CSE1901 - Technical Answers to Real World Problems (TARP)

Project Report

SMART IRRIGATION SYSTEM

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DECLARATION

I hereby declare that the report titled "**Smart Agriculture- Automated Irrigation System**" submitted by me to VIT Chennai is a record of bona-fide work undertaken by me under the supervision of **DR. UMA MAHESWARI**, School of Computer Science and Engineering, Vellore Institute of Technology, Chennai.

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CERTIFICATE

Certified that this project report entitled "**Smart Agriculture- Automated Irrigation System**" is a bonafide work of **S PRAVEEN (19MIS1003), AKTSHAY KUMAR K P (19MIS1096) , SURAJ SINGH (19MIS1114)** and **KARAN KUMAR D (19MIS1184)** they carried out the Project work under my supervision and guidance for SWE1901 - Technical Answers to Real World Problems (TARP).

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ACKNOWLEDGEMENT

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ABSTRACT

This project is an effective approach towards traditional irrigation system which was most of it had physical work. Here the system consists of Esp8086, moisture sensors, submersible water pump, relay mechanism and solenoid valve. So with the help of moisture sensors we are calculating the dryness of the soil and sending this info to our Esp8086 which will measure the amount of water needed to water/moisturise the soil. As the moisture gets restored it will automatically turn the water off with the help of solenoid valve. Thus we automate our process which reduces the manual labour for the process of irrigation.

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1. Introduction

1.1 **Objective and goal of the project** The objective of the project is to setup a smart irrigation system that facilitates automatic turning on and off of motor pump to water the plant. The system should be an integrated system of multiple features that help the users. The following procedures are the goals that need to be done in order for the system to work essentially.

- Soil Moisture Sensor checks the moisture level in the soil.
- Arduino switches on a water pump if moisture level is low.
- Water pump gets switched off when system finds enough moisture in the soil.
- Then updates the status of water pump and soil moisture.
- This system is completely automated and there is no need for any human intervention.

The automated system should minimize farmers intervention in farming, increase crop production, save time, help remote monitoring and controlling and should be easy to install.

1.2 **Problem Statement** Proper irrigation is an important feature for giving healthy crops. India is a country where plantation is considered as the center of economic revenue. Moreover, the variation of climate changes causes ancient and inefficient farming technique end up with improper harvesting. To keep up pace with the population growth, the in-demand agriculture techniques have to be smart and advanced. As we are stepping into a world of automation, the work load of the farmers can be reduced by replacing the traditional system with automated system of watering the plants according to its need. This system can be used for any crops, where according to the soil's moisture level, the plants will be watered.

1.3 **Motivation** The countries where agriculture has a big impact on economy demand a highly effective way of irrigation. A timely and consistent irrigation is need of the hour in such countries. Where lack of water is not

tolerated by soil during irrigation, the excess of water provision is also not recommended for crops flourishment. Hence a feasible irrigation for any land requires suitable amount of water with minimum amount of delays. Today's world demands improved methods as compared to the old ones to carry out processes faster and the world is moving towards automation of every process. In the proposed system, automatic irrigation system has been suggested which detects the soil moisture level and programmed in a way that if water level goes below necessary amount, it automatically starts the pumps to supply water. In this way, maximum results are attained out of the fields and water wastage is also reduced to significant level.

1.4 **Challenges** The challenges of a smart agriculture system include the integration of these sensors and tying the sensor data to the analytics driving automation and response activities. When integrated, the use of data analytics can reduce the overall cost of agriculture and contribute to higher production from the same amount of area through precise control of water, fertilizer and light. Smart methods allow for farming on smaller and more distributed lands through remote monitoring, whether indoor or outdoor. To successfully deploy a smart agriculture system, consider setting up a communications network that can integrate a limited number of sensors across a large area of farmland. This will require third-party network provisioning or setting up a private network consisting of access points and uplinks to a private backhaul network, which channels all the data traffic to centralized monitoring software or an analytics head-end system.

The communications network you choose is critical due to the reliability of the network. Topology of the land, wind and rain can affect point-to-point communications technologies for some private network types.

2. Literature Survey

1.An Automated Irrigation System for Smart Agriculture Using the Internet of Things

V. Ramachandran, R. Ramalakshmi and S. Srinivasan, "An Automated Irrigation System for Smart Agriculture Using the Internet of Things," 2018 15th International Conference on Control, Automation, Robotics and Vision (ICARCV), 2018, pp. 210-215, doi: 10.1109/ICARCV.2018.8581221.

- WEMOS D1 Controller is an ESP8266 compatible with Arduino IDE
- Solenoid Valve is used for controlling the flow of water by using pulse width modulation approach
- Soil Moisture Sensor: YL69 series or probe measures the volumetric water content in the soil.
- Flow sensor (YF-201) is used to measure the amount of water utilized in the process of irrigation.
- Data is transmitted using the GPRS internet connectivity available through the cellular network providers.
- Cloud-based Remote Monitoring: data from the controller is transmitted to the Thingspeak cloud, and the data can be viewed using Thingspeak website.

2.Sensor based Automated Irrigation System with IOT: A Technical Review Munoth, Priyamitra & Goyal, Rohit & Tiwari, Kuldeep. (2016). Sensor based Irrigation System : A Review.

- The Android SDK provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language.
- The System uses GSM(Global System for Mobile communication) module to send message to the users.
- An android app is been used to communicate with the user for sending details about over/under irrigation, leaching etc.
- The GSM and microcontroller are connected using MAX232.
- The flow of water is managed by solenoid valve.
- Microcontroller used can increase System Life and lower the power Consumption.

3.IOT based Agriculture System Using NodeMCU
K. Jyostsna Vanaja, Aala Suresh, S. Srilatha, K. Vijay Kumar, M. Bharath, "IOT based Agriculture System Using NodeMCU" International Research Journal of Engineering and Technology (IRJET), 2018, Volume: 05 Issue: 03.

- NodeMCU is an open source IoT platform. it includes firmware which runs on the ESP8266 Wi-Fi SoC from Expressive Systems, and hardware which is based on the ESP-12 module.

- The Arduino Nano is a small, complete, and breadboard-friendly board. It has more or less the same functionality of the Arduino Duemilanove, but in a different package.
- A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays.
- A simple soil moisture sensor for gardeners. Soil moisture sensors measure the volumetric water content in soil.
- A solenoid valve is an electromechanically operated valve. The valve is controlled by an electric current through a solenoid: in the case of a two-port valve the flow is switched on.

4.Gsm Based Solar Automatic Irrigation System Using Moisture, Temperature And Humidity Sensors

A. U. Rehman, R. M. Asif, R. Tariq and A. Javed, "Gsm based solar automatic irrigation system using moisture, temperature and humidity sensors," 2017 International Conference on Engineering Technology and Technopreneurship (ICE2T), 2017, pp. 1-4, doi: 10.1109/ICE2T.2017.8215945.

- Arduino Mega 2560 has been used because of its versatility. It has 54 digital I/O ports. There are 16 analog inputs, 4 UART's, 16 MHz crystal oscillator, USB port, power port, reset button and ICSP header
- Three sensors include: YL 69 is the soil moisture sensor. DHT11 is the humidity sensor. LM35 is its feature that it always gives temperature in Celsius
- SIM900D has been used for GPS purpose. This module makes the system wireless. The status of undergoing process will be updated to user via SMS.
- Solar panels are used to liberate irrigation from the shackles of load shedding. The requirement of water is judged and information is transmitted to the solar circuit which modifies its configuration such that it provides enough DC power to drive the pumps and fulfill the assigned task.

5.Designing of Smart Irrigation System Using Arduino

Abhay sharma, Lovepreet Singh and Harpreet Kaur Channi, "Designing of Smart Irrigation System Using Arduino ," IJSRD - International Journal for Scientific Research & Development| Vol. 9, Issue 6, 2021 | ISSN (online): 2321-0613

- Arduino is used for controlling the whole process
- GSM module is used for sending alert messages to user on his cell phone.

- If moisture is present in soil then there is conduction between the two probes of Soil Moisture sensor and due to this conduction, transistor Q2 remains in triggered/on state and Arduino Pin D7 remains Low.
- When Arduino reads LOW signal at D7, then it sends SMS to user about "Soil Moisture is Normal. Motor turned OFF" and water pump remains in off state.
- Now if there is no Moisture in soil then Transistor Q2 becomes off and Pin D7 becomes high. Then Arduino reads the Pin D7 and turns on the water motor and also sends message to user about "Low Soil Moisture detected.
- Motor turned ON". Motor will automatically turn off when there is sufficient moisture in the soil.

3 Requirements Specification

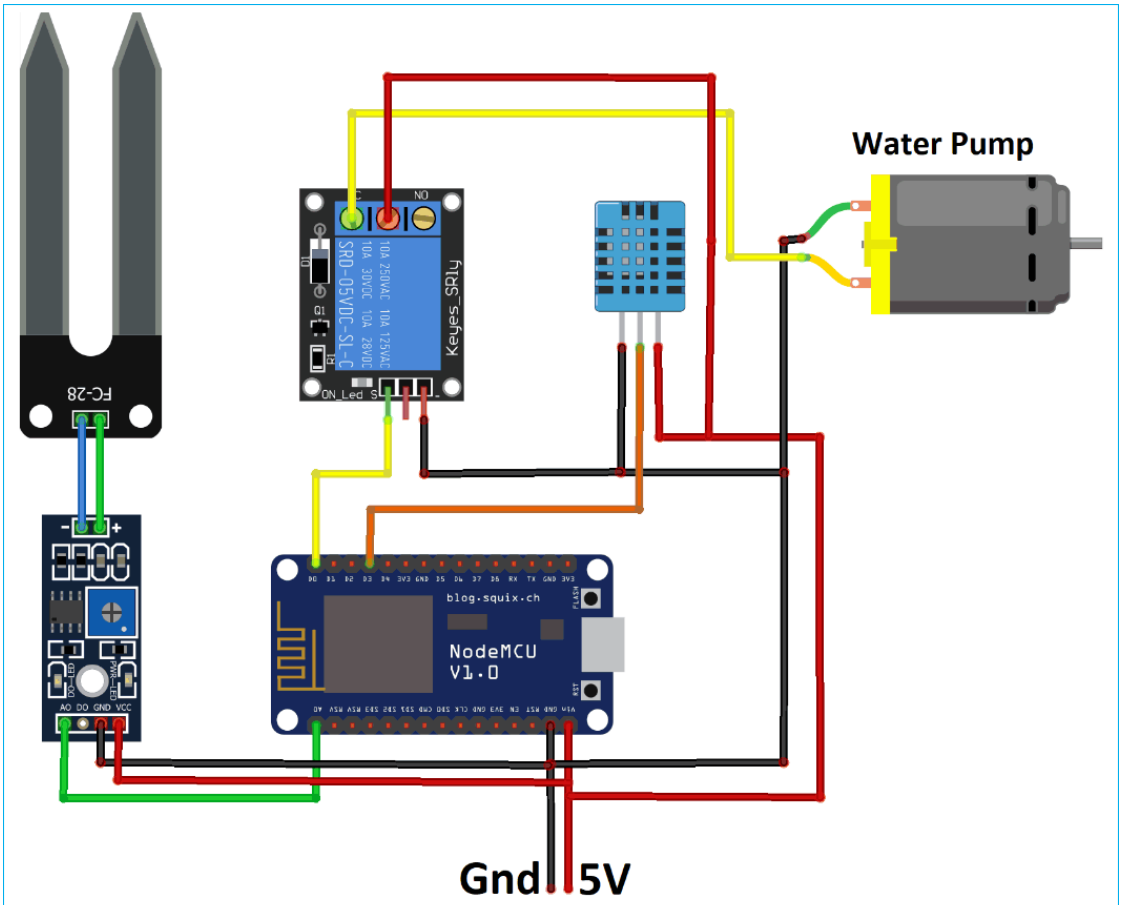
3.1 Hardware Requirements

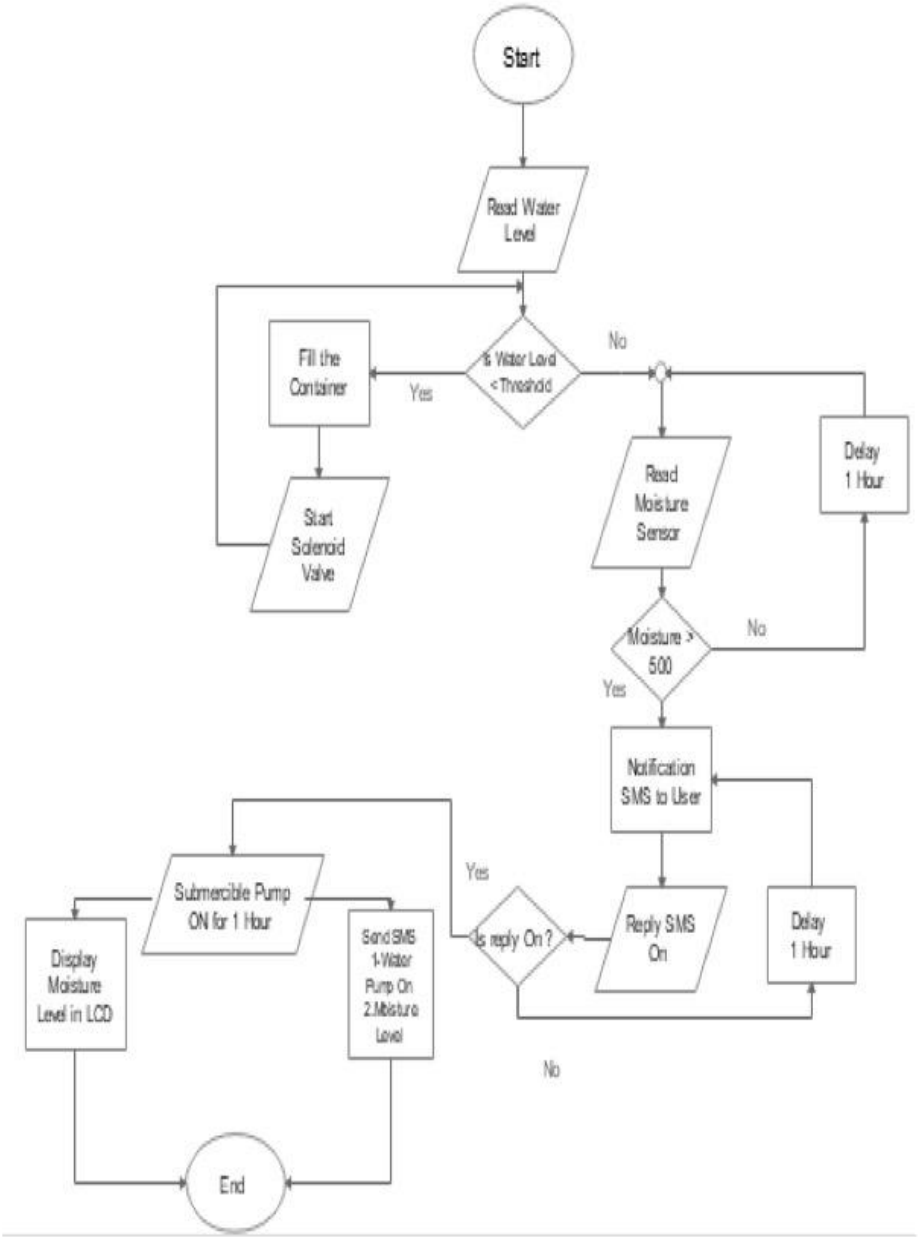
1. **Arduino Nano:** used to write and run computer code to the physical board
2. **Node MCU:** used to connect the soil moisture sensor
3. **IR Sensor:** used to measure the heat of an object and detect the motion of object as well
4. **Humidity Sensor:** used to measure the surrounding air and spits out a digital signal on the data pin
5. **Temperature Sensor:** used for measuring temperature variations around the sensor
6. **Soil Moisture:** used to measures soil moisture levels by capacitive sensing
7. **Relay:** used to control the 220VAC small water pump
8. **Motor:** used to artificially supply water
9. **Battery:** used to ensure the power supply of the equipment
10. **12V Adapter:** It is used for powering our system.
11. **Jumper Wires:** pair of insulated wires
12. **GSM 900A:** It provides an industry-standard interface
13. **LED Display:** used to display messages and status

3.2 Software Requirements

1. **Aurdino IDE**
2. **Windows OS**
3. **Mobile Phone**

4 System Design

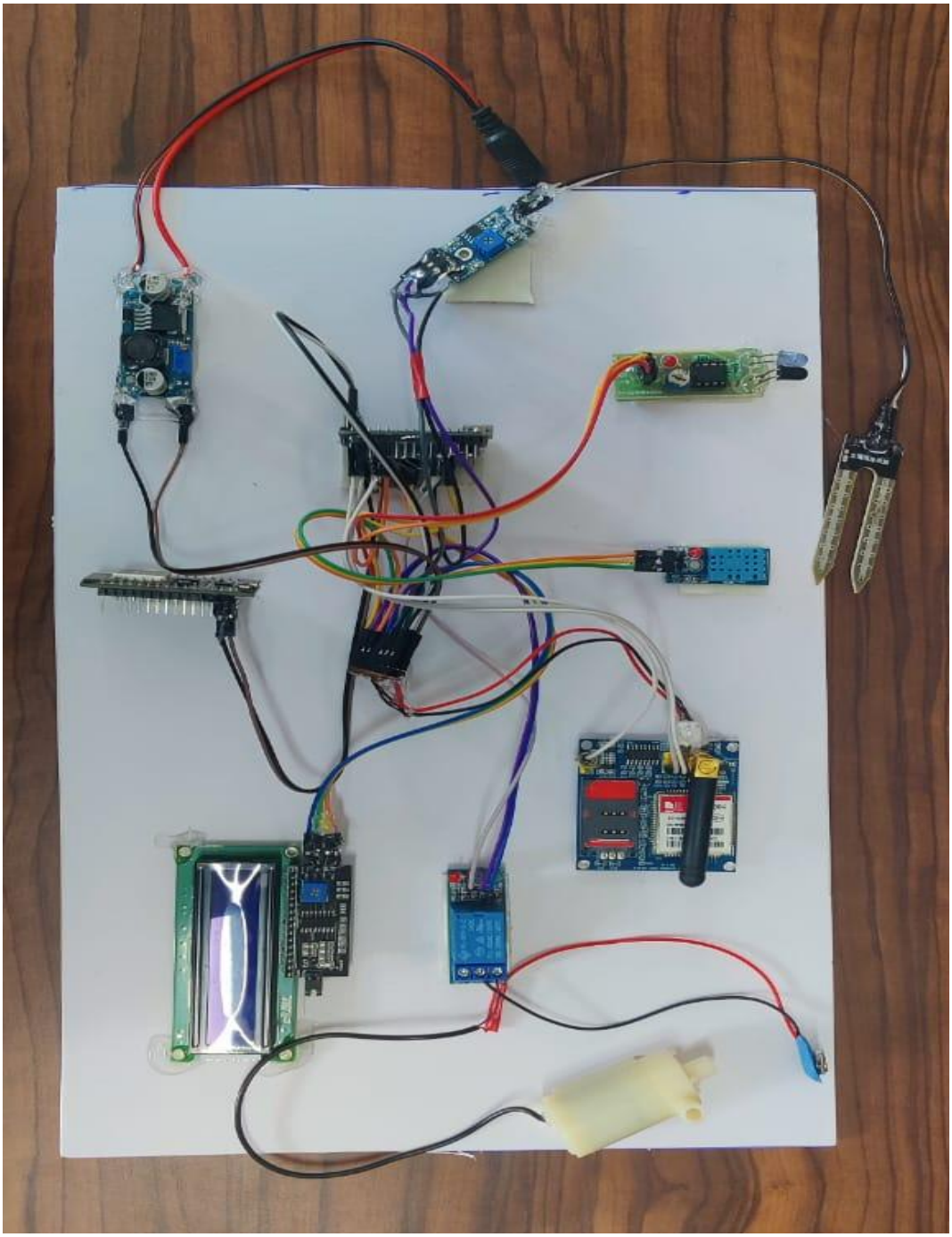




5 Implementation of System

The soil moisture sensor checks the moisture level in the soil. If the moisture level is present in soil then conduction occurs between the two probes of Soil Moisture Sensor. Due to this conduction, the transistor Q2 remains in triggered state and so Arduino Pin D7 remains Low. When Arduino pin reads LOW signal at D7. The GSM module sends SMS to the user that Soil Moisture is Normal and the motor is turned OFF. So water pump remains in Off state.

In case of low moisture in the soil the Transistor Q2 turns off and then the Pin D7 becomes High. Then the Arduino Nano reads the Pin D7 and triggers the water motor. Using the gsm module message is sent to the user about “Low Soil Moisture level detected and the Motor is turned ON”.The water Motor will automatically turn off when there is sufficient moisture in the soil.



6. Results and Discussion

The development of an automated irrigation system allows for the most efficient use of water and other resources. This technique aids in irrigation in water deficiet locations and promoting sustainability. This system requires little upkeep, is very stable, and may be easily modified to accommodate different kinds of crops. Similar strategies can be used to build and implement various modules depending on the project's utility, whether it be a green house or an open field. In addition to lowering costs, this effort contributes to the preservation of water, a necessity for life.

For this system we have taken 10 square feet of land. So for proper monitoring of the land moisture, we have installed 3 moisture sensors at 3 corners of the land covering most of the surface area while the Solenoid valve is placed on the fourth corner for supply of water across the whole land area. So only if the full area is supplied with water then all the three moisture sensors get activated stopping the flow of water by closing the Relay. And the LED display is placed at the user's location for convenience. This will inform the user whether the motor got turned on or turned off. And there is a pre-installed SIM in the GSM Module which needs to be recharged for sending SMS to the user’s mobile when the motion sensors get turned on along with the humidity and temperature information and the motor information. The motion sensor will alert the user when there is trespassing or unusual movements in the field.

7. Conclusion and Future Work

This project is feasible and cost-effective for optimizing water resources for agricultural production. This project allows cultivation in places with water scarcity thereby improving sustainability. It proves that the wastage of water can be reduced. I conclude that this system is very easy to implement. Here the user should visualize his soil’s moisture content from time to time and check whether the water level is sufficient or not. Smart irrigation system displays the values of the water level in the mobile of the user so that the user can operate them anytime.

8. REFERENCES

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