Plant Health Monitoring System

Project Exhibition -1

Submitted in partial fulfillment for the award of the degree of

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In

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(SPECILIZATION IN AI & CYBERNETICS)

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CANDIDATE'S DECLARATION

I hereby declare that the Dissertation entitled "**Plant Health Monitoring System**" is my own work conducted under the supervision of Dr. Amit Kumar Singh, Asst. Professor Junior, School of Electrical & Electronic Engineering at VIT University, Bhopal.

I further declare that to the best of my knowledge this report does not contain any part of work that has been submitted for the award of any degree either in this university or in other university / Deemed University without proper citation.

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

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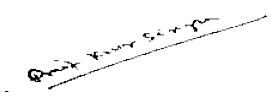

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CERTIFICATE

This is to certify that the work embodied in this Project Exhibition -1 report entitled **"Plant Health Monitoring System"** has been satisfactorily completed by **Ms. Priya Verma, Tanu Tomar. Registration No. 22BAC10024, 22BAC10023** respectively in the School of Electrical & Electronics Engineering of Electronic and Communication Specialization in AI & Cybernetics at VIT University, Bhopal. This work is a bonafide piece of work, carried out under my/our guidance in the School of Electrical and Electronics Engineering for the partial fulfilment of the degree of Bachelor of Technology.

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Acknowledgement

In the first place, we would like to thank **Dr. Amit Kumar Singh** (assistant professor SEEE), for their cooperation and guidance in completing our project PLANT HEALTH MONITORING SYSTEM. Above all and the most needed, he provided us with unflinching encouragement and support in various ways. His words have always inspired us to work in an efficient and comprehensive way. We would like to thank him for his constant encouragement that enabled us to grow as a person. His presence has definitely improved us as a human being.

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Executive Summary

Our Plant Health Monitoring System integrates advanced sensor technology, machine learning algorithms, and user-friendly interfaces to revolutionize agriculture. By continuously monitoring environmental and soil conditions, alongside employing imaging sensors, it ensures real-time data analysis for early issue detection and disease prediction. The intuitive dashboard facilitates easy interpretation of historical data trends, empowering farmers with actionable insights. With wireless connectivity, the system allows for remote monitoring and automated responses, seamlessly integrating with existing agricultural systems. Its scalability and adaptability cater to various crop types and plantation sizes, ensuring flexibility. Security measures prioritize data integrity and confidentiality. This cost-effective solution not only enhances decision-making but also contributes to sustainable farming practices, promising a compelling return on investment. Embrace the future of precision agriculture and cultivate prosperity with our innovative Plant Health Monitoring System.

List of Figures

List of Tables

Table of Contents

INTRODUCTION

In contemporary agriculture, the integration of advanced technologies has ushered in a new era of precision and efficiency. One of the groundbreaking innovations in this domain is the Plant Health Monitoring System, a comprehensive solution poised to transform how we perceive and manage the vitality of plants. With an intricate network of sensors and cutting-edge technologies, this system offers real-time insights into the environmental conditions, soil health, and overall well-being of plants in various settings, ranging from vast agricultural fields to urban green spaces.

As the global demand for sustainable and high-yield agriculture intensifies, the significance of proactive plant management becomes increasingly apparent. The Plant Health Monitoring System not only provides continuous data collection but also employs sophisticated algorithms to analyse and interpret this data, enabling the early detection of potential issues and predictive insights into plant diseases. In this introduction, we embark on a journey to explore the components, functionalities, and transformative potential of the Plant Health Monitoring System—a technological marvel poised to redefine the future of agriculture

In India 83% of water is consumed by agriculture. If there are no plan for the usage of water in farms, then it causes wastage of water. So, we need a system which will efficiently supply water. Arduino Uno is a microcontroller along with the moisture, temperature and humidity sensor can monitor soil content and accordingly it irrigates the field as when needed. The proposed system uses microcontroller Arduino Uno and IOT which enable farmers to remotely monitor the status of motor installed on the farm by getting approximate information from sensor thereby, making the farmers' work much easier as they can do other farm activities. And mostly this technique is driven by electrical power and on/off scheduling controlled.

LITERATURE REVIEW

1. Athawale, S.V., Solanki, M., Sapkal, A., Gawande, A. and Chaudhari, S., 2019. An IoT-Based Smart Plant Monitoring System. In Smart Computing Paradigms: New Progresses and Challenges: Proceedings of ICACNI 2018, Volume 2 (pp. 303-310). Singapore: Springer Singapore.

Abstract:

In this modern era of fast – moving technology, we can do things which we could never do before and to do these tasks there is a necessity to build a platform thses tasks. The proposed system puts forth the home automation technique for smart plant watering system. A smartphone empowers the user to be updated with their current garden status usint IoT from any part of the world.

2. Kamaruddin, F., Abd Malik, N.N.N., Murad, N.A., Latiff, N.M.A.A., Yusof, S.K.S. and Hamzah, S.A., 2019. IoT-based intelligent irrigation management and monitoring system using Arduino. TELKOMNIKA (Telecommunication Computing Electronics and Control), 17(5), pp.2378-2388

Abstract:

Plants, flowers and crops are living things around us that makes our earth more productive and beautiful. In order to growth healthy, they need water, light and nutrition from the soil in order to effect cleaning air naturally and produce oxygen to the world. Therefore, a technology that manage to brilliantly control plants watering rate according to its soil moisture and user requirement is proposed in this paper. The developed system included an Internet of Things (IoT) in Wireless Sensor Network (WSN) environment where it manages and monitors the irrigation system either manually or automatically, depending on the user requirement. This proposed system applied Arduino technology and NRF24L01 as the microprocessor and transceiver for the communication channel, respectively. Smart agriculture and smart lifestyle can be developed by implementing this technology for the future work. It will save the budget for hiring employees and prevent from water wastage in daily necessities.

3. Yu, L., Gao, W., R Shamshiri, R., Tao, S., Ren, Y., Zhang, Y. and Su, G., 2021. Review of research progress on soil moisture sensor technology.
   Link- https://oa.tib.eu/renate/handle/123456789/11011

Abstract:

Soil moisture is directly related to the amount of irrigation in agriculture and influences the yield of crops. Accordingly, a soil moisture sensor is an important tool for measuring soil moisture content. In this study, the previous research conducted in recent 2-3 decades on soil moisture sensors was reviewed and the principles of commonly used soil moisture sensor and their various applications were summarized. Furthermore, the advantages, disadvantages, and influencing factors of various measurement methods employed were compared and analyzed. The improvements were presented by several scholars have established the major applications and performance levels of soil moisture sensors, thereby setting the course for future development. These studies indicated that soil moisture sensors in the future should be developed to achieve high-precision, low-cost, non-destructive, automated, and highly integrated systems. Also, it was indicated that future studies should involve the development of specialized sensors for different applications and scenarios. This review research aimed to provide a certain reference for application departments and scientific researchers in the process of selecting soil moisture sensor products and measuring soil moisture.

4. Taneja, K. and Bhatia, S., 2017, June. Automatic irrigation system using Arduino UNO. In 2017 International Conference on Intelligent Computing and Control Systems (ICICCS) (pp. 132-135). IEEE

Abstract:

An automated irrigation system have been developed using sensors technology with Arduino to efficiently utilize water for irrigation purpose. The system has soil moisture sensor inserted into the soil of the plants and a water level sensor placed in a water container from where water will be pumped to plants for irrigation. An algorithm has been build out with threshold values of soil moisture sensor to control the water quantity in soil and also a water level sensor has been implemented to measure the water level in tank.

PROBLEM FORMULATION

Problem formulation in research is the foundational process of clearly defining the issue or question that the study seeks to address. This involves identifying a specific problem, contextualizing it within the existing body of knowledge, and stating clear research questions or objectives. The researcher reviews relevant literature to understand the broader context, ensuring that the chosen problem is both relevant and significant in the field. Articulating the significance of the problem is crucial, as it justifies the need for investigation and outlines potential contributions to knowledge or applications. Additionally, the scope and limitations of the research are defined to set realistic expectations. In cases where applicable, hypotheses may be formulated to predict relationships between variables. A well-crafted problem formulation not only guides the entire research process but also ensures that the study addresses a meaningful issue with clarity, purpose, and a clear understanding of its potential impact on the academic or practical landscape.

To provide support system using wireless sensor network which handle different activities of farm and gives useful information related to farm. Information related to Soil moisture, Temperature and Humidity content. Due to the weather condition, water level increasing Farmers get lot of distractions which is not good for Agriculture. Many stray animals dissipate the harvest and it cause of less yield.

METHDOLOGY

The methodology section of a research project serves as the blueprint for the entire study, delineating the systematic approach and procedures employed in data collection and analysis. It encompasses a detailed research design, articulating whether the study adopts a qualitative, quantitative, or mixed methods approach, and justifying this choice based on the research objectives. This section delves into the specifics of data collection methods, outlining whether surveys, interviews, observations, experiments, or archival research are employed. The sampling strategy is elucidated, explaining how the research sample is selected from the broader population, and the rationale behind this selection. Methodology also includes a discussion of data analysis techniques, shedding light on the statistical or qualitative methods used to derive meaningful insights from the collected data. Instruments utilized, such as questionnaires, sensors, or software tools, are detailed in this section. Ethical considerations form a crucial aspect, elucidating the ethical principles and safeguards in place to protect participants and ensure the integrity of the research. Furthermore, discussions on the validity, reliability, and any inherent limitations provide transparency and enable a critical evaluation of the study's methodology by peers and stakeholders. In essence, the methodology section is a methodical guide that underpins the research process, promoting transparency, replicability, and the credibility of the study's findings

Block diagram of Automatic Plant Watering System with I0T. Farmer monitors and control system in order to improve the efficiency with help of sensor parameters like temperature, humidity, soil moisture. When power supply is ON, the input module of three sensors (DHT22, Moisture, PIR) start to activate. When sensors get ON it will read the data from soil and from surrounding. According to the values that are detected by sensors motor will turn ON/OFF.

BLOCK DIAGRAM

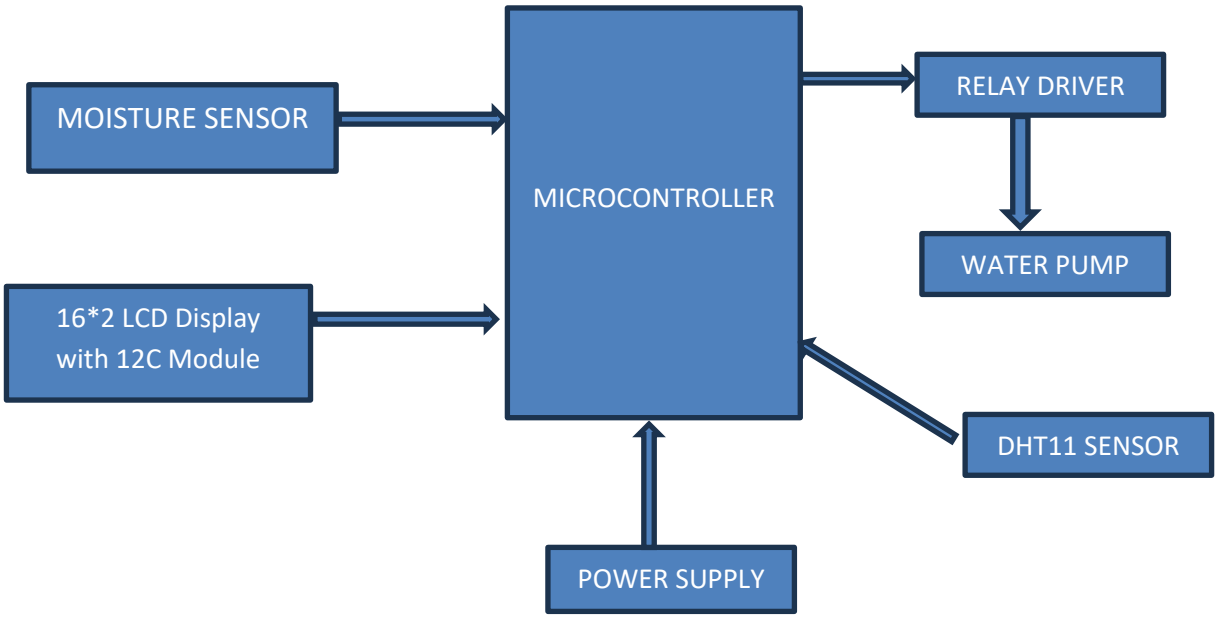


Fig. 2.1.1 Block Diagram

CIRCUIT DIAGRAM

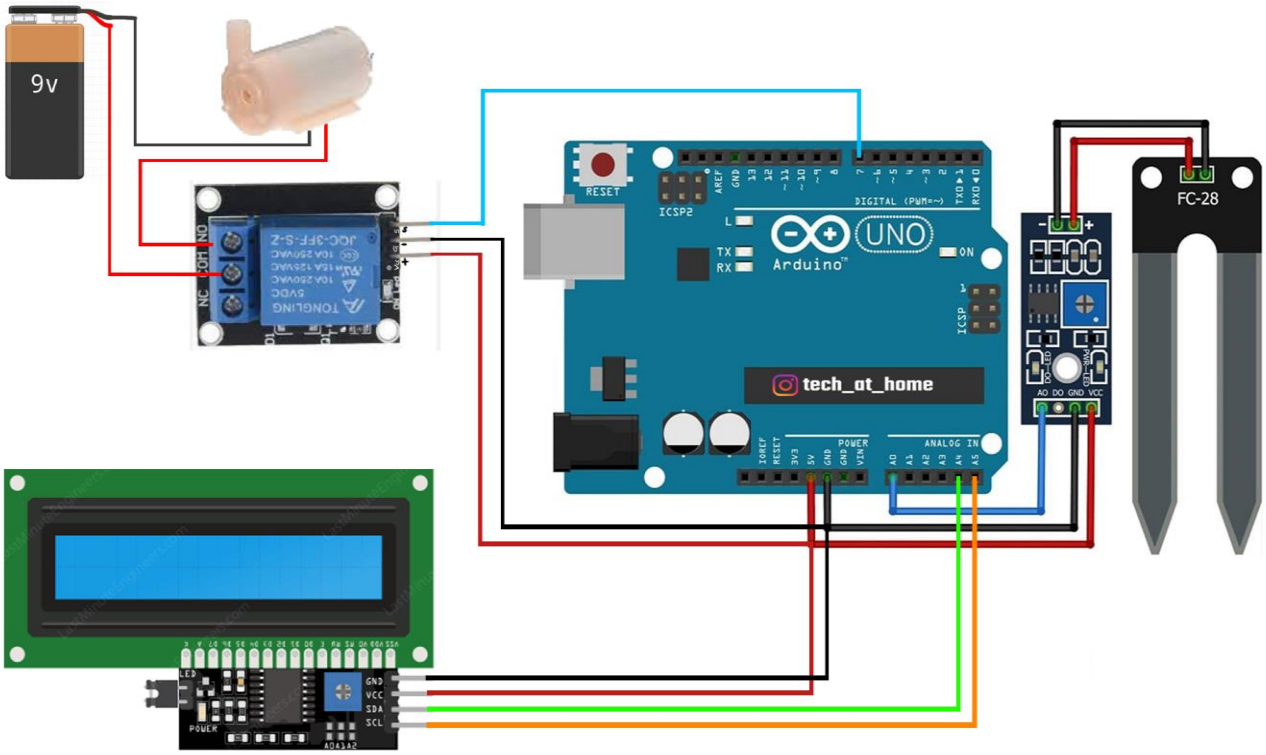


Fig. 2.1.2 Circuit Diagram

COMPONETS DESCRIPTION

Arduino UNO-

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing. The Arduino Uno is a microcontroller board based on the ATmega328. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

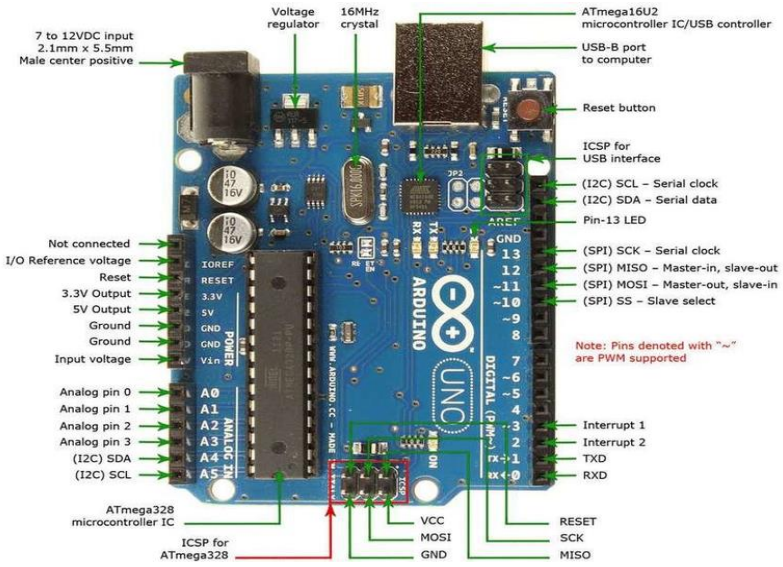


Fig.3.2.1.1 Arduino UNO

USB-

The USB connection with the PC is necessary to program the board and not just to power it up. The ESP8266 automatically draw power from either the USB or an external power supply. Connect the board to your computer using the USB cable.

Soil moisture sensor -

The soil moisture sensor is one kind of sensor used to gauge the volumetric content of water within the soil. As the straight gravimetric dimension of soil moisture needs eliminating, drying, as well as sample weighting. These sensors measure the volumetric water content not directly with the help of some other rules of soil like dielectric constant, electrical resistance, otherwise interaction with neutrons, and replacement of the moisture content. This sensor mainly utilizes capacitance to gauge the water content of the soil (dielectric permittivity). The working of this sensor can be done by inserting this sensor into the earth and the status of the water content in the soil can be reported in the form of a percent.

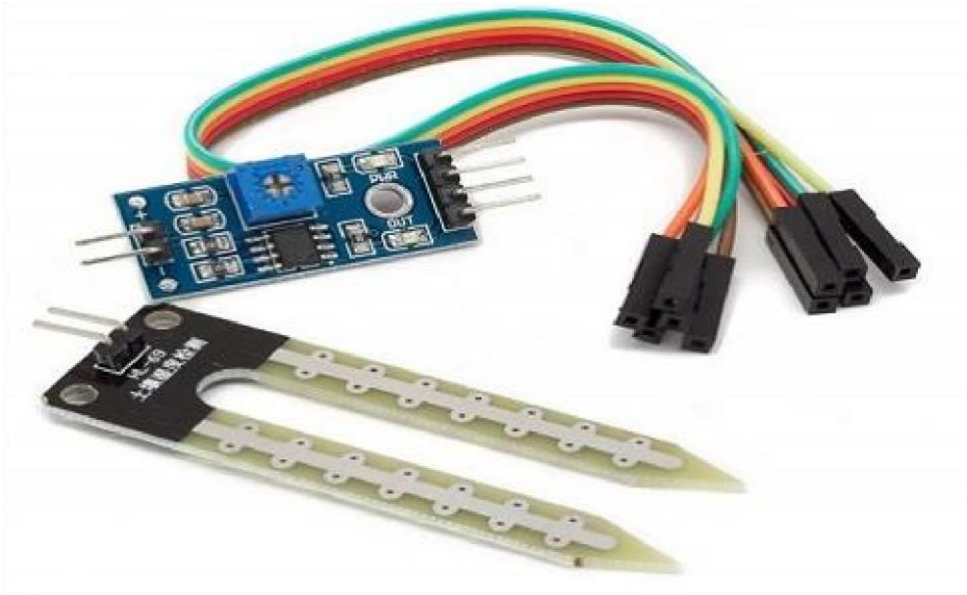


Fig. 3.2.1.2 Soil moisture sensor

SPECIFICATIONS:

- VCC pin is used for power.
- A0 pin is an analog output.
- D0 pin is a digital output.
- GND pin is a Ground.

DHT11 Digital Temperature Humidity Sensor-

Product Description:

DHT11 digital temperature and humidity sensor is a composite Sensor that contains a calibrated digital signal output of the temperature and humidity. Application of dedicated digital modules collection technology and temperature and humidity sensing technology, to ensure that the product has high reliability and excellent long-term stability. The sensor includes a resistive sense of wet components and an NTC temperature measurement devices and is connected to a high-performance 8-bit microcontroller.

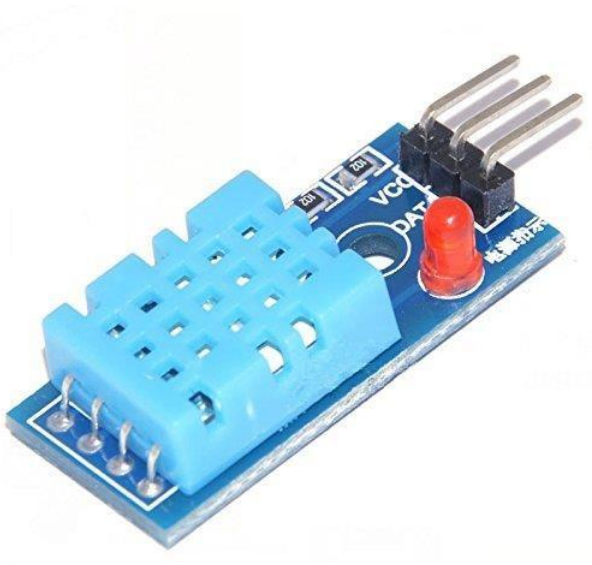


Fig. 3.2.1.3 DHT11 Sensor

Pin Description:

- 1, the VCC power supply 3.5～5.5V DC
- 2 DATA serial data, a single bus
- 3, NC, empty pin
- 4, GND, used to connect the module to system ground

5V Lithium-ion Battery-

A 5V lithium-ion battery is a rechargeable battery that uses lithium-ion technology to store and provide electrical power at a voltage of 5 volts. Lithium-ion batteries are a type of rechargeable battery that has become increasingly popular due to their high energy density, low selfdischarge rate, and long cycle life.

Fig3.2.1.4 5v Lithium-ion Battery

5V Relay module-

The 5V relay module can be used to control a load such as a lighting system, motor, or solenoid. It can also be used to switch AC or DC voltages. The maximum voltage and current that the 5V relay module can control is dependent on the specifications of the relay.

Fig3.2.1.5 5v relay module

Water pump-

The water pump works using water suction method which drain the water through its inlet and released it through the outlet. You can use the water pump as exhaust system for your aqurium and controlled water flow fountain. How to Use: Firstly, simply connect the red wire (+) and black wire (-) to a 3V or 5V DC supply.

Fig3.2.1.6 5v dc water pump

16X2 LCD Panel-

Product Description:

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. [1] LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and seven-segment displays.

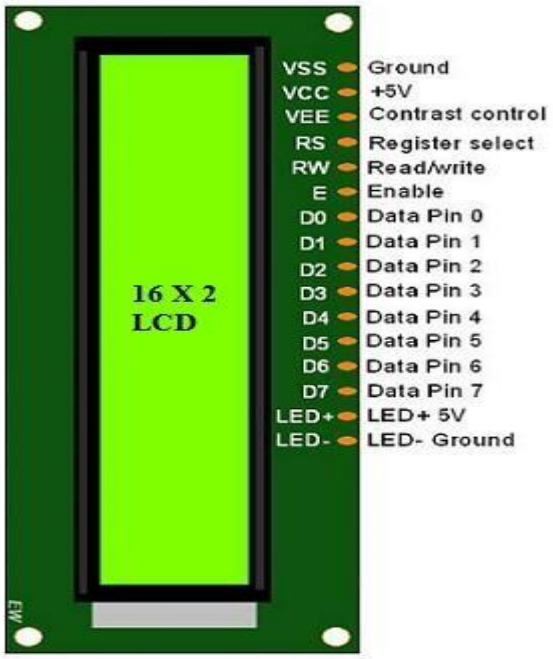


Fig. 3.2.1.7 LCD

Features of LCD16x2 :

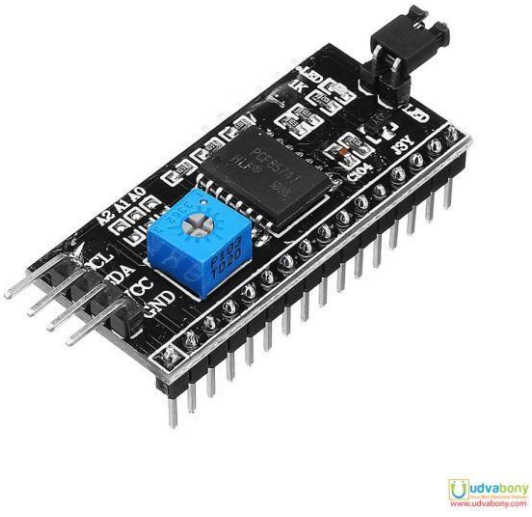
- The operating voltage of this LCD is 4.7V-5.3V
- It includes two rows where each row can produce 16-characters.

- The utilization of current is 1mA with no backlight
- Every character can be built with a 5×8 pixel box
- The alphanumeric LCDs alphabets & numbers
- Is display can work on two modes like 4-bit & 8-bit
- These are obtainable in Blue & Green Backlight
- It displays a few custom generated characters

I2C module for lcd

This is a RoHS compliant I2C Serial LCD Daughter board that can be connected to a standard 16×2 or 20×4 Character Display Module that supports 4-bit mode. All Character Modules sold on our site support 4-bit mode, and nearly all commercially available 16×2 and 20×4 line character modules support it too.

This board has a PCF8574 I2C chip that converts I2C serial data to parallel data for the LCD display. There are many examples on the internet for using this board with Arduino. Do a search for "Arduino LCD PCF8574". The I2C address is 0x3F by default, but this can be changed via 3 solder jumpers provided on the board. This allows up to 3 LCD displays to be controlled via a single I2C bus (giving each one it's own address)



Fig,3.2.1.8 I2c module

This section mentions some of the features and specifications of the I2C Serial Interface Adapter Module.

1. Operating Voltage: 5V DC
2. I2C control using PCF8574
3. Can have 8 modules on a single I2C bus
4. I2C Address: 0X20~0X27 (the original address is 0X20, you can change it yourself via the onboard jumper pins)

SIMULATION

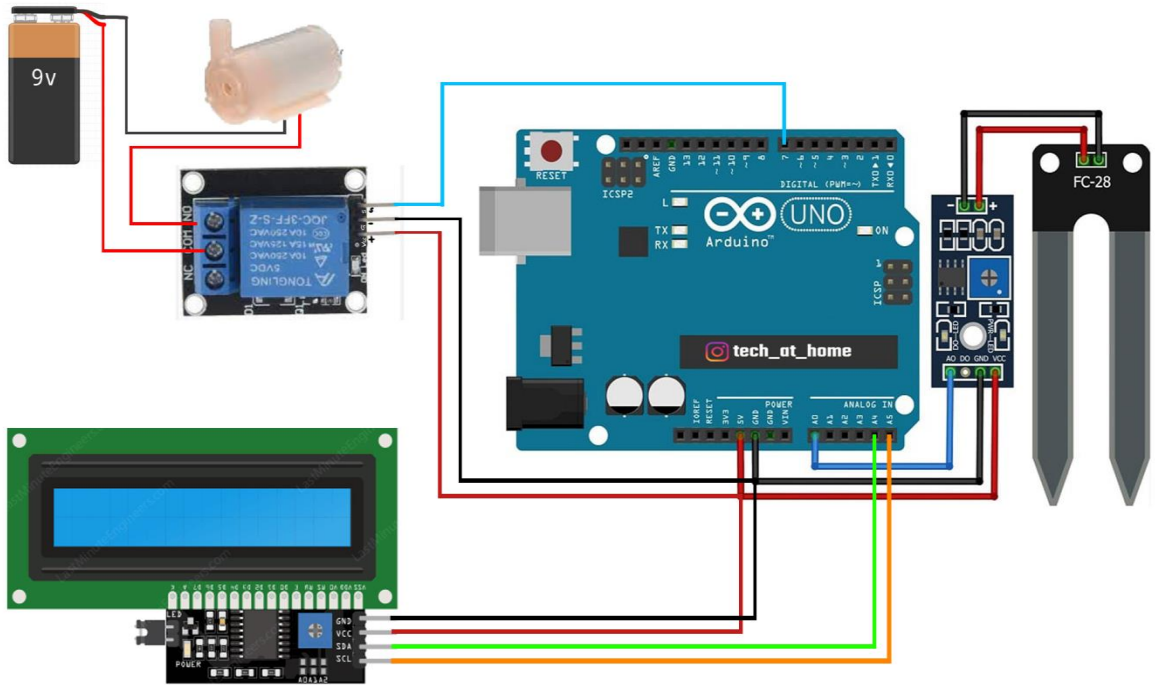


Fig. 2.1.3 Simulation

RESULTS AND DISCUSSION

RESULTS

Reading

The calculation formula is soil moisture content=W/M*100%, M is the weight of soil before drying, and W is the weight of soil moisture, that is, the difference between M and the weight of soil after drying M.

The output of the soil moisture sensor changes in the range of ADC value from 0 to 1023. This can be represented as moisture value in terms of percentage using formula given below. ***Analog Output=ADC Value/1023***

Moisture in percentage = 100-(Analog output*100)

For zero moisture, we get a maximum value of 10-bit ADC, i.e. 1023. This, in turn, gives 0% moisture.

Observation Table

Item	Condition	Min	Typical	Max	Unit
Voltage	-	3.3	/	5	V
Current	-	0	/	35	mA
Output Voltage	Supply Voltage 5 V	0	-	4.2	V
Output Value	Supply in dry soil	0	-	300	/
	Sensor in humid soil	300	-	700	/
	Sensor in water	700	-	950	/

Table no.1

Conversion of Sensor Value into Moisture Percentage

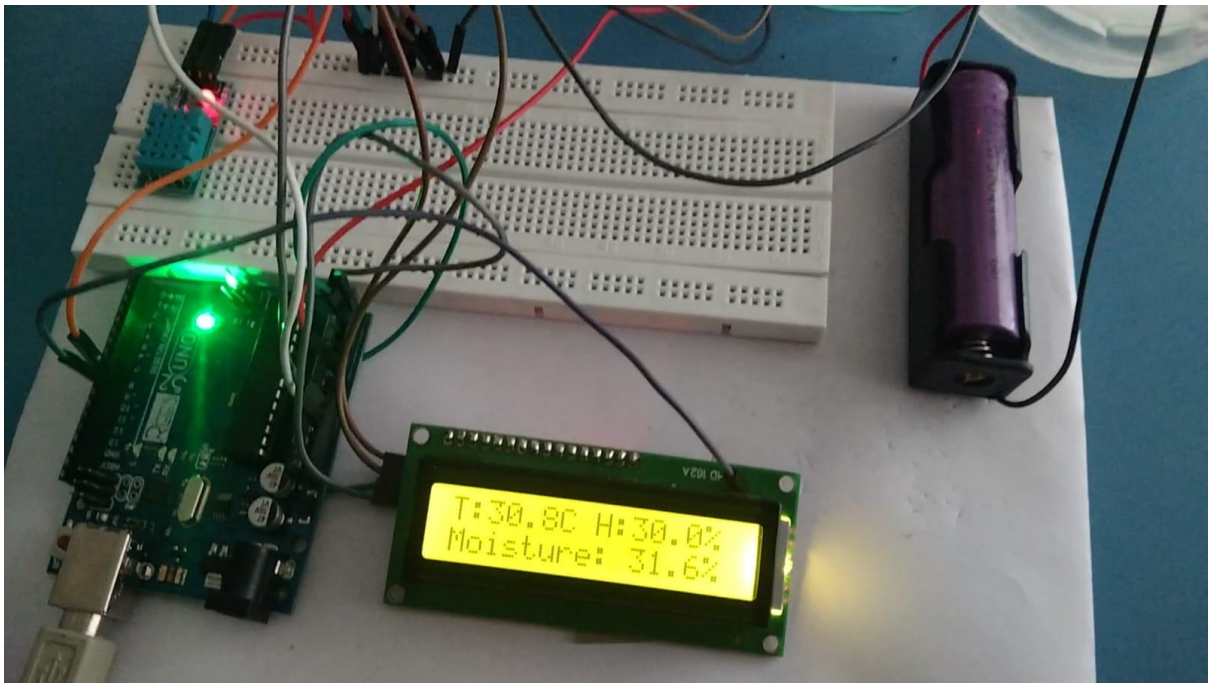


Fig. 2.1.4 Result Figure

CONCLUSION & FUTURE SCOPE

CONLUSION-

The development of a smart irrigation system using an Arduino Uno, DHT11 humidity sensor, soil moisture sensor, and relay can greatly enhance the efficiency and effectiveness of plant care. By monitoring soil moisture and environmental conditions and automating the irrigation process, you can ensure that plants receive the right amount of water, reducing water wastage and promoting healthy growth. The system's ability to factor in humidity and adjust watering schedules accordingly adds an extra layer of sophistication.

Key points to note in the conclusion:

- The system incorporates real-time data from soil moisture and humidity sensors.
- Automation through the relay ensures consistent and timely watering.
- Customizable logic can be implemented to tailor watering to specific plant needs.
- Monitoring and control can be extended through remote and scheduling features.

- Regular maintenance and calibration are essential for accurate operation.

FUTURE SCOPE-

The future scope of smart plant monitoring and irrigation systems is promising and multifaceted, with key areas of development including sensor technology, data analytics, wireless connectivity, energy efficiency, and sustainability. These systems will continue to evolve to meet the growing demand for efficient and eco-friendly agricultural practices, urban gardening, and educational applications. Future innovations in this field will not only enhance plant care but also contribute to resource conservation, increased crop yields, and the promotion of environmental sustainability.

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