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Automated Plant Watering System

Rohit Ganesh Vallamkondu(18BCE0917), Chandana Supriya Karamsetty(18BCE0937),
Prachi Singh(18BCE2081)
Under the guidance of our Faculty MR. NARESH.K
School of Computer Science and Engineering, Vellore Institute of Technology
Vellore, India

***Abstract*— An automatic plant watering system is designed to facilitate the automatic supply of adequate amount of water from a water source like small reservoirs or tanks to field or domestic crops or plants grown in home in all seasons and can be used any time. One of the objectives of this work is to see how to optimize the use of water in the process. The method employed is to continuously monitor the soil moisture level to decide whether irrigation is needed, and how much water is needed in the soil or it also can be employed with timer set irrespective of soil moisture. A pumping mechanism is used to deliver the needed amount of water to the soil. The work can be grouped into four subsystems namely; power supply, sensing unit, control unit and pumping subsystems which make up the automatic irrigation control system. An optional NODE MCU module also can be implemented so that it will be used to send and receive notifications (SMS).**

Keywords—plant watering system, pumping mechanism, sensing unit, control unit, pumping subsystems, micro controller based system

I. INTRODUCTION

Since nowadays, in the age of advanced electronics and technology, the life of human being should be simpler and more convenient, there is a need for many automated systems that are capable of replacing or reducing human effort in their daily activities and jobs. Here we introduce one such system, named as automatic plant watering system, which is actually a model of controlling irrigation facilities that uses sensor technology to sense soil moisture, temperature and humidity with a microcontroller in order to make a smart switching device to help millions of people.

Since irregular watering leads to the mineral loss in the soil and may end up with rotting the plants, we can then somehow know if the soil really needs to be watered and if so when required we water the plant automatically. We can automatically water our home and garden plants without bothering our neighbors when we decide to go on vacation or somewhere else for a long period.

II. LITERATURE REVIEW

1. Water Resources Management in Smallholder

Water collecting frameworks for a trim generation has an extensive potential in semi-dry locales of Eastern and Southern Africa; a potential which, to an expansive degree is undiscovered. The explanation behind this is the solid concentrate on in-situ water protection frameworks and the restricted utilization of surge and capacity water reaping. The improvement centres with regard to water assets administration has to a substantial degree concentrated on an expansive scale, downstream found frameworks, similar to water system plans. It appears that the dominating size of water gathering improvement at introducing in Eastern and Southern Africa is on the family unit scale. There are significantly fewer endeavours to plan and administration water gathering frameworks on a sub-catchment or catchment scale. There is a significant arrangement of scattered improvement endeavours on water reaping, however apparently little investigate on the suitability of the frameworks inside the setting of cultivating frameworks.

2. GSM Based Automatic Irrigation Control System for Efficient Use of Resources and Crop Planning By Using an Android Mobile

The water system has been the foundation of human progress since man has begun horticulture. As the age advanced, man created numerous techniques for the water system to supply water to the land. In the present situation on the preservation of water is of high significance. Exhibit work endeavours to spare the normal assets accessible to mankind. By constantly observing the status of the dirt, we can control the stream of water furthermore, along these lines diminish the wastage. The framework has a fused Bluetooth for remote checking which lessens the issue of range with NODE MCU system and spares SMS cost for the rancher. The smoke sensors used to send crisis data to the client in case of flame in the field or consuming of the engine. The outline is low power, minimal effort, and little size, vigorous and profoundly flexible. Along these lines, this framework dodges over water system, underwater system, topsoil disintegration and decrease the wastage of water.

3. Design and Development of an Automated and Contact Sensing System for Continuous Monitoring of Plant Health and Growth

A computerized plant observing framework has been produced for plant water status evaluation. In view of a dispersed flag preparing chain of command, information lumberjacks were utilized for neighborhood sensor excitation and flag preparing to diminish the unpredictability of the computer-based information obtaining framework. The framework can be utilized to gather natural information, measure shelter temperature, and distinguish morphological changes influenced by trial medicines utilizing non– contact sensors. Contact sensors, for example, soil dampness tests and micro– lysimeters are accessible for deciding evapotranspiration rate. Wellsprings of detecting and estimation blunder were breaking down and evaluated, and measures were taken to enhance the information precision. Exact soil dampness level could be kept up utilizing a closed– circle water system sub-framework. length. The validation observes confirmed that u maintained via the controller become dependable.

4. Irrigation Automation Based on Soil Electrical Conductivity and Leaf Temperature

The sensor with the brass plate as the electrode and washed sand as porous medium confirmed almost a consistent fashion within the dating between resistance and soil moisture content material in all trials. The automatic structures based on soil resistance become observed to be working effectively without frequent supervision and maintained the pre-set moisture content inside the root sector. The automatic device based on leaf-air temperature differential maintained the pre-set leaf-air temperature differential for the duration of the study duration.

5. Potato Minituber Production Using Aeroponics: Effect of Plant Density and Harvesting Intervals

On this paper, we've focused particularly on physiological records. But a few crucial issues ought to be addressed before putting in place an industrial gadget for minituber production. A fully automated system monitoring each nutrient answer and dynamic parameters, which include concentration, pH, and float rate would seem ideal. It needs to be geared up with appropriate excessive- tech security devices and alarms to control electric powered energy, pumping, spraying, and chemical variables. Each the fee for those additional facilities and such exertions-intensive tasks as staking and guide harvesting of plant life must be economically assessed.

6. An Automated System for Controlling Drought Stress and Irrigation in Potted Plants

Not like most computerized irrigation systems which result in leaching and run-off, our system had very little wastage of water. The machine required little protection at some point of observation. No matter the time of the day, the gadget irrigated the plants while the substrate moisture fell beneath the target stage. The controller additionally has the capability to be used in drought strain studies, due to the fact that it's far possible to control the amount of water to be had in the substrate (or soil) and consequently the extent of stress that the plant is uncovered to. The subsequent conclusions may be drawn from this look at: In place of the dry-down or common weighing approach for imposing drought pressure, this machine maintained u close to the set-point with little or no effect of surroundings and plant

7. Temporary Immersion Systems in Plant Micro Propagation

Transient immersion has fine consequences on all tiers of shoot proliferation and somatic embryogenesis with many plant species. Regenerated plantlets and somatic embryos are of higher first-rate. Excellent results have additionally been acquired at some stage in acclimatization of plant cloth from temporary immersion. Transient immersion combines the blessings of strong culture media (most gasoline exchanges) and liquid culturing. Their optimization, towards lower values, outcomes in better organic yields through more manage of morphogenesis, however also via the manipulate of hyper hydricity Immersion times may be as essential for each way of life degree as the length of subcultures and the chemical composition of plant boom media.

8. Automatic Non-Destructive Three-Dimensional Acoustic Coring System for in Situ Detection of Aquatic Plant Root under the Water Bottom

We evolved and tested a non-un favourable 3D acoustic coring system under the water backside. A discipline check becomes carried out in a pond and the system worked with none troubles arising. The sizing device can gather facts under the water backside and reconstruct the spatial fame. The prevailing observe showed that the natural lotus root (diameter of 0).020–zero. Half may be detected using the acoustic coring technique. A measurement machine is a flexible tool for the detection of lotus, the spread of which is an environmental problem in eutrophied lakes.

9. Performance Test of a Sea Water Multi-Stage Flash Distillation Plant

The performance takes a look at of a seawater multi-stage flash (MSF) desalination plant is finished at a hundred load, 70% load all through operation
in summer and iciness. Its miles concluded that:
To understand the manner and plant operation, the plant key working parameters are supplied for the tested cases (number of degrees, pinnacle brine temperature (TBT), temperature and strain variant inside the levels, and brine and flash steam flows. additionally, the plant normal performance indicators are supplied for the studied cases [performance ratio (PR) or gain output ratio (GOR), and concentration ratio (CR).
The consequences confirmed that:
For the same plant output at a hundred capacity, the principle cooling water is reduced from 47.1% to 20.1% for case-1 (summer) and case-2 (winter) respectively, which in turns immediately reduces the pumping energy by means of the identical ratio.

10. Cartagena’s Water Distribution System

Cartagena’s WDS has skilled over the last two decades,

sizable changes in its bodily configuration, going from a unified and radial network with delivering especially via gravity, to a network sectioned with waft prices and pressures monitored and managed. This configuration has allowed the water distribution optimization, lowering the unaccounted-for water price and postponing investment for the system enlargement. Mathematical modelling of the water distribution machine has been essential to assess and remedy troubles such as imperceptible leak detection; water excellent; assessment of systems potential to meet needs of recent city traits, and insurance extension of the water distribution provider in areas above carrier provision stage through the implementation of pressure ranges and pumping systems; amongst others.

III. Problem Statement

In daily operations related to farming watering plays a major role irrelative to the climatic conditions, it might be either too hot and dry or too cloudy and wet , we have to be able to control the amount of water that reach your plant. To water the fields in small scale would be way easier than the larger scale fields. In the large scale fields watering would involve large amount of labour work, which eventually increases in the expenses for the farmers. Even though we spend money, insufficient amount of water would be supplied to each plant by manually. So our project would help to overcome this problem (Manual work and cost) by detecting or sensing the humidity scale to be present in that particular temperature zone as per predefined records from the plant's water need, and this data would be stored in the cloud named ThingSpeak and our program would help to supply water to the zones where the humidity levels are low as per the records stored in our cloud.

IV. Proposed System

This project aims to deliver real time application by simplifying the lives of the people whose occupation comes under agriculture by automating the irrigation system.

The proposed system delivers a way to supply water to the agricultural field through time constrained and manually operatable system. The system analyses the moisture content and the rainfall and calculates the amount of water to be released to the field, if it is an automated system. For semi-automated system the user specifies/gives instructions on how much time the system needed to work.

A. System Architecture

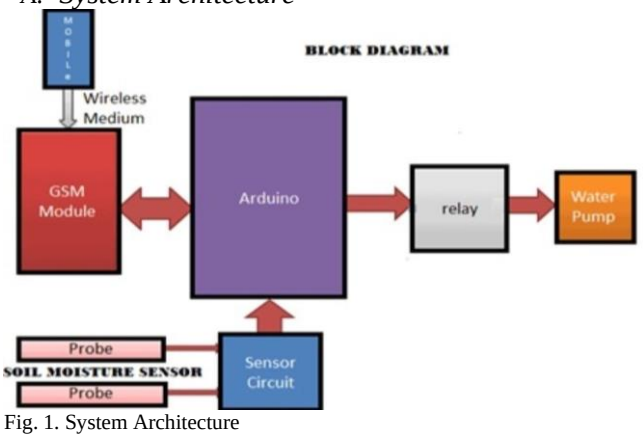


Fig. 1. System Architecture

B. Components Description

The NODE MCU module is connected to Arduino which helps in passing the messages. Humidity sensor is connected to Arduino which tells about the climatic conditions. Soil moisture sensor is connected to Arduino which tells about the water moisture level in the soil that helps in watering the field with sufficient amount of water. Water motor is connected which helps in pumping the water when request is given. Rain sensor helps to weathercast when the rain comes and stops water motor from watering the field

Arduino Board

Arduino is an open-source computer hardware and software company, project and user community that designs and manufactures micro-controller based kits for building digital devices and interactive objects that can sense and control the physical world.It uses various 8-bit or 32-bit microprocessors. These systems provide sets of digital and analog I/O pins that can be interfaced to various expansion boards ("shields") and other circuits.There are various types of Arduino board. In this project we are using Arduino UNO.

Soil Moisture Sensor

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity. Reflected microwave radiation is affected by the soil moisture and is used for remote sensing in hydrology and agriculture. Portable probe instruments can be used by farmers or gardeners.Soil moisture sensors typically refer to sensors that estimate volumetric water content. Another class of sensors measure another property of moisture in soils called water potential; these sensors are usually referred to as soil water potential sensors and include tensiometers and gypsum blocks.

Humidity Sensor

A humidity sensor senses, measures and reports both moisture and air temperature. The ratio of moisture in the air to the highest amount of moisture at a particular air temperature is called relative humidity. Relative humidity becomes an important factor, when looking for comfort. Humidity sensors work by detecting changes that alter electrical currents or temperature in the air. There are three basic types of humidity sensors: capacitive, resistive and thermal. All three types of sensors monitor minute changes in the atmosphere in order to calculate the humidity in the air.

Rain Sensor

A rain sensor is a switching device activated by rainfall. There are two main applications for rain sensors. The first is a connected to an automatic irrigation system that causes the system to shut down in the event of rainfall. The second is a device used to protect the interior of an automobile from rain and to support the automatic mode of windscreen wipers. An additional application in professional satellite communications antennas is to trigger a rain blower on the aperture of the antenna feed, to remove water droplets from the Mylar cover that keeps pressurized and dry air inside the wave-guides.

2 Channel Relay for Arduino

This is a 5V 2-Channels Relay module, it can be controlled directly by a wide range of microcontrollers such as Arduino, AVR, PIC, ARM and MSP430. 2 relays are included in this module, with “NC” ports means “Normally connected to COM” and “NO” ports means “Normally open to COM”. It is also equipped with 4 LEDS to show the status of relays.

Jumper Wires

A jump wire is an electrical wire or group of them in a cable with a connector or pin at each end, which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering. Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment. Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

Water Motor (With Ac Pump)

It is used to pump water from the reservoir or tank to irrigate the plant.

C. Use-Case Diagram

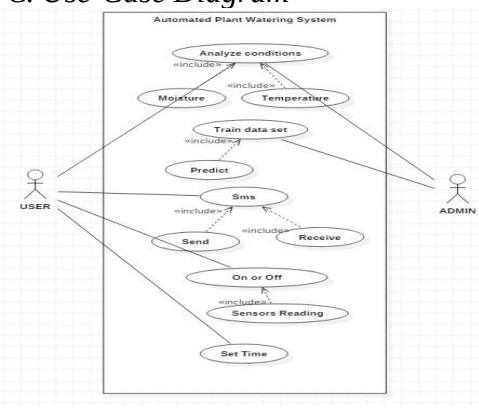
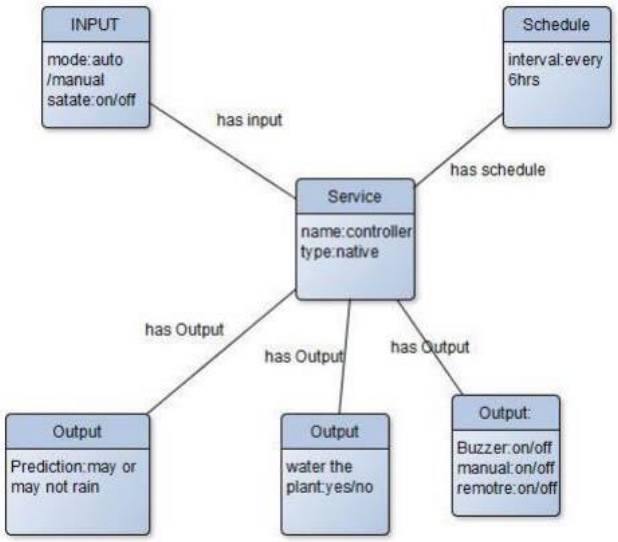


Fig 2: use case for automated plant watering system

D. Service Specification



PSEUDOCODE: INTERNAL ARCHITECTURE

```
//Libraries
#include <DHT.h>;
//DHT
#define DHTPIN 7    // what pin we're connected to
#define DHTTYPE DHT22   // DHT 22  (AM2302)
DHT dht(DHTPIN, DHTTYPE); //// Initialize DHT sensor for normal 16mhz Arduino
//Variables
int chk;
float hum;  //Stores humidity value
float temp; //Stores temperature value
//Soil-moisture
int sensor_pin = A0;
int ACWATERPUMP = 13;
int moisture_value ;
int sensor = 8;
int val;
const int sensorMin = 0;
const int sensorMax = 1024;
void setup() {
  Serial.begin(9600);
  pinMode(8,INPUT);
  pinMode(7,INPUT);
  pinMode(A0,INPUT);
  pinMode(13,OUTPUT); //Set pin 13 as OUTPUT pin, to send signal    to relay
    dht.begin();
}
void loop() {
    //Read data and store it to variables hum and temp
    hum = dht.readHumidity();
    temp= dht.readTemperature();
    //Print temp and humidity values to serial monitor
    //Serial.print("Humidity: ");
    Serial.print(hum);
    Serial.print(" ");
    //Serial.print(" %, Temp: ");
    Serial.print(temp);
    Serial.print(" ");
    //Serial.println(" Celsius");
  /*Serial.println("rain digi");
  Serial.println(digitalRead(7));
  Serial.println("rain analog");
```

```
  Serial.println(analogRead(A0));*/
//moisture_value= analogRead(sensor_pin);
  // moisture_value = map(moisture_value,550,0,0,100);
   //Serial.print("Mositure : ");
   //Serial.print(moisture_value);
   //Serial.println("%");
 val = digitalRead(8);  //Read data from soil moisture sensor
    Serial.println("soil moisture");
      Serial.println(val);
  if(val == LOW)
  {
   Serial.println("offffffffffffffffffffffffffffffffffffffffffffffff");
  digitalWrite(13,LOW); //if soil moisture sensor provides LOW
value send LOW value to relay
  }
  else
  {
Serial.println("onnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnn")
;
  digitalWrite(13,HIGH); //if soil moisture sensor provides HIGH
value send HIGH value to relay
  }
    delay(10000);
}
```

V.ANALYSIS

We use node MCU model for the wireless communication.

We use Thingspeak for the cloud analysis of humidity and temperature values to predict the occurrence of the rain, where different API 's have been collected inorder to collect the data and load into the cloud through Arduino.HTTP request-response application protocol for distributed, collaborative, and hypermedia information.

We use local area network when it is just restricted to only particular area.

VI.BENCHMARKING INNOVATION

In one of the existing systems the data for the system is collected from weather stations i.e., wind, temperature, solar radiation, humidity and rainfall from one or other system. It takes time to collect data from the stations and feed it to the system.

To avoid this problem *we are going to use a soil moisture sensor to collect data and directly feed it to the system, this is one of the main advantages of the planned system.*

https://patents.google.com/patent/US7403840B2/en?q=PLANT+WATERING&q=SYSTEM&oq=PLANT+WATERING+SYSTEM

In this existing system hundreds of plotted plants rapidly get amounts of water, with the supervision of nursery employees. Sometimes the employees may not be available every time. Or they might have been mistake.

So to overcome this problem in our system *we have given option for regular watering as well as for interval planting.* So the crops or plants might not get affected or died.

https://patents.google.com/patent/US3108400A/en?q=PLANT+WATERING&q=SYSTEM\&oq=+PLANT+WATERING+SYSTEM\

In this existing system the watering takes place on range based irrigation i.e. works in certain radius. Due to this there may be problems like no proper connection and every part of the area cannot be covered.

To overcome this in our project *we have added NODE MCU module*.

https://patents.google.com/patent/US20120036091A1/en?q=automated&q=PLANT+WATERING&q=SYSTEM&oq=+automated+PLANT+WATERING+ SYSTEM

In this existing system there is no output to display the amount of water is used till date and number of hours the system is been running.

The proposed system is equipped with a digital LCD monitor that displays the amount of water used for irrigating the area in specified units and time for which the system is running.

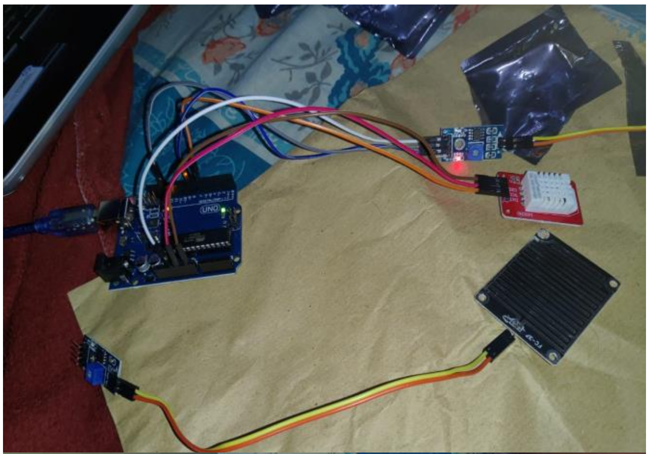
https://www.google.co.in/patents/US4684920?dq=automated+watering+system&hl=en&sa=X&ved=0ahUKEwjz6Of9m_vYAhXEso8KHaC1CvYQ6AEIQ jAE

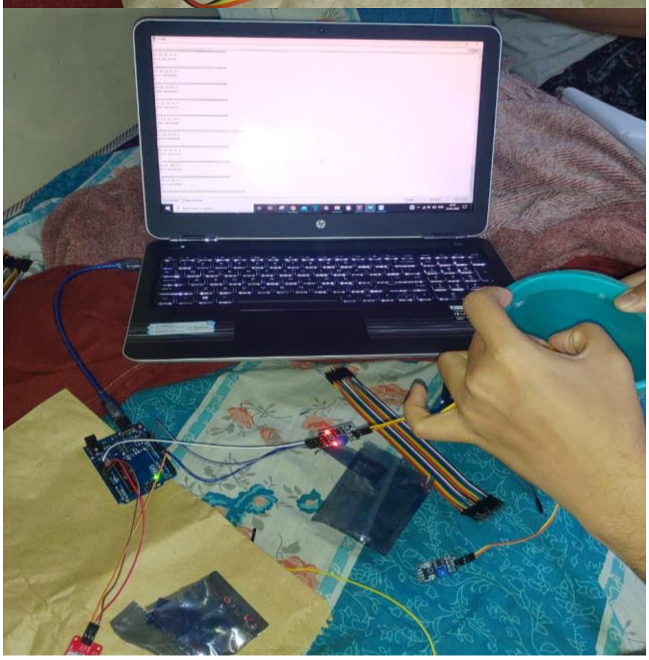
In this system the watering is done by directly measuring the moisture content of the soil there is no specific operation to stop or start watering the area. The moisture is measured by the moisture sensor and sent to the system for operation.

In the proposed system we will be providing an option to set intervals of watering the system or manual on/off the system via a mobile. The instructions are sent to the system by accessing the NODE MCU module.

https://www.google.co.in/patents/US6079433?dq=automated+watering+system&hl=en&sa=X&ved=0ahUKEwjz6Of9m_vYAhXEso8KHaC1CvYQ6AEIU DAG

VII.SNAPSHOTS OF WORK





VIII.CONCLUSION

We can use this product in agricultural fields for watering the plants at the regular interval of time, and to know when the plants are to be watered. This product can also be used at house for feeding pet animals or plants at regular time intervals by the

house owners. This product can also tell you the climatic conditions and weather reporting so you can come to know how much you have to water the field and when it's not needed. This information is helpful for both farmers and house owners. In future we develop this product in such a way that it can be used in large scale and we minimize the product size using the nano technology concepts.

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