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RAIN WATER HARVESTING SMART AGRICULTURE ROBOTIC SYSTEM

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Abstract: Scarcity of water has become a predominant problem all over the world. Water plays an important role in agriculture. With majority of the Indian population dependent on farming for their daily needs, it's important to find a solution for scarcity of water. This paper mainly focuses on rain water harvesting. The secondary objective of this paper is to provide farmers with an option of automating the irrigation process by equipping him with a smart IOT network which notifies him about the status of his crop and it also regulates the supply of water to the crops with the help of the per-feed information about the crops to the processor. Sometimes when there is a thunder storm the farmer will have to come out in the storm to stop excess rainwater. We intend to solve this problem using a convertible roof which is controlled by a processor. This will prevent excess rain water from damaging the crops and it will also protect the crops from hailstorms. During these situations the status quo of the crops is sent to the farmer through the internet.

Introduction

Although the major factors that inflict extensive damage to crops have been insects, pests and flooding of rivers, the effect of weather on crop damage has been underestimated and widely ignored by the global community. Ag fax an American agricultural news website reported that they find weather to cause the lion's share of crop loss in every year and every region in the United States . It has been observed that 85% of the overall crop loss was caused due to extreme weathers. Other factors include economic factors (10% of crop loss), natural disasters (2%) and other cause less than 1%. At this point of time, people in India might consider the losses in agriculture caused due to excessive rain fall to be insignificant, but with increase in global warming and increase in acid rain, this problem has the potential to evolve into a crisis. In order to prevent such a devastating effect on crops we have put forward the use of convertible roof in this paper.21st century has seen massive improvements in the field of IOT and automation across varied domains including defense and medicine, but agricultural domain is lacking modern infrastructure and it still depends

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on conventional means for harvest gains. This is one of the major reasons which impedes the economic development of a farmer. Therefore there is a need for IOT infrastructure to be deployed so that farmers can communicate and get to know about the condition of their crop by just scrolling through their phone rather than stepping out and walking long distances to their farm to monitor the crops. In this paper we are using as oil moisture sensor to detect the amount of moisture that is present in the soil. This soil moisture sensor is an analog sensor which contains a per-defined value with which it compares the soil moisture and sends there portback to the processor. The value used to compare depends on the each model of the sensor. The output of sensor is thus used by the processor to control the working the servo motors which in turn controls the convertible roof. This convertible roof performs the functions shielding the crops from extreme weathers. It also performs the function sofrain water harvesting. The convertible roof is placed at a 30degree inclined angle with one end of the roof used to collect the water. This water can further be redirected to a man-made or a natural reservoir and the harvested water can be used as a source of water supply during droughts. During thunderstorms there will be an increase in the water current that flows from convertible roof to there servoir. This current can be increased using pipes with gradually decreasing diameters. This increased current can bet apped in with the use of a turbine. By making the water current flowthrough the turbine electricity can begene rated which in turn can be used to run the processor. In case there is excess production of electricity the farmer can share with agrid network from which he will be economically benefited. This provides a sustainable environment for crop growth. In order to establish a communication line between the system and the user, we use an ESP8266 processor which establishes a connection with mobile phone of the user which is interfaced using the inbuilt Wi-Fi module that is present in the ESP8266processor.

Literature Review

Agriculture sector occupies25.9%of the world employment. The demand for food production is rapidly increasing with the increase of world population. Developing the existing agricultural infrastructure by incorporating modern technologies will help to match this increasing demand. This paper proposes a automated system to optimally control the climate and irrigation in a greenhouse by monitoring temperature, soil moisture, humidity and pH through a cloud connected mobile robot which can detect the unhealthy plants using image processing. A fuzzy controller will control the heating and cooling system, irrigation system and humidifiers installed in the greenhouse based on the sensor readings. The mobile robot navigates through a predefined map of the greenhouse and collect soil samples to perform

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measurements while onboard sensors will collect the ambient climate data. A camera mounted on the mobile robot will capture the plant and detect unhealthy crops based on the color and the texture of the leaves. Index Terms—Cloud Robotics, Smart Agriculture, Internet of Things, Monitoring, Automation. Agriculture is an important and necessary process to sustain the humankind. The techniques are used for agriculture has been developed from ancient time. During industrial revolution in 18th century, there is an huge development in agricultural industry along with other industries. Automation has not efficiently penetrated into greenhouse farming. It is clear that introducing automation into greenhouses and robots into the farming sector will be economical and it will reduce the work load of the farmer. It will also increase the productivity and reduce the amount of human intervention in farming. Greenhouses provide a good and safe environment for the growth of plants, as it protects the plants form harsh weather conditions and most of the external pests. It allows the plants to grow under optimal conditions, which maximizes the growth potential of the plants. Since the water and heat can be retained within a greenhouse, the plants have all necessary conditions to grow all year round. A greenhouse allows the growers to produce plants in places where climate would otherwise be unfeasible for the growing of plants. The production of crop plants is independent of the geographic location and time of the year. A direct example for this situation would be that the climate in Colombo, Sri Lanka is not suitable for the growth of strawberries. This paper presents an image processing-based disease detection system implemented with a mobile robot. The robot has various other measurement capabilities to deliver a wide range of capabilities. This paper only focus on the image processing based disease detection component of the robotic system.

Implementing image processing techniques to detect plant diseases was widely adopted by many researchers conducting research on image processing and machine learning algorithms [4]–[6]. Researchers in [7] has developed a cloud robotics architecture based on ROS which features separate subsystems to sensor manager, robot manager and actuation manager. Multiple researches supports the idea of plant disease detection based on the pictures of the respective plant leaves. Surface texture of the leaves changes due to diseases and this texture is unique to each disease [8], [9]. Some researches indicate that the K-mean clustering algorithm proven to be efficient in disease detection from plant leaves[10].There were several

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researches which developed robotic systems to data acquisition and controlling of farming within greenhouses [11]–[13]. Some of them uses ground robots and some of the muses aerial robots. It has to be noted that the mobile robots could be used with green house automation infrastructure instead of aerial robots. There are systems which have Agriculture is an important and necessary process to sustain the human kind. The techniques are used for agriculture has been developed from ancient time. During industrial revolution in 18th century, there is an huge development in agricultural industry along with other industries. Automation has not efficiently penetrated into greenhouse farming. It is clear that introducing automation into greenhouses and robots into the farming sector will be economica land it will reduce the work load of the farmer. It will also increase the productivity and reduce the amount of human intervention in farming.

Proposed System

In this paper we are using a soil moisture sensor to detect the amount of moisture that is present in the soil. This soil moisture sensor is an analog sensor which contains a pre-defined value with which it compares the soil moisture and sends the report back to the microcontroller. The value used to compare depends on each model of the sensor. The output of sensor is thus used by the microcontroller to control the working the servo motors which in turn controls the convertible roof. This convertible roof performs the functions shielding the crops from extreme weathers. It also performs the functions of rain water harvesting. The convertible roof is placed at a 30 degree inclined angle with one end of the roof used to collect the water. This water can further be redirected to a man-made or a natural reservoir and the harvested water can be used as as our ceo of water supply during droughts.

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Block Diagram

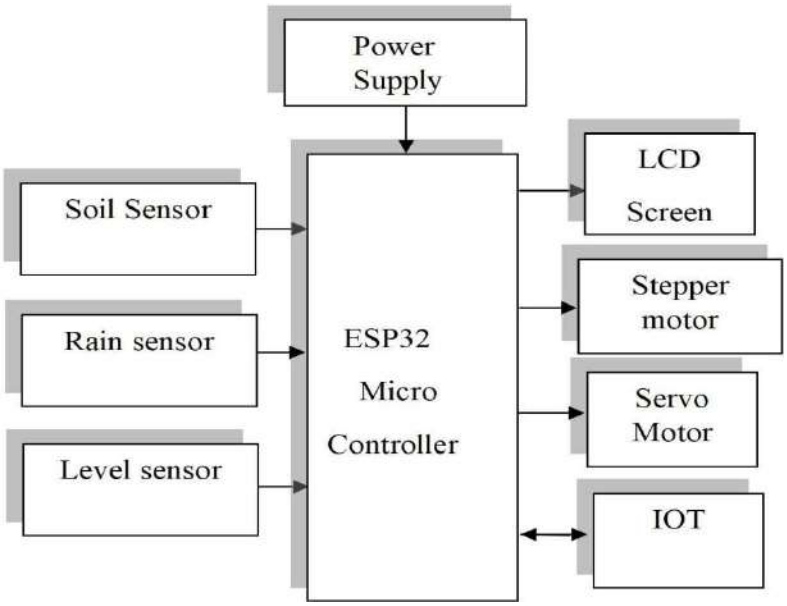

Figure 1. Block Diagram Of Rain Water Harvesting Smart Agriculture Robotic System.

Hardware Components

Power Supply

The power supply section is the section which provides +5V for the components to work. IC LM7805 is used for providing a constant power of +5V.The ac voltage, typically 220V, is connected to a transformer, which steps down the ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripples and also retains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes.

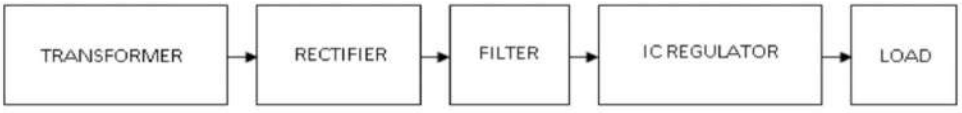

Figure 2. Block diagram of power supply

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Esp32 Module

The ESP32 module is a low-cost, low-power system-on-chip (SoC) microcontroller with integrated Wi-Fi and Bluetooth capabilities. It is manufactured by Espressif Systems, and is designed for use in a variety of applications, including Internet of Things (IoT) devices, wearable electronics, and other embedded systems. The ESP32 module features dual-core processors running at up to 240 MHz, as well as a variety of built-in peripherals, including touch sensors, analog-to-digital converters, and pulse width modulation (PWM) controllers. It also includes support for a wide range of communication protocols, including Wi-Fi, Bluetooth, and Ethernet.

Figure 3. Esp32 Module

LCD (liquid crystal display)

The most commonly used Character based LCDs are based on Hitachi's HD44780 controller or other which are compatible with HD44580. The most commonly used LCDs found in the market today are 1 Line, 2 Line or 4 Line LCDs which have only 1 controller and support at most of 80 charachers, whereas LCDs supporting more than 80 characters make use of 2 HD44780 controllers. Most LCDs with 1 controller has 14 Pins and LCDs with 2 controller has 16 Pins (two pins are extra in both for back-light LED connections).

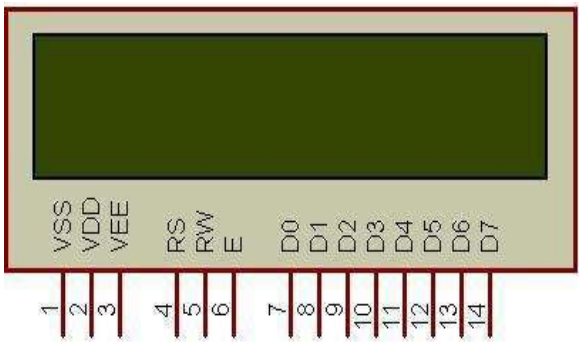

Figure 4.LCDtype HD44780 pin diagram

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SoilSensor

A Soil Moisture Sensor is one kind of low-cost electronic sensor that is used to detect the moisture of the soil. This sensor can measure the volumetric content of water inside the soil. This sensor is consisting of mainly two parts, one is Sensing Probs and another one is the Sensor Module. The probes allow the current to pass through the soil and then it gets the resistance value according to moisture value in soil. The Sensor Module reads data from the sensor probes and processes the data and converts it into a digital/analog output. So, the Soil Moisture Sensor can provide both types of output Digital output(DO)and Analog output(AO).

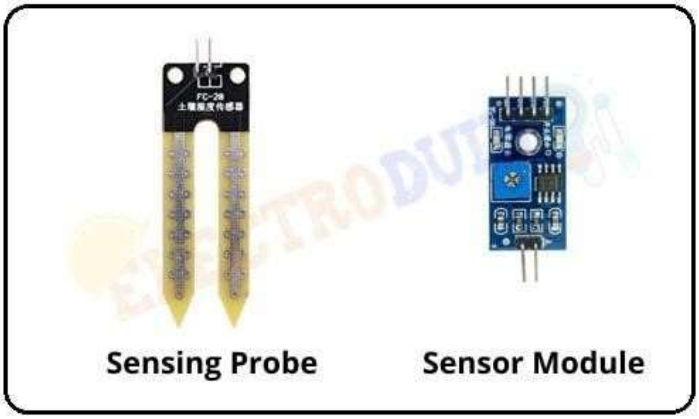

Figure5: SoilSensor

Rainsensor

A sensor that is used to notice the water drops or rainfall is known as a rain sensor. This kind of sensor works like a switch. This sensor includes two parts like sensing pad and a sensor module. Whenever rain falls on the surface of a sensing pad then the sensor module reads the data from the sensor pad to process and convert it into an analog or digital output. So the output generated by this sensor analog (AO)and digital(DO).

Figure 6:RainSensor

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Level Sensor

Level sensors detect the level of liquids and other fluids and fluidized solids, including slurries, granular materials, and powders that exhibit an upper free surface. Substances that flow become essentially horizontal in their containers (or other physical boundaries) because of gravity whereas most bulk solids pile at an angle of repose to a peak. The substance to be measured can be inside a container or can be in its natural form (e.g., a river or a lake). The level measurement can be either continuous or point values. Continuous level sensors measure level within a specified range and determine the exact amount of substance in a certain place.

Figure8: LevelSensor

Stepper Motor

A **stepper motor**, also known as **step motor** or **stepping motor**, is a brushless DC electricmotor that divides a full rotation into several equal steps. The motor's position can be commanded to move and hold at one of these steps without any position sensor for feedback (an open-loop controller), as long as the motor is correctly sized to the application in respect to torque and speed. A step motor can be viewed as a synchronous ACmotor with the number of poles (on both rotor and stator) increased, taking care that they have no common denominator. Additionally both permanent magnets and soft iron cores.

Figure9: Stepper Motor

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Servo Meter

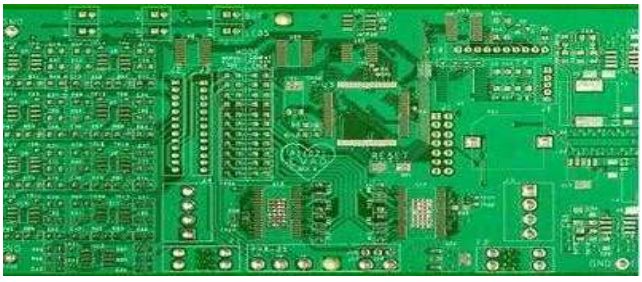
A Servo motor is a rotary actuator or linear actuator. It allows for precise control of angular or linear position, velocity, and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller. Often a dedicated module designed specifically for use with servo motors. It is an electrical device which can push or rotate an object with great precision. If you want to rotate an object at some specific angles or distance, then you have to use servo motor. It is just a simple motor which run through **servomechanism**.

Figure10:Servo Meter

PCB

A **printed circuit board**(**PCB**; also **printed wiring board** or **PWB**)is a medium used in electrical and electronic engineering to connect electronic components to one another in a controlled manner. It takes the form of alaminateds and which structure of conductive and insulating layers: each of the conductive layers is designed with an artwork pattern of traces, planes and other features (similar to wires on a flat surface) etched from one or more sheet layers of copper laminated onto and/or between sheet layers of a non-conductive substrate.[1] Electrical components may be fixed to conductive pads on the outer layers in the shape designed to accept the component's terminals.

Figure11:PCB



Result

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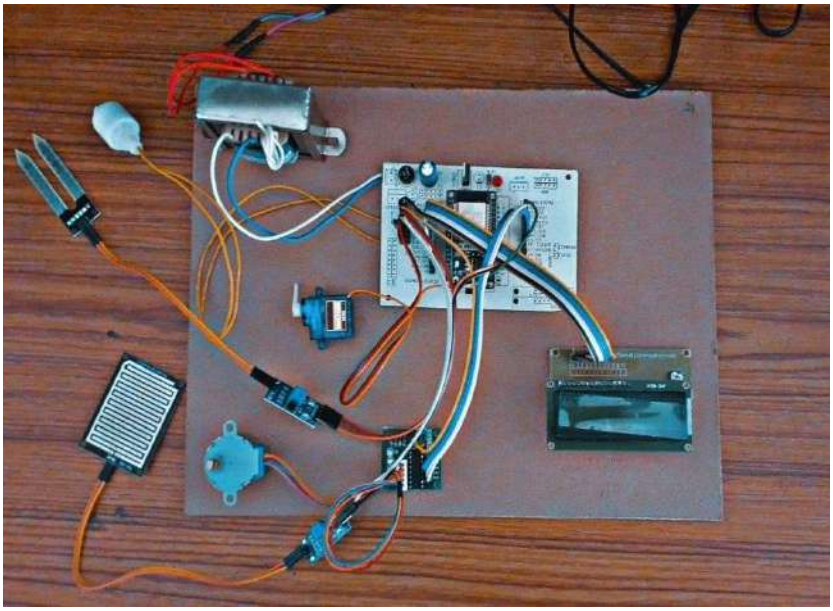

Figure12:BeforeTheExecution

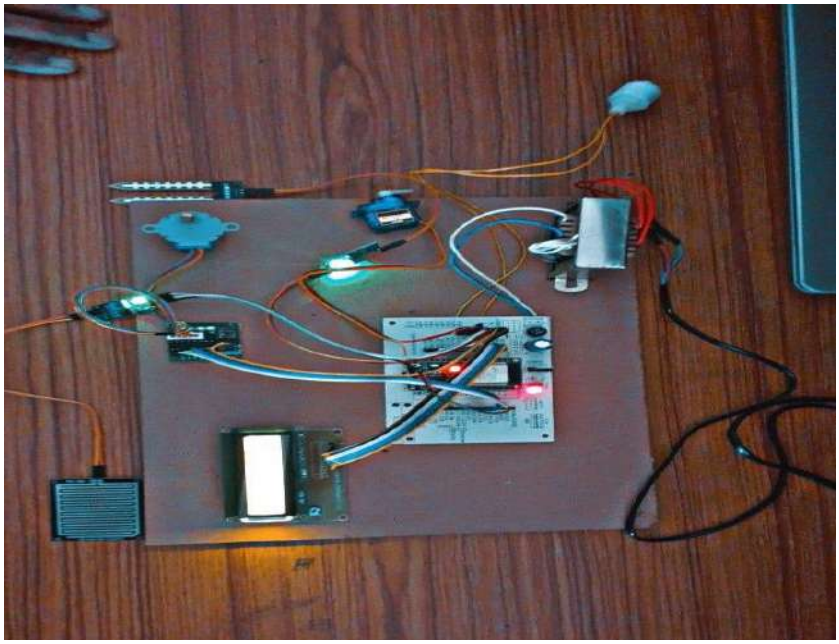

Figure13: AfterTheExecution

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Conclusion and Future Scope

The project "**RAIN WATER HARVESTING SMART AGRICULTURE ROBOTIC SYSTEM"** has been successfully designed and tested. It has been developed by integrating features of all the hardware components used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly using highly advanced IC's and with the help of growing technology the project has been successfully implemented.

FUTURE SCOPE:-

- Scope in agriculture
- Remote and rural areas
- Rain harvesting for future climate disaster
- Easy implementation.
- Accurate inuse
- It can be used in farming
- Remote Monitoring

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