement of technology it has become necessary to increase the annual crop production output entirely agro-centric economy.

The ability to conserve the natural resources as well as giving a splendid boost to the production of the crops is one of the main aims of incorporating such technology into the agricultural domain of the country.

To save farmers effort, water and time. Irrigation management is a complex decision making process to determine when and how much water to apply to a growing crop to meet specific management objectives.

If the farmer is far from the agricultural land he will not be noticed of current conditions. So, efficient water management plays an important role in the Irrigated agricultural cropping systems.

By developing a Smart Wireless Sensor and by using upcoming techniques a farmer can increase his profit by solving different problems that are faced by the farmer in his routine life

Conclusion

The primary applications for this project are for farmers and gardeners who do not have enough time to water their crops/plants. It also covers those farmers who are wasteful of water during irrigation.
Given project can be a very great implementation in agriculture sector. Project proposed is very feasible and is expected to work perfectly. The integration of sensors with the Arduino can be done easily, and the further output unit that is pump can be operated in the similar way. This process will not only records values of temperature and humidity, it will also control the motor accordingly. Analysing the weather condition motor will automatically maintain water supply making it possible to maintain greenery without human

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Limitations and Future Scope

Given project can be a very great implementation in agriculture sector. Project proposed is very feasible and is expected to work perfectly. The integration of sensors with the Arduino can be done easily, and the further output unit that is pump can be operated in the similar way. This process will not only records values of temperature and humidity, it will also control the motor accordingly. Analysing the weather condition motor will automatically maintain water supply making it possible to maintain greenery without human intervention. ,the system can be expanded to include various other options which could include mobile application control of motor and wi fi controlled monitoring. These will expand the working capability and efficiency of this prototype. Arduino systems are relatively simple to design and install. It is safest system and no manpower is required.

References

Journals:

1. Design and testing of an automatic irrigation controller for fruit tree orchards, based on sap flow measurements. Australian Journal of Agricultural Research 59(7) 589-598 https://doi.org/10.1071/AR07312

2. 'Crop evapotranspiration—guidelines for computing crop water requirements.' FAO Irrigation and Drainage Paper 56. Allen R , Pereira LS , Raes D , Smith M (1998) (FAO: Rome) www.fao.org/docrep/X0490E/X0490E00.htm

3. Application of automatic irrigation control system XU Zhong-hui1 PAN Wei-guo2 SHI Hong-mei1(1 Changping District Water Authority of Beijing,102200,China;2 Beijing Hydraulic Research Institute,Beijing,100048,China)

4. Design and implementation of an automatic irrigation system based on monitoring soil moisture. Ayoade Felix Agbetuyi, Orovwode hope Evwieroghene, Electrical & Information Engineering Department, Covenant University, Nigeria https:// www.researchgate.net/ publication/ 309251140_Design_and_implementation_of_an_automat ic_irrigation_system_based_on_monitoring_soil_moistur e

5. Automatic Irrigation System using WSNs INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY Automatic Irrigation System using WSNs Ravinder Singh Dhanoa Ravinder Singh

6. K. S. Nemali and M. W. Van Iersel, Nov. 2006, "An automated system for controlling drought stress and irrigation in potted plant", Scientia Horticulture, vol. 110, no. 3, pp. 292–297.

7. S. A. O'Shaughnessy and S. R. Evett, Apr. 2010, "Canopy temperature based system effectively schedules and controls center pivot irrigation of cotton", IEEE Transaction on Agricultural Water Management, vol. 97, no.

9, pp. 1310–1316.

8. R. G. Allen, L. S. Pereira, D. Raes, and M. Smith, 1998, Crop Evapotranspiration-Guidelines for Computing Crop Water Requirements—FAO Irrigation and Drainage Paper 56. Rome, Italy.

9. M. Dursun and S. Ozden, 2007, "A wireless application of drip irrigation automation supported by soil moisture sensors", Scientific Research and Essays, Vol. 6(7):1573-1582, 2011.

10. "Sensors and wireless sensor networks for irrigation management under deceit conditions", International Conference on Agricultural Engineering 2008.