

IOT BASED SOLAR POWERED SMART IRRIGATION SYSTEM

Submitted in partial fulfillment of the requirements for the award of a Bachelor of Engineering degree In Mechanical Engineering By

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DEPARTMENT OF MECHANICAL ENGINEERING

SCHOOL OF MECHANICAL ENGINEERING

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

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DEPARTMENT OF MECHANICAL ENGINEERING
BONAFIDE CERTIFICATE

This is to certify that this Project Report is the Bonafide work of Ayush Kumar (Reg. No. 39150012) and MD Sameer Khan (Reg. No. 39150084) who carried out the project entitled "**IOT BASED SOLAR POWERED SMART IRRIGATION SYSTEM**" under my supervision from June 2022 to April 2023.

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DECLARATION

We Ayush Kumar (39150012) and MD. Sameer Khan (39150084), hereby declare that the project report entitled “**IOT BASED SOLAR POWERED SMART IRRIGATION SYSTEM**” Done by us under the guidance of **Dr.M. ANISH., M.E.,Ph.D.**, is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree In Mechanical Engineering.

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ABSTRACT

The principal perseverance need on earth is Water. Lately, the water deficiency is extended in light of the augmentation of the general population and deforestation. This paper considers the progression of a Web of Things with sun-based energized water frameworks using an embedded methodology which is convincing in the country field. Our undertaking is to design a model of PIC for the water framework structure which is regulated using the Wi-Fi module (ESP8266). The Wi-Fi module is worked using a (PIC) 16F877A from a Microcontroller by utilizing the energy from the sun-controlled charger, running the motors which water the field by recognizing the suddenness in the soil. The water over the stepped level is guided out by a motor by the information from the level sensor. The types of progress of development like IoT has an enormous interest in various exercises. This structure can successfully get to the farmer to control the water framework from any put in the world in a convincing manner. The Sun-situated Filled Adroit Water Framework Structure hopes to give an IoT plan in automating the watering framework using an Arduino-based microcontroller and sensors. It is an energy-useful and eco-obliging system that makes power from the photovoltaic cells to supply water to the plants from the water siphons. The watering framework is driven by the moisture content of the soil using sensors. Edge limit are set for soil moistness sensor to ensure capable and strong usage of water resources. The head microcontroller unit controls the structure whenever the sensor I across limit regard. In like manner, the structure has understood temperature and tenacity sensors to screen the climate condition on the specific environment. Another sensor is completed to measure the water tank level which fills in as limit that arrangements the water to the system. With the blend of IoT, the modernized water framework can be really gotten to and somewhat saw over a compact application through a remote-specific device. With these astute water framework techniques, it replaces the customary water framework structure that helps decline manual intervention and blunders.

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CHAPTER 1

INTRODUCTION

The overall large critical wellspring of all living animals is Farming. 66% of land open on earth is used for cultivation, and it hydrates available. The referred to level of using water grows reliably due to globalization and people's improvement. The making propels are for the most part improved and supportive in the late new development. The issues in adventures can be settled by using various advancements. The combination of parts used is extending rapidly. The systems joined with electronic parts clear a way to the emerging development. The utilization of significant level parts is open, in light of everything. The electronic parts or systems open are used in adventures like mechanical and aeronautical endeavour's in a strong association. This usage of parts is merged to come by an optimal outcome structure. The essential unit is the microcontroller, an electrical part that is a predominant show central processor unit that controls the entire structure.

From the get-go, the vital power was made from the daylight-based charger, by exchanging the light energy over totally to electrical energy by using the photovoltaic effect, the subsequent power from the board is taken care of in the external battery. The voltage in the battery isn't the unquestionable level's place to work the system. To adjust the acquired voltage by giving the 230V AC to the Step-Down Transformer, it changes over 230V to 12V AC power, then, the 12V AC is gone through the rectifier which changes over the air conditioner ability to DC which works the entire system and PIC microcontroller. The pearl oscillator delivers a beat of 20MHz. Different harvests are watered under different techniques. Assuming that there ought to be an event of an excess of water staged in the field over the referred to even out, the level sensor identifies the wealth of water, and the siphon gets worked and liberates the wealth of water from the field. The Wi-Fi module which is created with the structure is added to move the field data from any district of the planet by using the ADAFRUIT IO server or a few different stages to get and see data from the field. The IoT module helps with controlling the model from any spot by using a site page or application made. The checking and controlling of the model ought to be conceivable time frames as could be anticipated. Power is also added to the most fundamental requirements throughout everyone's life. The diagram of

imperativeness usage is getting extended bit by bit while the essentialness resources are diminishing similarly. To change the lack of force, various sources are used to deliver power. For the time of force, there are two distinct ways: one is by conventional procedure and another is by the non-conventional method. A piece of the imperativeness carriers like non-sustainable power sources and nuclear powers are moreover used, be that as it may, they are not boundless resources (i.e., they are not 'finished off' normally) and being no ordinary is said. In this undertaking, we are using an inexhaustible wellspring of energy (daylight-based source) which is extremely monetary and feasible. The sun's bars may catlike as a huge focal point for the period of force by changing over it into electric power. Such application is called sun-situated warm essentialness, which is customary. Despite the fact that different reasonable sources are open, for instance, wind, storms, tides, geothermal, trademark-based bio fills, and common biomass, the force enjoys colossal benefits. The general shock rate in India is 64.5%, while 35.5% of the general population notwithstanding everything lives without admittance to control. The snare of things infers simply the arrangement of Actual articles. This gives the relationship of each article in the world by techniques for far-off sensor association. A part of the contraptions, designs, vehicles, and various articles embedded with programming, sensors, equipment, and framework accessibility can enable these things to accumulate and exchange data. This IoT (Web of Things) is achieved by far-off sensor frameworks, sensor frameworks, 2G/3G/4G, GSM, GPRS, RFID, WI-FI, GPS, miniature regulator, microprocessor, etc. Drawing in types of progress for the Web of Things are considered and collected into 3 portrayals. They are propelled that empower "things" to recognize coherent information. that empower "things" to deal with significant data, and Progression to further develop security and confirmation. Crops on ranches are commonly attacked by neighbourhood animals like bison, cows, goats, birds, and so forth. This prompts immense misfortunes for the rancher. Because of overpopulation, happens deforestation which brings about a lack of food, water, and haven in backwoods regions. Thus, creature impedance in local locations is expanding step by step which influences human existence and property and causes human-creature struggle yet according to nature's standard, each living animal on this planet plays a significant part in the environment. So here we propose a programmed crop assurance framework for creatures. This is a microcontroller-based framework utilizing the PIC family microcontroller. These

frameworks utilize a movement sensor to recognize wild creatures moving toward close to the field. In such a case the sensor flags the microcontroller to act.

OBJECTIVE:

- To design and implement a Solar-Powered Smart Irrigation System using IoT Approach.
- To build an energy-efficient and cost-effective system using renewable resources.
- To integrate the system using various sensor parameters such as temperature and humidity sensor, soil moisture sensors and tank storage capacity sensor to collect information.
- To monitor and track the system using IoT technology.

PROBLEM STATEMENT:

To design an IOT-based solar-powered smart irrigation system for proper crop cultivation as well as to monitor crops' health and growth which is also useful for maintaining a good amount of water supply.

CHAPTER 2

LITERATURE SURVEY

INTRODUCTION

A novel technique for smart agriculture was proposed by developing a smart sensing framework and irrigator equipment using wireless sensor technology. This approach focuses on checking external parameters like soil moisture, pH of the soil, and nutrient level, and based on the measured parameters the essential amount of water supplied for the crops via the irrigator system which is placed on the crane system. Mobile integrated smart automated irrigation scheme which includes soil and temperature sensors. The principal objective of this framework is to manage the water and take care of the plants over cell phone which empowers the farmers to water the plants without human nearness and get the state of the motor and the temperature status on mobile, proposed an automated smart irrigation system using Arduino and Raspberry pi where the user inputs are refined on Raspberry pi and on or off messages are received by the Arduino microcontrollers from raspberry with ZigBee technology. The Aim of this system is to water the plant by sending mail without the need for human presence to monitor watering. Irrigation regulation with system security was proposed where the main objective of this system maintain the necessary amount of water in the field and throw up the excess water by using two pumps, and wireless messaging is used to provide information about the land. The system consists of a water sensor which is cost-effective and helpful to find the water content in the field. In order to provide security for the pumps and other equipment password lock system has been used. An Arduino-based irrigation system with Wi-Fi technology was proposed and the system consists of soil moisture and temperature sensor where it senses the values from the soil, and according to that the water is supplied. Arduino obtains the data from sensors and updates it with the cloud. An Irrigation system using a soil moisture sensor, air humidity sensor, and air temperature sensor was proposed for vegetable crops the main goal of this project is to overcome the drawbacks faced in the traditional approach. This system provides 96% accuracy in command control. By referring to all the papers no system provides the integration of automated irrigation as well as seed sowing in a single system and we achieved this in our proposed system.

Mohit Korche, Sarthak Tokse, Shubham Shirbhate, Vaibhav Thakre⁴, S. P. Jolhe⁵, Students, Final year, Dept. of Electrical Engineering, Government College of Engineering, Nagpur ⁵Head of Dept., Electrical Engineering, Government College of Engineering, Nagpur (2021) – they have contemplated that protection of crops and sensors are also very necessary and have proposed different and smart ways to protect crops as well as sensors.

Najeem O. Adelakun Department of Electrical / Electronic Engineering (2018) –They have proposed that solar energy is the prime important source of energy and it has continued to gain popularity globally, about 486 GW of solar PV was installed worldwide. One of the key requirements for socio-economic improvement in any nation of the world is the provision of dependable electricity supply systems.

Neelam_Rathore a Department of Renewable Energy Engineering, College of Technology and Engineering, Udaipur, India (2019) -- They have presumed Solar photovoltaic (PV) systems play an important role in electricity production using solar energy. Underdeveloped or developing nations still strive for a constant supply of electricity. When fossil fuel is used for electricity generation, it leads to an increase in pollutants and greenhouse gases. This is creating environmental problems.

Aqeel-Ur-Rehman Hamdard University, Karachi, Pakistan (2014) – contemplated that Agriculture is one of such domains where sensors and their networks are successfully used to get numerous benefits Wireless Sensor Networks' application in various aspects of agriculture

Vivek Chamoli Department of Electronics & Communication Engineering, Graphic Era Deemed to be University, Dehradun, Uttarakhand, India

Rishi Prakash Department of Electronics & Communication Engineering, Graphic Era Deemed to be University, Dehradun, Uttarakhand, India (2021) - This audit accentuates that why it winds up basic to assess different techniques utilized by the analysts for assurance of the soil moisture. Likewise, a necessity for finding new soil moisture estimation methods or altering the current strategies has been surveyed.

Mohammad Hamed Samimi (2009) a department of Electrical and Computer Engineering, Faculty of Engineering, University – Proposed that Power transformers are the heart of high voltage substations playing an important role in power delivery. The continuous service of power transformers is vital for reliable energy transmission, and to ensure this continuous service, different sensor systems monitor the key parameters of a transformer. The sensors utilized in the monitoring system of a power transformer comprise various electrical, chemical, mechanical, acoustic, and optical types. This diversity of sensors is because the parameters needed to be monitored have various natures. In fact, a power transformer requires a complex sensing system, which should qualify specifications such as low cost, high stability, high accuracy, and compatibility with the transformer condition.

SUMMARY OF LITERATURE SURVEY

A ton of investigation work has been done to deal with the execution of the cultivating field. In the structure uses Arduino advancement to control the watering and material of the nursery. It uses quantifiable data secured from sensors (like temperature, sogginess, suddenness, and light power sensors) differentiated and the weather patterns measure for the autonomous course. Agribusiness Framework uses temperature, pH, sogginess sensors, and soft inducing to enter the data from sensors. The system screens the sensor information on LCD and PC. In Remote Recognizing Organizations ZigBee development effectively controls air tenacity, soil moistness, and temperature.

All of the structures portrayed above are similar in the setting of a far-off sensor centre. The qualification lies concerning the correspondence progress and the storing of data assembled from the centre points. Overall structures use something like one server to store the accumulated data. Exactly when how many centres are extended, servers will require more space for limit, coming about a swelled expense. This paper proposes a water framework structure that depicts the mix of the far-off sensor association, IoT correspondence development, and cloud server to accomplish the execution of the system and data storing. The proposed structure gives remote noticing and controlling of water frameworks with steady recognition of climatic and soil conditions like air temperature, moistness, and soil suddenness.

IoT-based water framework further creates farm creation with basically no human hindrance.

CHAPTER 3

AIM AND SCOPE OF WORK

3.1 AIM

The aim of the project is to reduce human labor efforts on farmlands using renewable energy resources (SOLAR ENERGY). The primary focus of IoT technology makes the irrigation system capable of monitoring the field and taking the decision to irrigate automatically. IoT is the abbreviated form of the Internet of Things. IoT is abroad technology given to every object that can relay information when connected to the network. The design of an IoT-based solar energy system for smart irrigation is essential for regions around the parts of the world, which face water scarcity and power shortages

3.2 SCOPE OF WORK

The current review includes assessing of the design and model of the sensors, microcontrollers, relays wi-fi modules, etc. Sunlight-based following components improve the vitality addition of sun-powered force plants. Programmed sun oriented following framework is commonly the one that arrives at the most noteworthy vitality gain in each area. It is consequently the most flexible framework, since it very well may be introduced anyplace, ensuring a high vitality gain.

As a result of the utilization of IOT right now, there is an enormous extension for future work can include present day gadgets and sensors without the dread of similarity. The adaptability of this framework is its uniqueness. Adding more sensors, it can gauge AC voltage and flow yield, power utilization of burden, sun-based irradiance and compare yield of the observing and control to improve conventional solar-based electrical vehicle framework for converter plan and the reception of reasonable Maximum Power Point Tracking (MPPT) strategies.

3.3 PRESENT INVESTIGATION

IoT-based sun oriented fuelled shrewd water system frameworks are acquiring expanding consideration because of their true capacity for working on agrarian proficiency and supportability. This innovation includes the utilization of sensors, a web network, and a sunlight-based ability to screen and control the water system process in farming fields. A new examination on this subject included the plan and improvement of an IoT-based sun-oriented controlled shrewd water system framework for tomato development. The framework was intended to consequently control the water system process in view of soil dampness, temperature, and stickiness estimations.

The framework utilized a sunlight-based charger to create power, which was put away in a battery for use when required. The framework was additionally outfitted with sensors to screen soil dampness levels and natural circumstances, like temperature and stickiness. Information from these sensors were sent to a cloud-based stage for examination and independent direction. The aftereffects of the examination showed that the framework had the option to really control the water system process, bringing about critical water investment funds while keeping up with ideal developing circumstances for the tomato plants. The utilization of sun oriented power likewise decreased the framework's dependence on conventional energy sources, making it more supportable and savvy.

One of the critical advantages of utilizing an IoT-based sun-oriented controlled savvy water system framework is that it considers exact and designated water system, which can prompt more proficient water use and further develop crop yields. This is especially significant in districts with restricted water assets or where water is costly. As well as diminishing water use, these frameworks can likewise assist with lessening work expenses and increment efficiency. Ranchers can remotely screen and control the water system framework, which saves them time and exertion. The framework can likewise be modified to change the water system plan in light of weather patterns or yield development stage, guaranteeing that the plants get the perfect proportion of water with impeccable timing.

One more benefit of these frameworks is that they can assist with decreasing the ecological effect of agribusiness. By utilizing sun-based ability to produce energy,

the framework lessens ozone-harming substance emanations and dependence on non-environmentally friendly power sources. Moreover, the exact and designated water system can assist with lessening spill over and soil disintegration, which can adversely affect the climate. In any case, there are likewise a few difficulties to carrying out these frameworks. One of the principal challenges is the underlying expense of introducing the framework, which might be restrictive for certain ranchers. Furthermore, the framework requires dependable web availability, which may not be accessible in a few provincial regions.

In general, IoT-based sun oriented fuelled savvy water system frameworks can possibly change agribusiness by further developing productivity and maintainability. Further innovative work is expected to conquer the difficulties and guarantee that these frameworks are open and reasonable for ranchers around the world. By and large, the examination showed the capability of IoT-based sun-oriented controlled savvy water system frameworks for working on horticultural proficiency and supportability. Further exploration is expected to advance the plan and execution of these frameworks for various yields and conditions.

CHAPTER 4

MATERIALS AND METHODOLOGY

4.1 METHODOLOGY

As shown in fig 4.1, the parts are associated with the PIC microcontroller which is the CPU of our framework. The dampness sensor is kept in the dirt of the field. The temperature sensor is kept in the air of the field. The level sensor is kept at an ideal range from the field. The voltage sensor is associated with the battery which is likewise called a battery criticism sensor. The IoT module persistently concentrates and conveys the sensor's and field's information to the web created utilizing ADAFRUIT IO. The wellsprings of ability to work the framework are accomplished by three unique parts: sunlight-powered charger (sun-based energy) , transformer, and battery(electrical energy). The LCD show which is set in the PIC microcontroller assists with examining the field condition face to face. The principal power supply of 230V AC is switched over completely to 15V DC through transformer circuits.

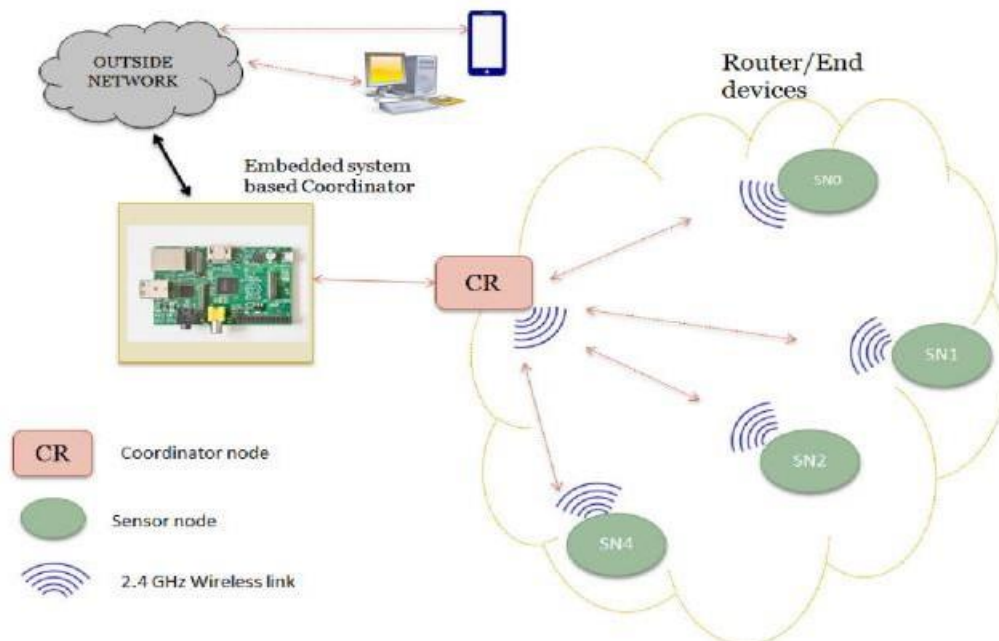


Fig 4.1: IOT MODULE

4.2 ENERGY USE IN IRRIGATION (DESIGN)

As shown in fig 4.2, irrigation requires a significant expenditure of fossil energy both for pumping and delivering water to crops. Annually in the U.S., it is estimated that 15% of the total energy expended for all crop production is used to pump irrigation water. Overall, the amount of energy consumed in irrigated crop production is substantially greater than that expended for rain fed crops. Solar energy is the most abundant source of energy in the world. Solar power is not only an answer to today's energy crisis but also an environmentally friendly form of energy. Photovoltaic generation is an efficient approach for using the solar energy. One of the applications of this technology is used in irrigation systems for farming. Solar powered irrigation system can be a suitable alternative for farmers in this present state of energy crisis.

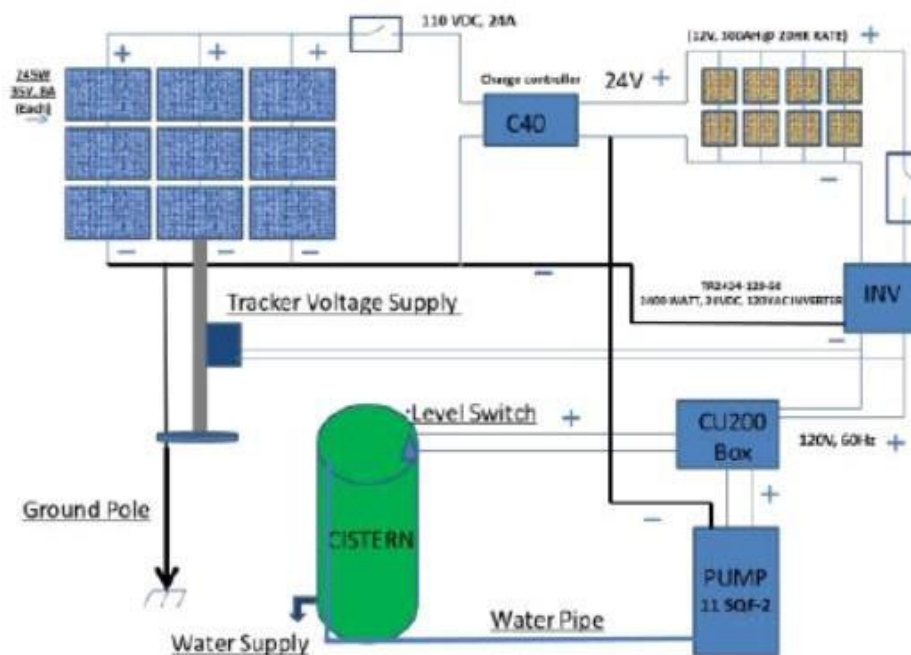


Fig 4.2: Renewable energy power system

4.3 METHODS TO PROTECT SENSORS FROM NATURAL CALAMITIES

Soil sensors have underlying hardware, which safeguards them against normal flood conditions. Establishments in lightning-inclined regions, nonetheless, require extraordinary safeguards, particularly when sensors are associated with a solid Campbell Logical lumberjack. As recently referenced, a solitary ground point for the framework ought to be laid out at the information lumberjack utilizing a ground bar. The ground bar ought to be produced using a metal that won't discolor or consume (like hardened steel). Rebar is occasionally utilized yet can rust and give high surface protection from the ground. Generally divided sensors need a low opposition way to this focal ground that is not through the sensors. By introducing ground bars nearby soil dampness sensors furthermore, running a different AWG copper wire from that pole back to the focal ground pole, earth current drifters from adjacent lightning strikes are limited, so voltage spikes on sensors are decreased. The accompanying figures show two setups with fitting establishing in lightning-inclined regions.

4.4 MATERIALS

4.4.1 RELAYS

As shown in Fig 4.3, the hand-off is the electrical gadget used to precisely work a switch. It is utilized to control a few circuits by a single result. The intensifiers are the principal transfer transmit circuits. The principal work of the intensifiers is that they move the sign. Relays are utilized as switches. Strong State Relays are utilized in the spot of semiconductor gadgets because of their high effectiveness. Transfers with aligning elements that safeguard the project. In the advanced electronic frameworks, the "defensive transfers" are utilized to keep away from over-burdening. The transfers are gadgets that are programmable to a period deferral of 1 second. In this task, the strong and best 5-Channel transfer is utilized by alluding to the diaries beneath. The three pins on the transfer are NO, NC, and C.

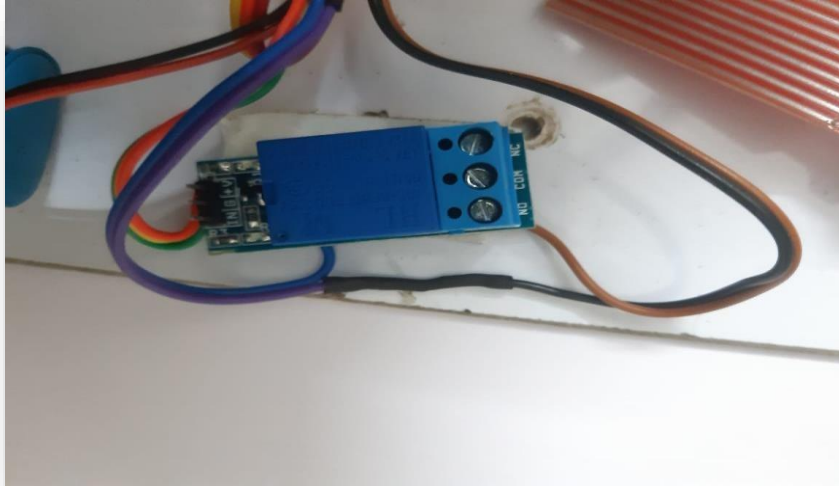


Fig 4.3: Relay

4.4.2 ESP8266 Wi-Fi Module

As shown in Fig 4.4 ,an ESP8266EX Wi-Fi module is constrained by utilizing TCP/IP convention that can get to any sort of remote availability organization. ESP8266 Wi-Fi Module is cost productive, requires the least circuit associations, and elite execution with regards to capacity and handling of the information. It permits the association of various sensors to the Wi-Fi module through GPIO pins. It processes the sensor information in the least measure of time. It is worked with one chip self-adjusted RF permit to work under various circumstances. The Wi-Fi module CPU is fixed with a microcontroller where the information is handled and goes about as a transporter which moves the information from the sensors and other linkage frameworks to the server made utilizing ADAFRUIT IO. The detected information is handled by paired codes and gets moved remotely through the information lines or information interfacing elements like beneficiary and moving ports to the server. The essential elements of ESP8266 WIFI MODULE comprise of Integrated 10bit ADC working in the module and its Recurrence range differs from 2.4GHz - 2.5GHZ. It chips away at the Operating voltage of 3.0v~3.6v. It has a network of Wi-Fi 2.4 GHz. It upholds WPA/WPA2 Security. Adafruit IO header documents contains APIs to fixed with a server. A server contains a limit of 8 feeds. This framework processes

Chinese company Expressive Systems, and it is widely used by hobbyists, makers, and professional developers alike.

The ESP8266 includes a 32-bit microcontroller, a Wi-Fi transceiver, and various other components on a single chip. It supports the IEEE 802.11b/g/n Wi-Fi standards and operates in the 2.4 GHz frequency band. The module can function as a standalone device or can be used as a slave module with a host MCU.

One of the main advantages of the ESP8266 is its low cost and small size, which make it an attractive option for low-power, connected devices. It is also highly customizable, with a rich set of features that can be configured via software.

The ESP8266 has a wide range of applications, including home automation, sensor networks, smart agriculture, and industrial automation. It is also widely used in DIY electronics projects, and there are many online resources available for learning how to program and use the module.

Overall, the ESP8266 Wi-Fi module is a powerful and versatile tool for adding Wi-Fi connectivity to embedded devices and IoT applications.

SENSORS

A sensor is a device that detects and responds to some type of input from the physical environment. The input can be light, heat, motion, moisture, pressure, or any number of other environmental phenomena. In our undertaking, sensors assume a significant part in distinguishing the dampness content in the field, estimating the moistness content in the environment, estimating the water content of the field, for recognizing the excess voltage in the outer battery. Moreover, every sensor is committed for each reason. The sensors are touchy in nature.

MOISTURE SENSOR

As shown in Fig 4.6, moisture sensors are a vital component of modern irrigation systems that help to optimize water usage and improve crop yields. These sensors are designed to detect the moisture level of the soil and provide feedback to the irrigation system's control system or microcontroller. By monitoring soil moisture levels, the moisture sensor can help to regulate water flow, ensuring that crops receive the appropriate amount of water without wasting water resources. In an irrigation system, moisture sensors are typically placed at various depths in the soil

to monitor moisture levels across different layers. These sensors can use a variety of technologies, including capacitance, resistance, or time domain reflectometry, to measure soil moisture levels accurately. Once the moisture level is measured, the sensor provides feedback to the control system, which can then determine whether to activate the irrigation system's pump or valve.

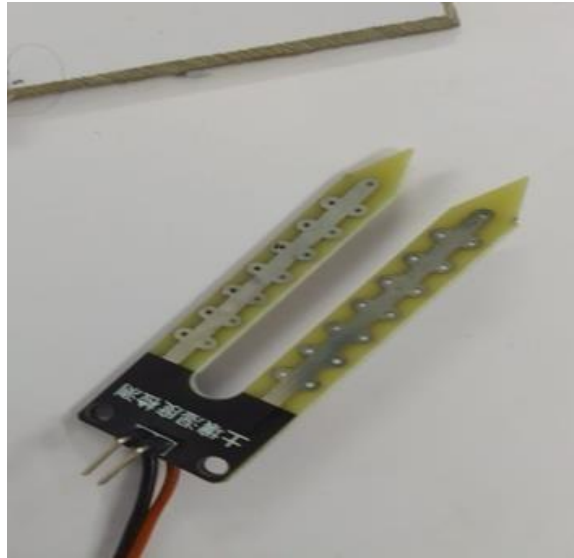


Fig 4.6: Soil moisture sensor

The feedback from the moisture sensor is critical for optimizing water usage and improving crop yields. By providing real-time information about soil moisture levels, the control system can adjust the water flow rate, duration, and timing. For example, if the moisture level is too low, the control system can activate the irrigation system's pump or valve to increase water flow. Conversely, if the moisture level is too high, the control system can reduce water flow to prevent waterlogging or other issues. Using moisture sensors in an irrigation system has several benefits. Firstly, it helps to ensure that crops receive the appropriate amount of water, which can improve crop yields and reduce water waste. Secondly, it helps to conserve water resources by preventing over-irrigation or unnecessary watering. Finally, it can reduce the risk of soil erosion, nutrient leaching, and other issues associated with excessive water use.

In conclusion, moisture sensors are a crucial component of modern irrigation systems. By monitoring soil moisture levels and providing feedback to the control system, they help to optimize water usage and improve crop yields while conserving

water resources. Their ability to detect soil moisture levels accurately and make real-time adjustments to water flow rates is critical for achieving sustainable and efficient irrigation practices.

Reactivity: it is characterized as the capacity to respond to the framework and give deliberate information to the client.

Strength: It is characterized as the head of working of the sensor in the open-air climate.

This framework is built utilizing the LM393 dampness sensor. his dampness sensor is comprised of a discovery test and sensor working board. It gives different result modes like computerized, simple, what is more, sequential. The sensor will gauge the dampness content of the dirt around it. The capacity of the dampness sensor discovery is around 1 sq. ft. On the off chance that the recognized dampness content is low, the module shows the result through the microcontroller by moving the information through yield pins. This dampness sensor deals with the rule that it passes the current to the dirt through the two tests accessible in it, and the dampness content is identified by ascertaining the distinction of the obstruction levels accessible between the two tests. The water accessible in the land assumes an imperative part in the working of the dampness sensor, when the field or framework comprises the water content, the power is directed effectively through the field and the discovery of dampness is done simpler whereas in the dry field the obstruction of the field or framework increments. The point of our dampness sensor is to screen ceaseless varieties in surface dampness content over the long run. The progressions in surface dampness produce results in the water balance and re-energize of groundwater.

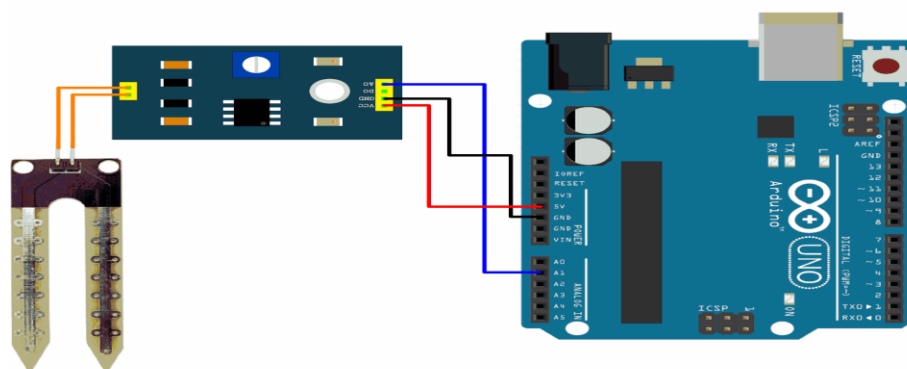


Fig 4.7 :Circuit of soil moisture sensors

VOLTAGE SENSORS

As shown in Fig 4.8 ,it is an electrical sensor that detects the voltage in the outside battery. It comprises of two terminals info and result. It straightforwardly faculties the worth and showcases the voltage level in LCD show. The yield is in a simple arrangement. The ADC converter in MC changes the simple sign-over completely to advanced which is reasonable by the microcontroller. As per the dependence of the channel or battery, the voltage sensor gives the voltage. The voltage sensor recognizes the battery input and delivers the yield voltage by moving the resulting voltage worth to the microcontroller.

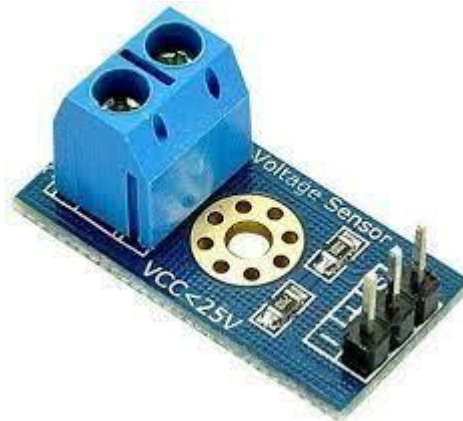


Fig 4.8: voltage sensors

Voltage sensors are an important component of modern irrigation systems, particularly those that rely on sensors to monitor soil moisture levels, temperature, humidity, and other parameters. The purpose of a voltage sensor is to detect the voltage level of a power supply and provide feedback to a control system or microcontroller. By monitoring the voltage level, the voltage sensor can help to regulate the power supply and ensure that all sensors receive the essential power they need to function properly.

In an irrigation system, voltage sensors can be used to monitor the voltage level of the power supply that provides essential power to all sensors. This is particularly important in systems that rely on battery power or solar panels, which may have variable output levels depending on weather conditions or other factors. By monitoring the voltage level, the voltage sensor can provide feedback to the control

system, which can then adjust the power supply to ensure that all sensors receive the necessary power.

Voltage sensors can also be used to detect voltage spikes or drops, which can be indicative of problems in the power supply or other components of the irrigation system. For example, a voltage drop may indicate a loose connection or damaged wiring, while a voltage spike may indicate a malfunctioning component. By detecting these issues early, the voltage sensor can help to prevent damage to the system and ensure that it continues to operate effectively. One of the advantages of using voltage sensors in an irrigation system is that they can be easily integrated with other sensors and digital devices. By providing feedback on the voltage level of the power supply, voltage sensors can help to optimize the performance of the entire system, ensuring that all sensors and equipment receive the necessary power to function effectively.

Overall, voltage sensors are an essential component of modern irrigation systems. By monitoring the voltage level of the power supply and providing feedback to the control system, they help to regulate the power supply and ensure that all sensors receive the necessary power to function effectively. By detecting voltage spikes and drops, they can also help to prevent damage to the system and ensure that it operates reliably over the long term.

DC MOTORS

As shown in Fig 4.9, the functioning standard of a DC engine is to switch the electrical energy over completely to mechanical energy. In this framework, the DC engine consumes the electrical energy from the power supply and converts it to mechanical work by siphoning the water from the outside tank to the field. The primary utilization of the DC engine is utilized for speed control and burden qualities as indicated by the framework. The primary benefit of the DC engine is the simple controllability and exact result so the use of the DC engine is huge for business reasons. The speed control of a DC engine is significant so it is expected to satisfy all the necessities of a DC motor. At the point when the DC engine is on, it requires a specific investment to reach the max throttle.



FIG 4.9: DC MOTOR

DC (direct current) motors are commonly used in irrigation systems to pump water from a source, such as a well or a reservoir, into the fields or tanks. A DC motor operates by converting electrical energy from a direct current power supply into mechanical energy, which is used to drive a pump or other equipment.

In an irrigation system, DC motors are typically used to drive centrifugal pumps, which are commonly used to move water through the system. Centrifugal pumps work by creating a rotating motion, which creates a flow of water through the pump. The DC motor provides the necessary torque and speed to drive the pump and move water through the system. One of the advantages of using DC motors in an irrigation system is that they are highly efficient. DC motors have a high power-to-weight ratio, which means they can provide a lot of power relative to their size and weight. This makes them well-suited for use in irrigation systems, where space and weight are often at a premium.

Another advantage of using DC motors in an irrigation system is that they can be easily controlled. By varying the voltage or current supplied to the motor, the speed and torque can be adjusted to suit the specific requirements of the system. This allows for precise control over the flow of water through the system, which can help to optimize water use and improve crop yields. In addition to pumping water into the

fields, DC motors can also be used to pump water into tanks or storage reservoirs. This is particularly useful for irrigation systems that rely on rainwater harvesting or other sources of water storage. By using a DC motor to pump water into the storage tank, farmers can ensure a steady supply of water for their crops or plants, even during periods of low rainfall.

Overall, DC motors are an important component of modern irrigation systems. By providing the necessary power and control to drive pumps and other equipment, they help to ensure that water is delivered efficiently and effectively to crops or plants.

BUZZER

As shown in Fig 4.10, a buzzer is an electrical device that produces a loud, distinctive sound. It is commonly used as an alarm or warning signal in various applications, including irrigation systems. In irrigation systems, a buzzer is often used as a safety device to alert individuals of potential danger. Irrigation systems are designed to provide water to crops or plants for optimal growth and yield. These systems use pumps, valves, and pipes to distribute water throughout the fields. However, these components can malfunction or fail, which can result in water leaks, flooding, or other hazards. To prevent these hazards, a buzzer can be installed in the irrigation system to alert individuals of any issues.



FIG 4.10: BUZZER

When a malfunction or hazard occurs in the irrigation system, the buzzer is triggered, producing a loud sound. This sound serves as a warning signal for individuals to take action and address the issue. For example, if a valve fails and water begins to overflow, the buzzer will sound, alerting individuals to the issue so they can shut off the valve and prevent further damage. In addition to preventing hazards, a buzzer can also help individuals identify and address issues more quickly. By sounding an alarm as soon as a problem occurs, individuals can respond promptly and prevent further damage. This can help to minimize downtime and ensure that the irrigation system continues to function properly.

Overall, a buzzer is an important safety device in irrigation systems. It serves as a warning signal for individuals to address issues and prevent hazards and can help to minimize downtime and ensure that the system continues to function properly.

IOT PAGE

IoT-based sun oriented fuelled brilliant water system frameworks utilize a blend of innovations to mechanize and streamline the water system process in horticultural fields. These frameworks normally comprise of sensors, regulators, web availability, and sunlight-based power parts. The sensors are put in the dirt to gauge key boundaries like dampness, temperature, and stickiness. The information gathered from these sensors is then sent to a focal control unit, which utilizes it to decide the ideal water system plan.

The focal control unit might be a nearby PC or a cloud-based stage that can be gotten to from a distance. The control unit investigates the information got from the sensors and chooses when to turn on and off the water system framework. It might likewise change the water system plan in view of weather patterns or different elements. The water system framework itself is fuelled by sun-powered energy, which is produced by a sun-powered charger that is normally introduced on or close to the water system framework. The sun-powered charger changes over daylight into power, which is then put away in a battery for some time in the future.

At the point when the focal control unit verifies that the water system is required, it conveys a message to the water system framework's regulator to turn on the water siphon. The water is then conveyed to the plants through an organization of lines and sprinklers. One of the vital advantages of an IoT-based sun-oriented fuelled

shrewd water system framework is its capacity to change the water system plan for continuous considering changing ecological circumstances. This guarantees that the plants get the ideal measure of water with flawless timing, which can prompt superior harvest yields and decreased water use.

Generally speaking, the working of an IoT-based sun oriented fuelled shrewd water system framework includes the utilization of sensors, regulators, and sun oriented power parts to computerize and upgrade the water system process in agrarian fields. The framework's capacity to change the water system plan in view of changing ecological circumstances makes it a promising innovation for working on horticultural proficiency and manageability.

Notwithstanding the parts referenced over, an IoT-based sun oriented fuelled savvy water system framework may likewise incorporate a UI for ranchers to screen and control the framework. This can be gotten to through a cell phone application or online interface, which permits ranchers to see information from the sensors, change the water system plan, and get cautions or notices about the framework's presentation.

Also, these frameworks can be incorporated with different advances, for example, weather conditions gauging, crop demonstrating, and prescient examination to additionally upgrade the water system process. For instance, by consolidating climate information with soil dampness information, the framework can change the water system timetable to represent impending precipitation or other climate occasions. One more benefit of IoT-based sun oriented controlled brilliant water system frameworks is their capacity to diminish the requirement for difficult work. Customarily, ranchers have needed to genuinely investigate their fields to decide when water system is required and physically work the water system framework. With a shrewd water system framework, this cycle is mechanized, saving ranchers' time and decreasing the gamble of human mistake.

At last, the utilization of sun-based ability to create energy diminishes the framework's dependence on non-environmentally friendly power sources, making it more reasonable and financially savvy in the long haul. By and large, the working of an IoT-based sun oriented fuelled savvy water system framework includes the joining of sensors, regulators, web network, and sun-oriented power parts to

robotize and advance the water system process in horticultural fields. The framework's capacity to change the water system plan for continuous in view of changing ecological circumstances, diminish difficult work, and utilize environmentally friendly power makes it a promising innovation for working on horticultural productivity and maintainability.

Work Breakdown Structure

As illustrated on Fig 4.11 , it shows the work breakdown structure for the development of the Solar-Powered Smart Irrigation System. It consists of seven main phases and its sub-activities.

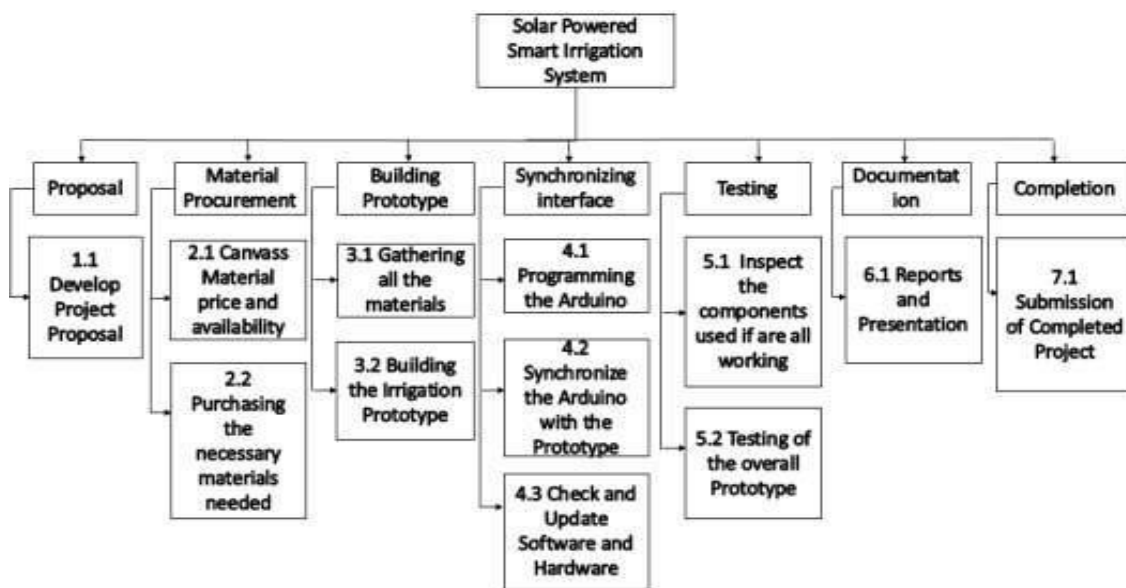


Fig 4.11: Work break down structure

The various components of the system, including the PIC microcontroller, moisture sensor, temperature sensor, level sensor, and voltage sensor, are interconnected. The moisture sensor is inserted into the soil, while the temperature sensor is placed in the air, and the level sensor is installed at a desired height above the field. The voltage sensor is connected to the battery, which is also referred to as the battery feedback sensor. The IoT module is responsible for collecting and transmitting the data from the sensors and the field to a web application developed using ADAFRUIT IO.

The system is powered by three different components, namely a solar panel (for solar energy), a transformer, and a battery (for electrical energy). The LCD display in the PIC microcontroller helps analyze the field's condition in person.

The system's main power supply is 230V AC, which is converted to 15V DC through transformer circuits. The PIC microcontroller operates on 5V DC. When the moisture sensor sends the field data to the microcontroller, the microcontroller analyses the data and determines whether to turn the DC motor on or off. If the moisture level falls below a specific value, the motor is activated. If the water level reaches the level sensor float, it triggers another DC motor that extracts excess water from the field.

The aim of this project is to improve the overall efficiency and sustainability that utilizes clean energy and technological innovation. The revamping of IoT in agricultural business, it will create a strategic and well-managed irrigation practice. This may result in good environmental outcomes and overcome perceived climate intensification issues.

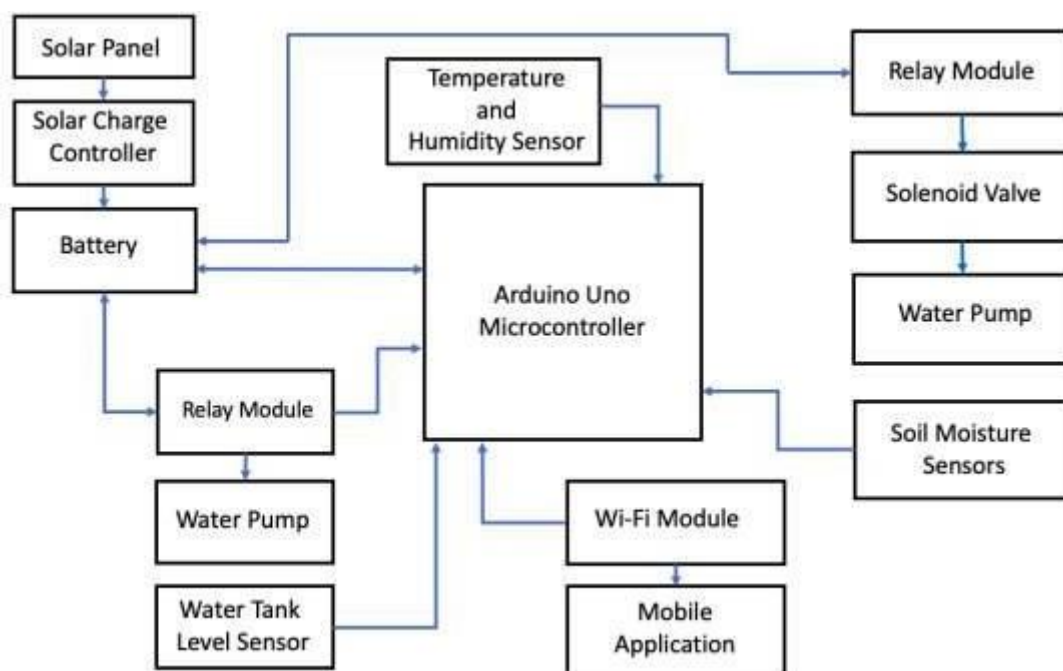


Fig 4.12 : SCHEMATIC DIAGRAM

Based on Figure 4.12, represents the flow chart of how the irrigation system works. It starts with the mobile app initialization of the user and powering on the main controller of the system. Various sensors will acquire data from the temperature and humidity sensor, moisture sensor, and water tank level sensor. For the water pumps to work, set point values have been established within threshold limits. The acquired data will be sent to the mobile application for the user to remotely monitor the system via the Wi-Fi module.

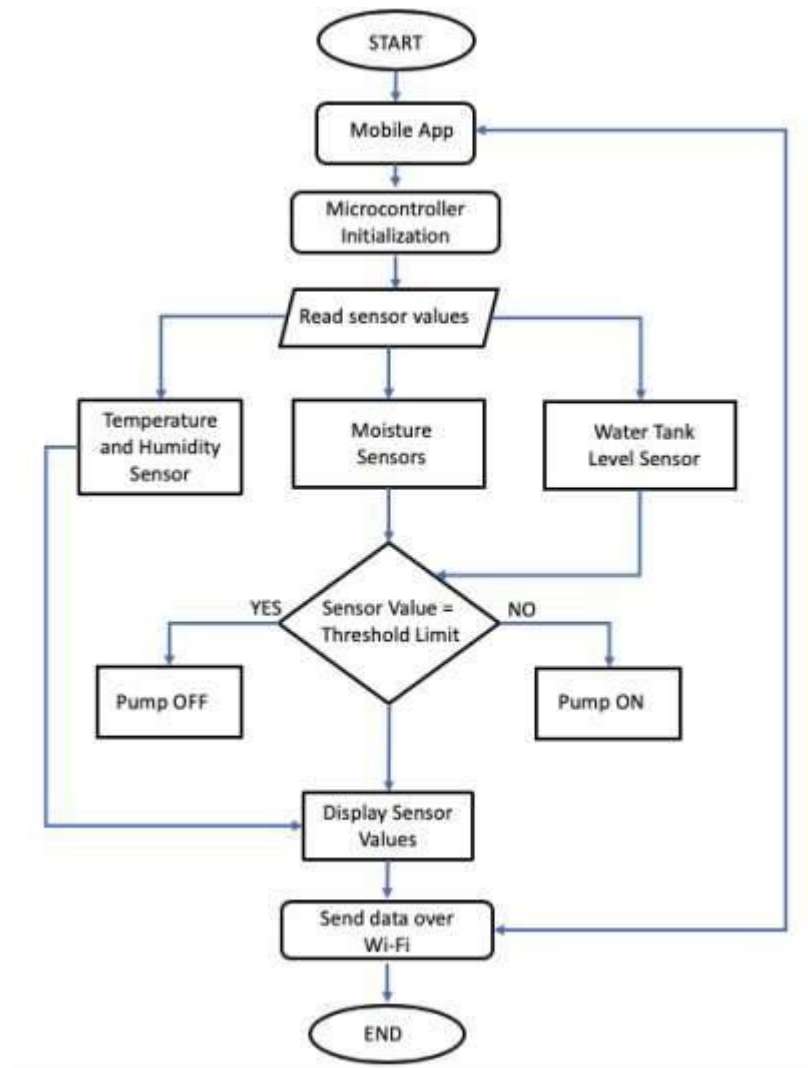


FIG: 4.13 Flow chart of irrigation system

PROJECT IMPLEMENTATION

As shown in Fig 4.14, it is clear from the description that the solar-powered smart irrigation system uses an Arduino Uno microcontroller as the main component. The

system is powered by photovoltaic cells and a battery. Once the power supply is connected, the microcontroller system initializes all the connected devices, including sensors, relays, the water pump, and the wireless module.

The system uses sensors to collect data on temperature, humidity, soil moisture, and tank storage capacity level. This data is wirelessly transmitted to a mobile application interface, where it is displayed for the user.

The sensor measures the temperature and humidity of the area where the system is located. The irrigation process is initiated when the soil moisture sensor detects a moisture level below the set threshold limit of 30%-55%. If the moisture content is below this threshold, the microcontroller triggers the relays to activate the valves and switch on the water pump. This allows water to flow into the soil until the desired moisture content is reached.

Once the desired moisture level is reached, the microcontroller signals the relay to stop, and the valves switch off. The system then displays the acquired data, including the state of the valves (open or closed), on the mobile application interface.

Overall, the solar-powered smart irrigation system provides an automated and efficient way to irrigate plants, while also conserving water resources by ensuring that water is only used when necessary.

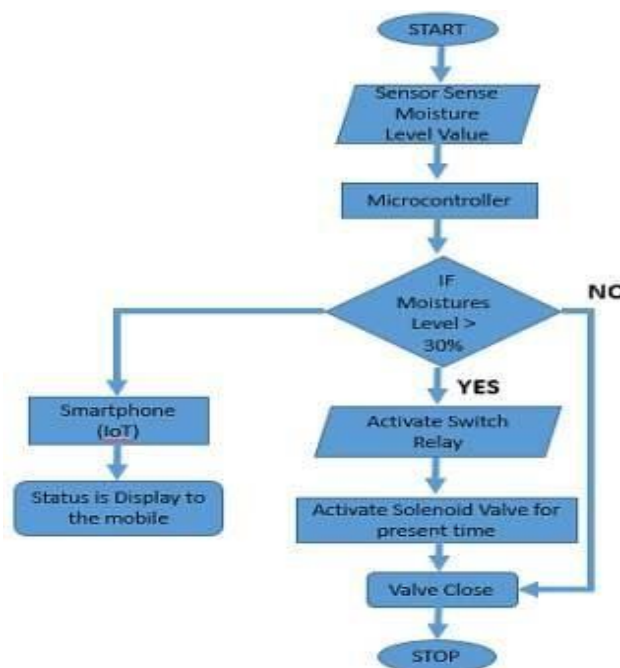


Fig 4.14: IOT system

SOLAR PANEL

As shown in Fig 4.15, simple to-computerized converters (ADCs) are a part that is fundamental in signal handling units, for example, portable interchanges, radar, and satellite communications. DC switches simple signs over completely to a digitalized structure by changing over the information. Simple to-computerized converters (ADCs) are a circuit that assists with changing over the information procured from a human unmistakable structure to a PC conspicuous structure. The restrictions of ADCs not entirely settled by the capacity of the incorporated circuit (IC) process.

Solar panels are a form of renewable energy technology that is increasingly being used in irrigation systems to power water pumps, valves, and other equipment. A solar panel is a device that converts sunlight into electricity through a process called the photovoltaic effect. When sunlight hits the solar panel, it generates an electric current that can be used to power various devices.

In an irrigation system, solar panels are often used to power water pumps, which are essential for delivering water to crops or plants. Solar panels are particularly useful in remote areas where there is no access to grid electricity. By using solar panels, farmers can save money on energy costs and reduce their dependence on non-renewable sources of energy. One of the advantages of using solar panels in an irrigation system is that they require minimal maintenance. Once installed, solar panels can generate electricity for up to 25 years with minimal maintenance. This makes them a cost-effective and reliable source of energy for farmers.

Another advantage of using solar panels in an irrigation system is that they are environmentally friendly. Solar energy is a clean, renewable source of energy that does not produce greenhouse gas emissions or other pollutants. By using solar panels to power their irrigation systems, farmers can reduce their carbon footprint and contribute to a more sustainable future. Finally, using solar panels in an irrigation system can improve the reliability of the system. Solar panels are designed to work even in low-light conditions and can continue to generate electricity even during cloudy or overcast days. This means that even in the event of a power outage, the irrigation system can continue to function and deliver water to crops or plants.

Overall, solar panels are a useful and effective source of energy for irrigation systems. They are cost-effective, environmentally friendly, and reliable, making them an attractive option for farmers who want to reduce their energy costs and improve the sustainability of their operations.



Fig 4.15: SOLAR PANEL

CHAPTER 5

RESULTS AND DISCUSSION

The proposed plan is straightforwardly associated with the ADAFRUIT IO server through the IoT Wi-Fi Module which is arranged in the framework to send the field values from the plan to the server. With the assistance of information detected from the field utilizing the accompanying sensors {Temperature sensor, Level Sensor, Moisture sensor, Voltage Sensor}, the information is organized in the page planned. The temperature sensors distinguish the temperature in the field and show on the site page in the unit of Degrees Celsius. The Moisture Sensor Analysis the water content present in the field in a constant way and it is associated with the IoT and shows the worth of dampness in the deliberate worth in the ADC esteem. The other sensor framework that is demonstrated in the framework is the Voltage Sensor, it recognizes the voltage that is put away in the outer battery circuit where the sunlight-powered charger is associated, and the voltage sensor estimated esteem is addressed in the unit of Volts. The Designed IoT Webpage that is made utilizing ADAFRUIT IO is shown with the detected values and the functioning status of engines. As a result of the utilization of IoT right now, there is an enormous extension for future work that can include present-day gadgets and sensors without the dread of similarity. The adaptability of this framework is its uniqueness. Adding more sensors, it can gauge AC voltage and flow yield, power utilization of burden, and sun-based irradiance, and compare the yield of the observing and control to improve conventional solar-based electrical vehicle framework for converter plan and the reception of reasonable Maximum Power Point Tracking (MPPT) strategies.

CHAPTER 6

CONCLUSION

In the typical water system design, the water wastage is high since it is done physically. This proposed framework comprises the benefit of both physically worked as well as programmed water system design, which clears the way for the expanded yield. The additional benefit of this framework is that the framework does not permit the stale water to remain inside the field, breaking down the expected water level for each yield. The course of an overabundance of water expulsion from the field is finished utilizing the extra siphon associated with the framework. The productivity of this framework is expanded and contrasted with the current framework accessible. The parts used in this framework is cost productive. In this paper, the design and implementation of a smart irrigation system, powered by solar energy were presented. The design uses an automatic irrigation system that can be tailored to the type of food crop being grown.

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