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Solar Based Smart Irrigation System using Internet of Things

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ABSTRACT: Agriculture is the backbone of every country and it has been the most important from the human life. Appropriate atmospheric conditions are necessary for expected plant growth, better crop fields, and proper use of water and other resources. Traditional methods for irrigation such as overhead sprinkler type is not that much efficient. They result in a lot of wastage of water. Automated irrigation system is for conservation of the water and indirectly of the farm. About 85% of total available water resources across the world are used for the irrigation purpose. In upcoming years this demand is likely to increase because of increasing population. In automation system water availability to crop is monitored through sensors and watering is done through the controlled irrigation. The idea is to focus on temperature and soil moisture. This is a Mobile Integrated and smart irrigation system using Internet of things (IoT) based on controlled monitoring system. The main objective of this project is to control the water supply and monitor the plants through a Smartphone. Solar powered smart irrigation systems used to the Indian farmer. This system consists of solar powered water pump along with an automatic water flow control using a moisture sensor. This system conserves electricity by reducing the usage of grid power and conserves water by reducing water losses. In this project laboured work is so less. Due to IoT the data can be accessed from anywhere in the world and the control can be achieved by internet and user will be continuously notified an android app. User can be notify for any change in motor condition atmospheric conditions are necessary for plant growth, better crop fields, and proper use of water and other resources. The objective of this project is to design simplest, ready to install circuit to monitor and analyses the values about soil moisture.

KEYWORDS: Automated irrigation, IoT, Smart agriculture, solar power.

I.INTRODUCTION

Irrigation is an artificial supplying of water to the root of plant. Irrigation has been used to assist in the growing of agricultural crops maintenance of landscapes [1]. This system consists of solar powered water pump along with an automatic water flow control using a moisture sensor [2]. This model is automatic microcontroller based on irrigation system. The system we are using a different sensor this sensor are placed on the continuously sense the water level and give the message to the farmer informing the water level [3] [4]. Without visiting the fields, farmers can get the information about the water level and motor on/off. All system is automatic when water level reaches to the danger level; the motor will automatically start without confirmation of farmer to ensure the proper water level in the site. Automatic operation and All the real time data we can monitor in smart phone and web page also and this system is develop by industry revolution 4.0. This system is use for farmers and this system is very help full to the agriculture nursery [5] [6].

In this paper, agriculture is in the grip of a revolution. Digital information about weather, soil conditions and crop health are already helping modern farmers optimize their harvest fields. So, the Digital agriculture refers to tools that digitally collect store, analyse, and share electronic data and information along the agricultural value chain. This is the definition of digital farming, sometimes known as smart farming or e-agriculture. In digital farming use on-farm technologies, like field mapping, GPS guidance systems, and variable-rate application, fall under the domain of precision agriculture and digital agriculture [5]. Digital technology changes economic activity by lowering the costs of monitoring, transporting, tracking, and searching for data. Due to these falling costs, digital technology will improve efficiency throughout the agricultural value chain.

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In Digital agriculture a wide range of technologies is included, most of which have multiple applications along the agricultural value chain. Those technologies are cloud computing/big data analysis tools, artificial intelligence (AI), Machine learning, distributed ledger technologies, digital communications technologies, automatic section control, advanced imaging.

II. SYSTEM MODEL AND FLOWCHART

This system consists of a solar panel, which is the main source of energy and is given to the charge controller for extracting regulated power from solar panel at different irradiation and also to maintain correct charging voltage and current in order to charge the battery and increase its life. The main working principle behind this system is in connecting the soil moisture sensor, which was previously embedded into the plant, to the Arduino microcontroller, which is also connected to another electronic component. Measurement of soil moisture is done by the sensor which forwards the information and parameters regarding the soil moisture to the microcontroller, which controls the pump. If the level of soil moisture drops below a certain value, the microcontroller sends the signal to the relay module which then runs a pump and certain amount of water is delivered to the plant. Once the enough water is delivered, the pump stops doing its work.

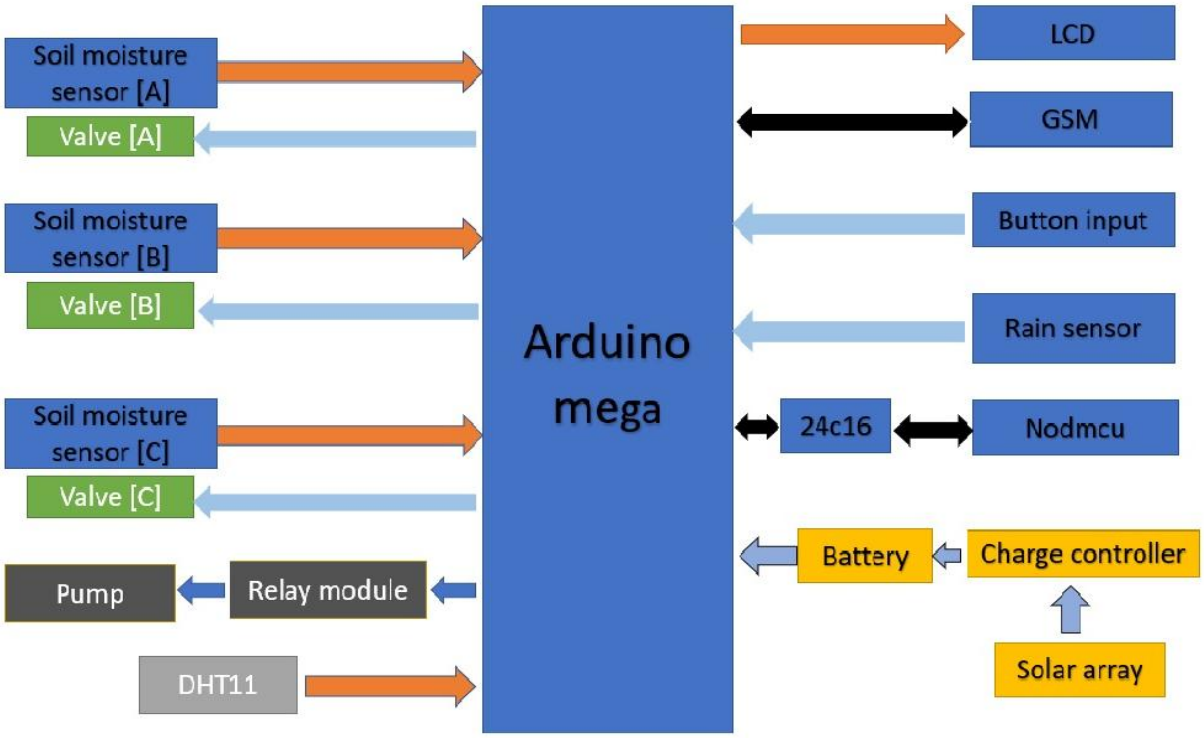

Fig. 1 Block diagram of solar based smart irrigation system

Whenever the soil moisture content values goes down, the sensor senses the humidity change, giving signal to the microcontroller so that the pump can be activated. This concept can be used for automatic plant watering system. This circuit comprises an Arduino MEGA, a soil moisture sensor, a 24V motor pump.

If weather condition is such that it started raining, then the micro-controller will shut down the motor pump till raining. And after that it checks whether the soil moisture sensor has reached the threshold value or not. If it crosses the threshold value then motor pump will remain shut down otherwise it will start again automatically. This helps in saving water resource and electricity. The buck boost converter is used to convert DC to DC power to improve the output power of the solar panel.

Here in project we are connecting GSM module with controller. Sometime the water is come to the night time at that time the call the system and GSM through single generate in controller and motor is on as well as off. And Send a text

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to that mobile number. And we also use Wi-Fi module (node MCU) so all the data of system we can see in smart phone.

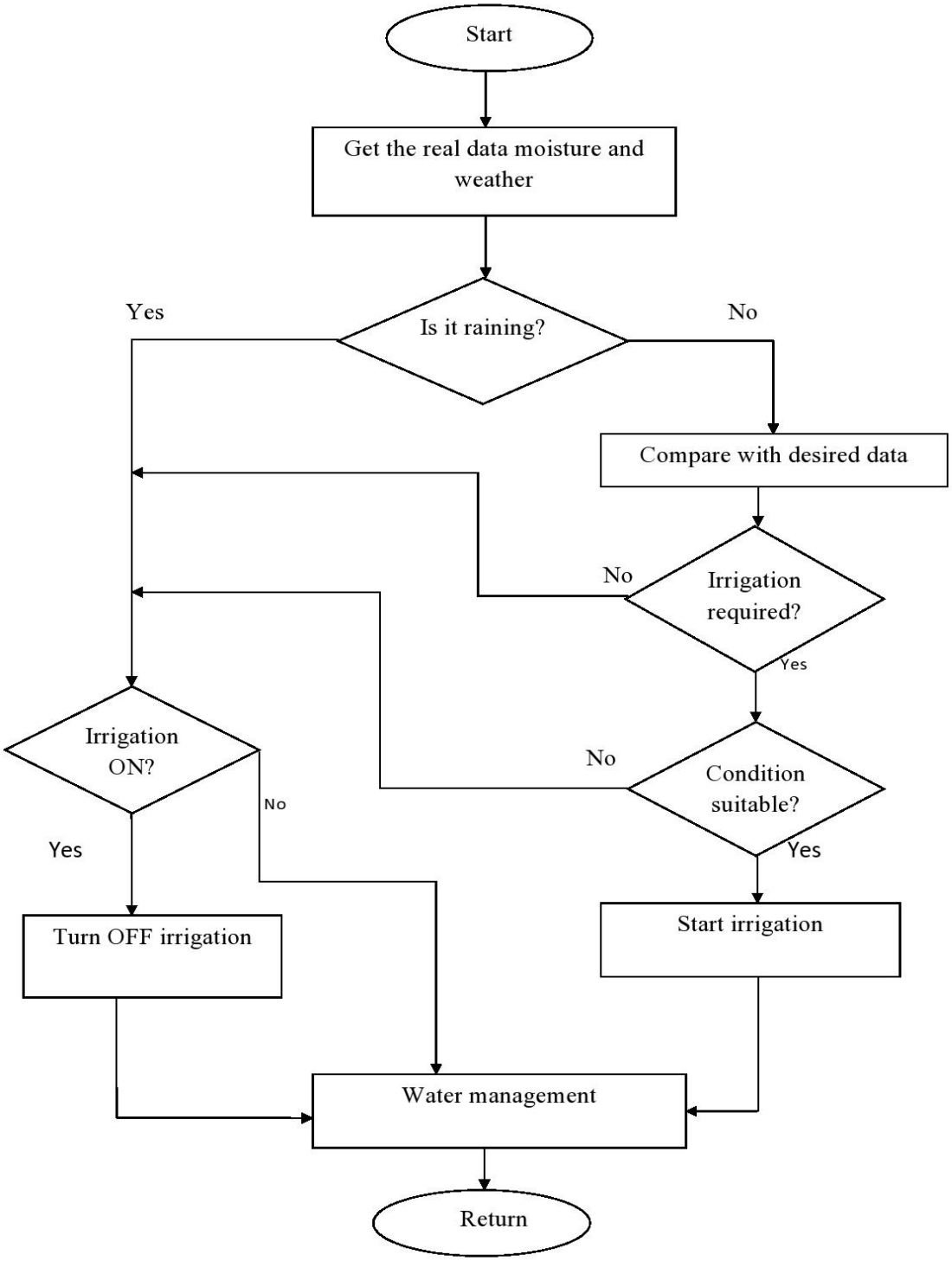

Fig. 2 Flowchart for solar based smart irrigation system

The working of system is that it will collect real data from different sensors connected to the system regarding to moisture and wether condition and check about rain. If the desired data is not match with collected data then identified whether it required irrigation or not. Now if it required the irrigation, turning on the pump and checking the actual data with desired data after some finite interval. If data is match, the system will stop irrigation by turning off pump. In

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rainy day most of time irrigation is not needed but in winter most of time system will turn on and off the irrigation. While in summer it required more water so most of time system is on

III. CIRCUIT DIAGRAM HARDWARE IMPLEMENTATION

For our project we decide to make it cost effective system with renewable energy source. We use solar energy for powering our project and work whole system on it. These panels are designed with solar cells composed of semiconductor materials. The main function of solar panels is convert solar energy into DC electrical energy generally of 12V, which is further used for the rest of the circuit. The number of cells required and their size depends on the rating of the load. The collection of solar cell can be produced maximum electricity. The charge controller is suitable for charging flooded lead acid, gel cell or sealed lead (SLA) and Absorbed Glass met type batteries. The Boost converter charge controller keeps the solar panel current and voltage at the regulated power point while charging the battery. Boost converter helps to maintain the constant output from solar panel to battery.
Node MCU is the Wi-Fi enabled controller which can be programmed by LUA script or Arduino IDE. Node MCU can be used at the place of Arduino as a controller. For IoT application Arduino requires another Wi-Fi module ESP8266 But in Node MCU there is only ESP82666 of module ESP-12E. so we can say that Node MCU is the WI-FI enabled Arduino frequency is 80MHz. it can be powered by two ways, one is by providing the power through the micro-USB cable or second way providing power from Vin pin and GND pin.

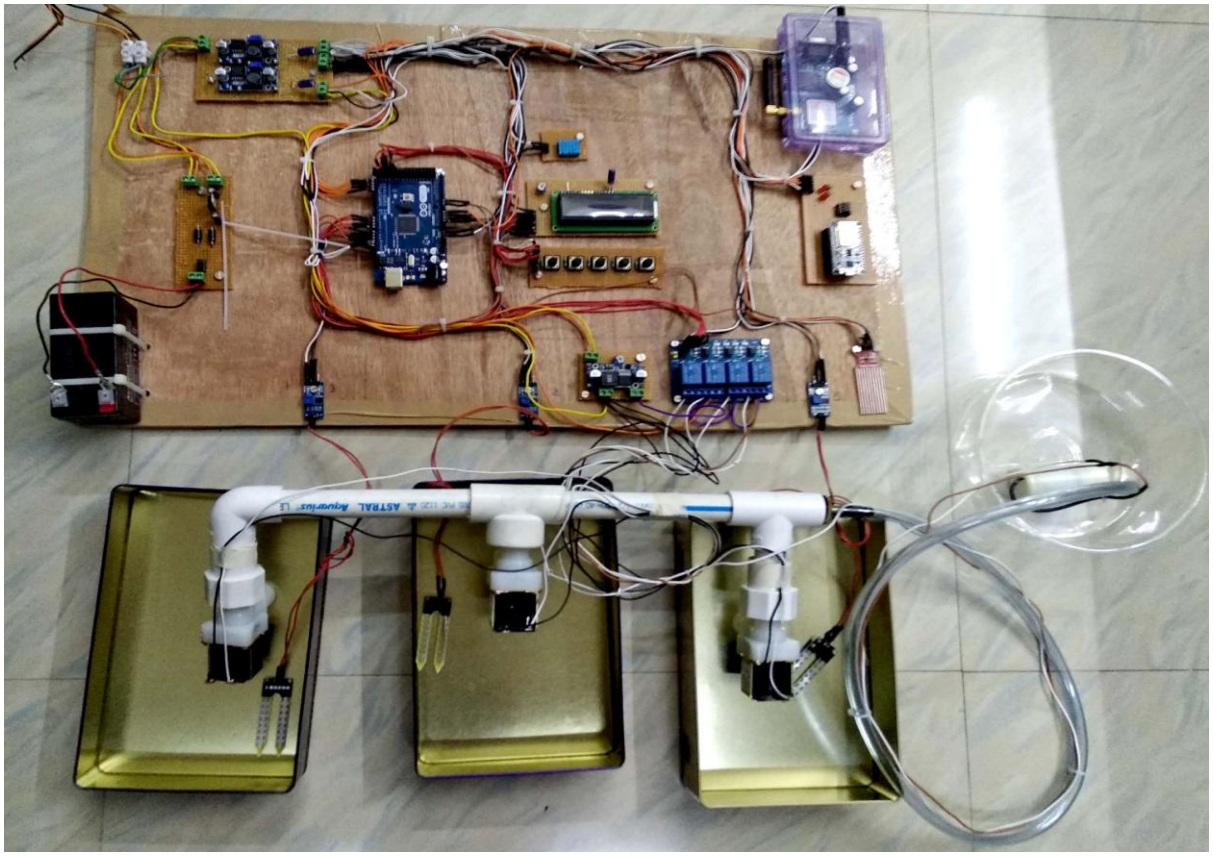

Fig. 3 Hardware of solar based smart irrigation system

The Arduino Mega is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (which 14 pins can be used as PWM outputs), 16 analog inputs, 4 URATs (hardware serial ports), a 16 MHz crystal, a USB connection, a power jack, an 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 AC-to-DC adapter or battery to get started. The mega 2560 R3 also adds SDA and SCL pins next to the AREF. Global System for Mobile is the most popular and widely used digital mobile telephony system in the word. GSM is considered a second generation (2G) cell phone system as both the signaling and speech channels are digital which h differs from the previous technology. Here we are used SIM800a Quad-Band GSM module.

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Soil moisture sensor is used for measuring the water content present in the land. It is simple then removing the land weighing it and compared to get to know how much water particles are present. A normal Soil Moisture Sensor consists of two parts in the sensor. A two leg facility, that will goes in the soil or anywhere where water particles content has to be measured in the land. This has two pins on head which will connect to an Amplifier circuit or Analog to digital circuit which will be in turn connect to the controller. The Amplifier consists of a input pin, Ground pin, Analog as well as Digital Data Pin. So that one can get the value in both forms Analog as well as Digital from the sensor. The relay is also electrically operated device which consists of operating coil. There are two contacts named as NC and NO, which is elaborated as Normally Closed and Normally Open contacts. When there is no supply to the coil there is no change in the contact position. When supply is given to the coil, the contact NO closes and NC opens. It is unchanged until the coil is in energized condition. The DHT11 is a low-cost as well as the basic digital temperature and humidity sensors for Arduino and different controller. It use the capacitive based humidity sensor and a thermistor for measuring the temperature, and gives output in form of digital signal on the output pin. It is generally simple to use, but it requires precise timing for grabbing the data. The only problem of the sensor is that you can get new data from it once every 2 seconds. Comparing to other modules like DHT22, this sensor is lesser precise, lesser accurate and works in a small range of temperature and humidity, but it is smaller as well as less expensive.

V.CONCLUSION

A smart irrigation system is best system that can help to detect and measure, and control the amount of water in the soil accurately because it uses sensors that can detect the plant's water needs and satisfy them. The system is basically to control the amount of water that is supplied to the plants and to ensure each plant has enough water and to protect plants from dying by using a humidity sensor, a temperature sensor, a moister sensor and a timer using renewable energy PV system. The device will work as a control system and sense the rate of water, temperature and humidity of plants as well as to detect wither the plants are dry or how much of water is needed. Its purpose is to save the huge amount of water that goes to waste and to save money. Its goal is to protect plants are dying due to many reasons such as dryness, excessive water and high temperature. The project is accessible, its energy renewable and sustainable, inexpensive and portable, and its components are simple and small. This model is to be implemented for carrying out organic farming in the field areas in colleges. The connectivity will be provided with different fields using the same server. Further it will be extended to other field areas bringing the irrigation under control for a large network. On adding drip and center pivot irrigation technologies would enhance the efficiency of the system. The inventive system will enhance the yield production and improve the economic condition.

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