iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** V **Month of publication:** May 2020

DOI: http://doi.org/10.22214/ijraset.2020.5285

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue V May 2020- Available at www.ijraset.com

IOT based Irrigation Monitoring

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Abstract: ***Agriculture has a major impact on economy of the country. India's population is growing rapidly, in parallel to that irrigation area is also decreasing. In order to fulfill the needs, farmers need to grow high quantity of crops with optimum investment. Farmers cannot fulfill this objective with traditional methods of irrigation, thus to overcome this problem we implement Smart Irrigation technique to enhance the growth of crop water management using different sensors. Cost effective solar power can be the solution for all our energy needs. Important aspect of the project is to bring updated farming facilities using IoT.***
Keywords: IoT, Solar power, Smart Irrigation.

I. INTRODUCTION

Agriculture has become main economy and essential need in India. Nowadays population is increasing day by day, hence demand for food also increasing but due to lack of smart knowledge farmers were not able to reach the target because of traditional methods, shortage of water and electricity. By considering all these problems in recent days modern techniques can be implemented to cultivate the high quality and quantity crops within short period by continuous monitoring of crops and by providing proper supply of water and electricity. Where storing of energy plays a vital role hence can be done by the form of renewable i.e. solar energy for the production of electricity which helps out the former to store energy and can utilize it based on requirements. The improper supply of water also lead to crop failure hence continuous monitoring of crop is essential which can be achieved by smart method with help of sensors and controller.



Figure 1: Smart Irrigation

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Where sensor detects the percentage of moisture and temperature content in crop and relays the controller about sensor value, in turn controller compares the sensor value with preset value and stores the data to cloud with help of IoT and intimates the message to the user android application when values exceed and based on sensor value controller controls the opening and closing of pump automatically, and feeds the required amount of water to the crop. By adapting smart irrigation farmer can reach the needs of a country as well as economy. IoT is an internet of things is nothing but communicating device by using internet which stores all information of sensors to cloud where it can be easily accessed. Cloud is not limit only to store data but also help out in data analysis, gathering and visualization. In IoT data is transmitted from sensors and then can be stored and analyzed by diverse IoT platforms like Blynk, Thinger and Thingspeak.

II. LITERATURE REVIEW

This section discuss about existing system. Design of automatic irrigation system which uses an 8051 series microcontroller which is programmed to receive the input signal of varying moisture condition of the soil through the sensing arrangement. This is achieved by using an op-amp as comparator which acts as interface between the sensing arrangement and the microcontroller. Once the controller receives this signal, it generates an output that drives a relay for operating the water pump. An LCD display is also interfaced to the microcontroller to display status of the soil and water pump [1].Design of smart irrigation technology based on IOT using Raspberry pi. The system can be used to control the water motor automatically and can also monitor the growth of plant by using webcam, and can watch live streaming of farm on mobile phone using suitable application by using Wi-Fi network [2]. To monitor the relative soil moisture at many different location throughout the field to more precisely scheduled irrigation cycle. By using solar energy, we can save the electrical energy. The sensing system is based on feedback control mechanism with microcontroller unit depending upon the varied requirement of different crops we can irrigate our field [3]. Design of solar system to collect maximum solar energy that is converted into electrical energy which in turn is used to power the irrigation system. This system consists of solar powered water pump along with an automatic water flow control using a moisture sensor. The irrigation pump can be controlled by both automatic and manual mode [4].

Developed an automated irrigation using solar power for organic that are geographically isolated. The internet link is provided where access through mobile devices are established. System concentrates on cloud storage and GSM technology to water the crops efficiently [5].

III. PROPOSED SYSTEM

The Node MCU used to monitor the irrigation system with the help of sensors which is used to acquire data of some parameters like soil moisture, temperature and humidity sensor. Based on the input from sensors and light dependent resistor relay module this will in turn drive the water pump. An automatic irrigation is a concept of controlled watering of plants without any manual operations, so as to maintain a water level ideal for its cultivation. For an automatic plant watering system, can adopt various techniques such as time based water pump controlling, by sensing various parameters of the soil and surroundings. Here in this system, watering is done by monitoring the instantaneous level of water content or moisture present in the soil.

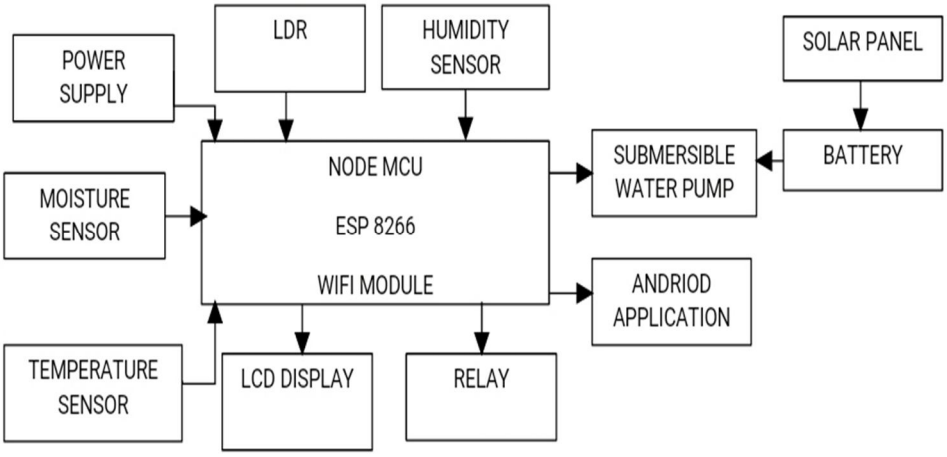


Figure 3: Block Diagram of Smart Irrigation

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Solar Panel is used to harness solar energy which is a renewable source of energy. It is proposed in our system to minimize the utilization of fossil fuels to give power to the water pump which is very expensive and cannot be afforded by farmers. As solar energy is renewable and also inexpensive, it is captured by photovoltaic cells and is transferred to lithium ion battery whenever the intensity of sunlight is more so that it can later be used as alternative power Supply to water pump to irrigate the field. Relay module acts as a Switch, it is used to turn ON/OFF the water pump based on the output of soil moisture sensor and LDR.

Soil Moisture Sensor is used to detect the moisture content present in the soil. If the content is more, then water is not pumped to the field and if the soil is dry water is pumped throughout. The moisture level measuring works with the basic principle of Electrical conductivity of water. A wet soil will have less resistance value than a dry soil. Similarly, a dry soil will have poor electrical conductivity. From this, the corresponding moisture level can be obtained by the sensor module with respect to the electrical conductivity of the soil. Whenever the soil moisture is under the reference moisture condition it displays moisture percentage On LCD display as well as sends a notification to mqtt platform. If there are any abnormalities in the measured parameters it works as programmed. LDR (Light Dependent Resistor) is used to detect the intensity of sunlight during the day time. Arduino UNO is an open source microcontroller board equipped with sets of digital and analog input/output pins that may be interfaced to various other circuits.

IV. HARDWARE DESCRIPTION

This section gives brief description about hardware components

A. Power Supply

A Power supply is an electrical device that supplies electric power to an electrical load. The function of a power supply is to convert electric current from a source to the correct voltage, current and frequency to power the load.

B. Moisture Sensor

Sensor can be used to test the moisture of soil, when the soil is having water shortage, the module output is at high level, and else the output is at low level, by using this sensor one can automatically water crops. Module triple output mode, digital output is simple, analog output more accurate, serial output with exact readings.

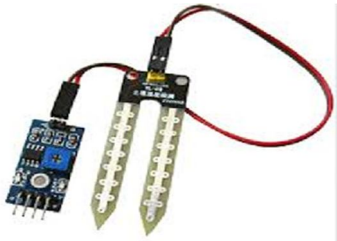


Figure 4: Soil moisture sensor module

C. Temperature And Humidity Sensor DTH 22/11

DHT11 digital temperature and humidity sensor is a composite Sensor contains a calibrated digital signal output of the temperature and humidity. The sensor includes a resistive sense of wet components and an NTC temperature measurement devices, and connected with a high-performance 8-bit microcontroller.

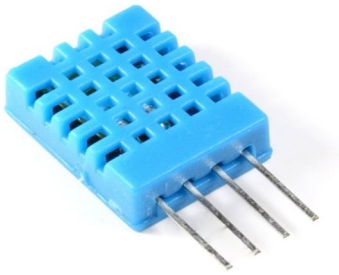


Figure 5: DTH Sensor

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Volume 8 Issue V May 2020- Available at www.ijraset.com

D. LDR

It is basically a photocell that works on the principle of photoconductivity. When light falls on the LDR then the resistance decreases, and increases in the dark. When a LDR is kept in dark place, its resistance is high and, when the LDR is kept in the light its resistance will decrease.

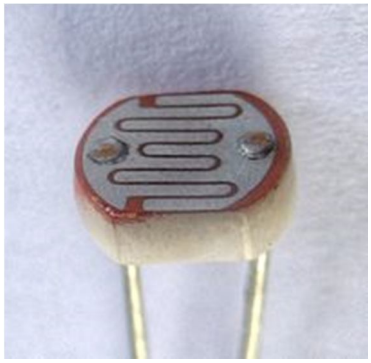


Figure 6: LDR

E. Relay

An electromagnetic relay is basically a switch operated by magnetic force. This magnetic force is generated by flow of current through a coil in the relay. The relay opens or closes a circuit when current is passed through it or stopped through it. A relay has two circuits to make and break first is normally open and the other is normally closed. The relay has a coil which has to be certain voltage to make it energies when it is energized the piston is pushed and connected to the other end when the voltage on the coil is removed it come back to its stage normally open.

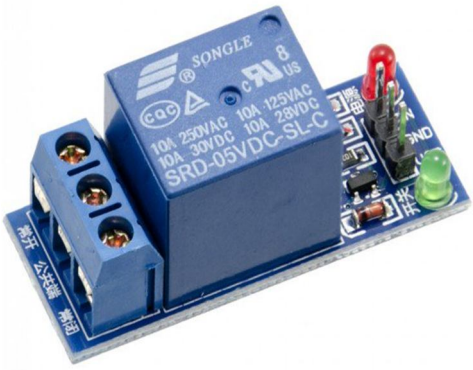


Figure 7: Relay

F. Solar Panel

Used to convert light from the sun, which is composed of particles of energy called photons, into electricity that can be used to power electrical loads.



Figure 8: Solar Panel

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G. Node MCU ESP8266

ESP8266 is an impressive, low cost Wi-Fi module suitable for adding Wi-Fi functionality to an existing microcontroller via a UART serial connection.ESP8266EX has been designed for mobile, wearable electronics and Internet of Things applications with the aim of achieving the lowest power consumption with a combination of several proprietary techniques. The power saving architecture operates mainly in 3 modes: active mode, sleep mode and deep sleep mode.

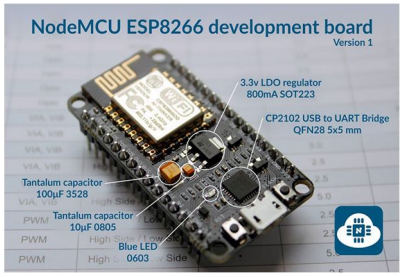


Figure 9: Node MCU

H. Battery

Batteries are collection of one or more cells whose chemical reactions create flow of electrons in a circuit.

I. LCD Display

A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs.



Figure 10: LCD Display

J. Submersible Pump

A submersible pump (or sub pump, electric submersible pump (ESP)) is a device which has a hermetically sealed motor close-coupled to the pump body. The whole assembly is submerged in the fluid to be pumped. The main advantage of this type of pump is that it prevents pump cavitation, a problem associated with a high elevation difference between pump and the fluid surface. Submersible pumps push fluid to the surface as opposed to jet pumps which create a vacuum and rely upon atmospheric pressure. Submersibles are more efficient than jet pumps. Hydraulic submersible pumps (HSP's) use pressurized fluid from the surface to drive a hydraulic motor down hole, rather than an electric motor, and are used in heavy oil applications with heated water as the motive fluid.



Figure 11: Submersible Pump

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V. SOFTWARE DESCRIPTION

This section gives brief description about software requirements

A. Arduino IDE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them. It is also called as sketches. The sketches are written in text editor and saved with file extension .ino. The software also includes libraries, third party hardware and serial monitor.



Figure 11: Arduino Software

B. ADAFRUIT MOTT

It is a protocol for device communication that Adafruit IO supports. Using a MQTT library or client you can publish and subscribe to a feed to send and receive feed data.

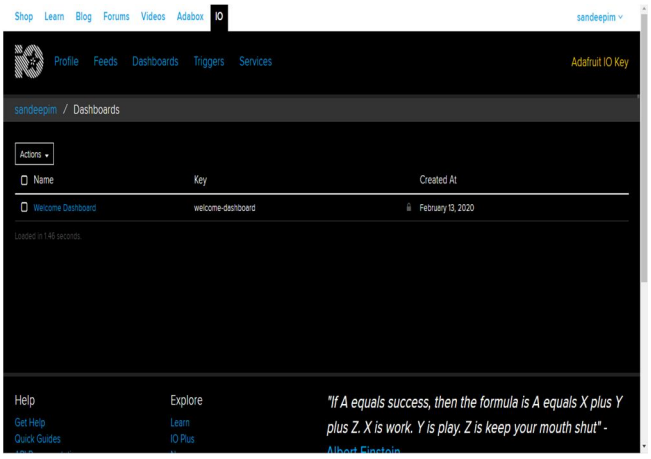


Figure 12: Adafruit MQTT Dashboard

VI. CONCLUSION

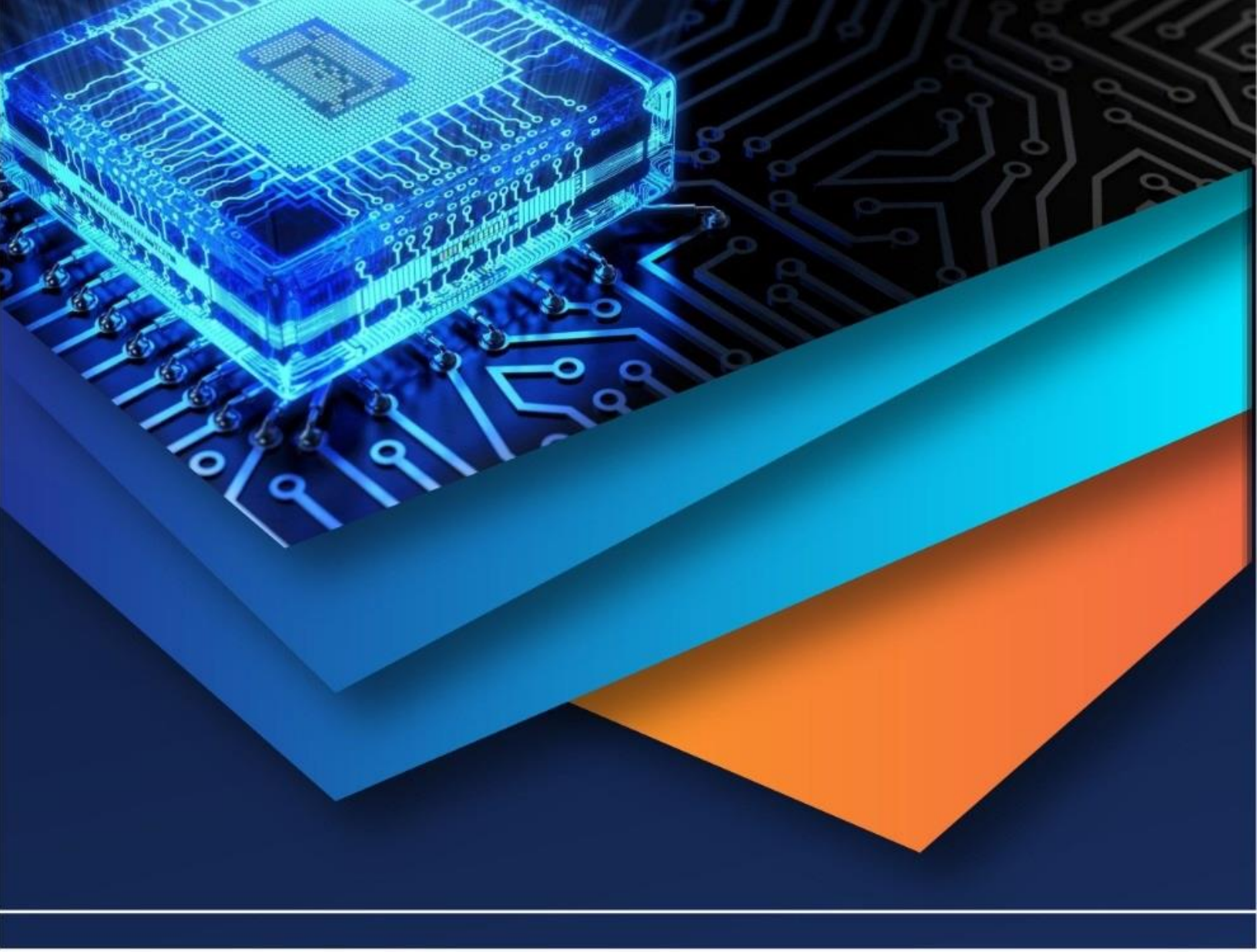
In this paper, the smart technology used it results in reduced usage of water. Non-renewable source of energy that is solar energy is used which will be abundantly available for farmers, In case of power failure or less sunlight then batteries were used as an alternative. Sunlight is detected by Light Dependent Resistor, Based on intensity of sunlight water pump will in turn result in driving circuit required for irrigation. As the system is working based on the soil moisture level, over irrigation for crops can be controlled which helps in increasing the quantity of crops grown.

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