Solar Power Based Modernization of Agriculture For Crop Protection Using IOT

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***Abstract*— This project presents a collaborative system made up of a Wireless Sensor Network (WSN) using sensor Temperature and air or dust sensor in this project depending on nature variation, sensor detects the value and take the decision to protect the crop by opening and closing the sheet or panel through dc motor. We protect the crop by measuring the soil moisture level in the water depending on the values the controller decides to supply the water or not. This work includes agriculture and has simulators with micropr ocessors, electronic farming that can attract farmers and use the m to manage natural resources. So this question has fueled the in terest of farmers to use remote monitoring for agricultural fields in their agricultural work. The main purpose is to communicate directly with the farmers and make their work easier. This is do ne using mobile phones to inform farmers about soil moisture, te mperature, level, weather conditions and physical activity. The p roject will send notifications to farmers in a form on the website with the date and time so they can manage their land.Farmers us ing this method will feel comfortable working on their land stres sfree. Using IoT, a farmer will be able to monitor his land when he cannot control it. Farmers can access their land from anywhe re. They need to take care of the use of IoT so as not to change it in their own territory. They can also take care of their crops by checking their phones.The other main objective is to generate the revenue or some amount from the same land using solar renewable sources.**

Keywords—Arduino UNO, Embedded C, Adafruit IO Software

I. INTRODUCTION

Agriculture is the backbone of India. [1] Today, India is the second la rgest wheat, rice, etc. is the manufacturer. The upbringing changed ac cording to people's lifestyle. Now technology is making people lazy, so agriculture has now been developed with new tools. Crop protectio n is must in agriculture, for farmers to know about their crops, the far mer needs to login to the website with a unique username and passwo rd, so that he can see the content sent by Arduino, including the date, time and data used.WiFi Boarding, they can easily monitor their land over WiFi.Drylands are a major threat to farmers. To understand and make the main points, there is no small feat in our thesis.

Here we frequently post methods for preventing crops from rotting du e to heavy rain and exposure to sunlight.

This has been achieved through the design process using IoT technol ogy. The clear idea is to protect crops from heavy rains and sunlight b y closing receptive areas and conserving rainwater. We used IoT, Sen sors and Soil Moisture Sensors in this system to complete this researc h. Here,we use only renewable energy, which is solar energy produce d by solar panels, as the energy source for this project.A growing port ion of the population depends on leaf crops for cultivation or employ ment. Here we see that agriculture is brutal today because of the rava ges of diseases.

The benefits of technological development in agriculture depend on whether India can develop and produce infrastructure such as water c onnectivity, flood control, reliable electricity alone. Irrigation is no w an important part of the growth of our country's economy. With timely irrigation and proper use of biofertilizers and prop er maintenance of fields, Indian agriculture was modernized. T his expansion strategy will be an important tool in reducing th e energy costs required for ventilation in agriculture. The syste m uses a combination of wired and wireless technology with an ARM controller to provide continuous updates on the farming environment and measures necessary for farming.

II. EASE OF USE

A. PROBLEM STAEMNET

- Agriculture is the backbone of India. Plant protection is a mandatory thing in agriculture
- There is no system like to protect the crops from environmental disasters like heavy rain, heavy sun rays, heavy chemical industries pollutions, and fire detection to the crop.

B. OBJECTIVES

- To develop a smart sensor network for an agricultural environment.
- Monitoring agricultural environment for various factors such as temperature and humidity along with significance to protect the crops from environmental heavy rain, heavy sun rays, heavy chemical industries pollutions, and fire detection to the crop with help of sensors where farmer can get update of the field.
- To make ensure of individual farmer to monitor agriculture without high investment.
- The hardware is constructed with help of natural renewable power sources.

C. EXISTING SYSTEM

- There is no proper crop protection.
- No natural renewable energy can be used to crops.
- No indication system for farmer.

III. LITERATURE SURVEY

In over 50 years since its independence, India has done a great job in its agriculture to increase food. Two years of severe drought in 1965 and 1966 caused India to change its agricultural policy. Despite the s uccess of the agricultural policy, the groundwater is so poor that India n farmers built wells to collect groundwater.Large lands are irrigated with new technologies. The longterm benefits of agricultural technolo gy development depend on India's infrastructure improvements such as water connectivity, flood control, reliable electricity and generatio n capacity. Together with the rivers, it becomes an important part of t he growth of our country's economy. Timely irrigation and use of bio fertilizers along with proper management ofthe fields has led to the m odernization of Indian agriculture.This turns out to be a very interesti ng idea that will be an important tool in reducing the energy costs req uired for agricultural fogging. The system uses a combination of wire d and wireless technology with ARM controller to control the agricult ural environment and provide the necessary protection for production in farm farming today.

Balaji Banu [1] developed a wireless sensor network to monitor agric ulture and improve crop yield and qualitysensors, water level, humidi ty, temperature, etc. The designer uses analogtodigital conversion and Zigbee protocolbased wireless sensor nodes and wireless transceiver modules for multistate monitoring, such as the ATMEGA8535 and I CS8817 BS system. Databases and web applications are used to store and store information. In this test, the sensor nodes are inactive and c ontrol the energy performance.

Liu Dan [2], Joseph Haul, Kisangiri Michael [3], Wang Weighing, Ca o Shuntian [38] conducted a smart farm monitoring experiment based on ZigBee technology. Theaim of their experiments is to obtain a go od working environment in the greenhouse, which can control the en vironment, reduce investment and farming, save energy and electricit y. The IoT technology here is based on the BS standard and cc2530 w orking chip for wireless sensor nodes and controllers. The gateway is based on the Linux operating system and the cortex A8 processor.

The design is known for remote monitoring of the greenhouse and als o reduces energy costs by replacing traditional electrical appliances w irelessly.

However, there are also some challenges that need to be addressed when using WSN in automated irrigation systems. One of the main challenges is the limited battery life of the wireless sensors, which can affect the reliability of the system. In addition, there can be issues with communication and data transmission in agricultural environments, where there may be interference from other devices or environmental factors like terrain and weather conditions.To address these challenges, researchers and industry practitioners are working on developing more robust and energy-efficient WSN technologies for use in agriculture.

IV. METHODOLOGY

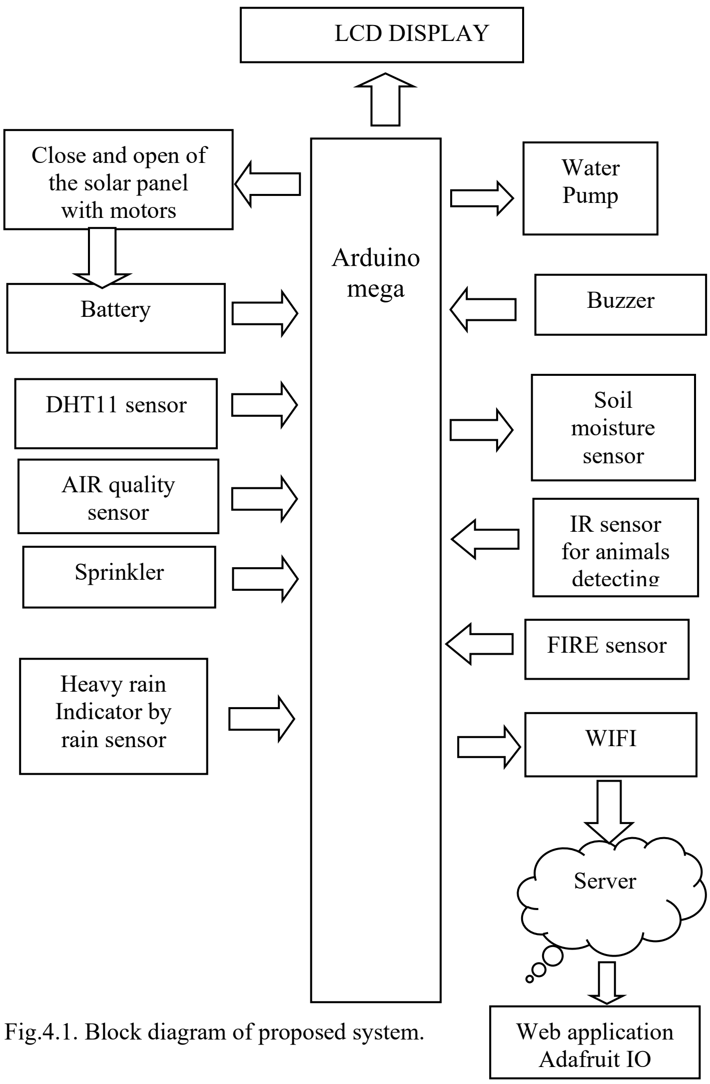

Fig.4.1. Block diagram of proposed system.

A. WORKING:

First, the processor detects the presence of solar energy, which is con nected to the motor and then to the driver. The solar panel rotates 180 ° clockwise and counterclockwise and stops by hiding in the battery. Sensors control the maximum and minimum soil moisture levels. Wh en soil moisture is low, the pump motor will pump water into the fiel d. The thermometer will measure the temperature around the farm, th e rain gauge will detect heavy rain and close the panels to protect the crops, and all the above information will be sent to the user via IoT te chnology.Therelay is connected to the water pump and when the hum idity sensor detects that the soil is dry, the pump starts pumping water The humidity sensor is used to detect the humidity of the farmland a nd feed it with water, we also control the infrared sensor, if the sensor sees the data, the data is sent and the buzzer turns on to prevent the a nimals from entering the area.The system uses the solar power to work all sensors and controller.

1. The main aim is to provide crop protection from different types environmental disaster or climate variation, like heavy sun, heavy rain, any gas leakage from industries and fire.
2. The sensor is placed to monitor the different caritas like heavy sun, rain etc.
3. The solar panel is used for protecting for high temperature and rain and industrial leakages.
4. The system is developed in such way that the opening and closing system on the crops made, depending on the area the panels are fitted.
5. The power generation is made to revenue or income to the framer as back up or backbone if crop get loss due any caritas.
6. The system is designed to take automatic decision and perform the task.
7. The all data can be sent to framer with help or IOT using WIFI, or SMS using GSM.
8. Object is placed to detect animals or any inactivity and alarm is buzzer.
9. Fire sensor is to detect the fire and alert.

B. SYSTEM ALGORITHM

Here's a more detailed flowchart for the automatic control and monitoring mode of the system:

1. Begin
2. Read inputs from sensors or other sources (temperature, moisture content, weather conditions, obstacle detection, etc.)
3. Process inputs to determine appropriate actions based on predetermined setpoints and thresholds
4. Generate control signals to adjust output devices (e.g., fans, water pumps, heaters, etc.)
5. Send control signals to actuators or other output devices
6. Monitor system response
7. Adjust control signals as needed based on feedback from sensors
8. If a parameter reaches its threshold value, send a signal to the microcontroller
9. The microcontroller receives the signal and switches to manual mode, enabling the user to take control of the system
10. The user can adjust setpoints and control signals manually to achieve the desired system behavior
11. If the user is finished with manual mode, switch back to automatic mode and resume automated control and monitoring
12. Repeat steps 2-11 as necessary
13. End

In this flowchart, the system is designed to operate in automatic mode, continuously monitoring and adjusting system parameters to maintain optimal greenhouse conditions. However, if a parameter exceeds a predetermined threshold, the system switches to manual mode, allowing the user to take control of the system and make adjustments as necessary. Once the user is finished with manual mode, the system can be switched back to automatic mode to resume automated control and monitoring, as shown in the Fig.4.2. and Fig.4.3.

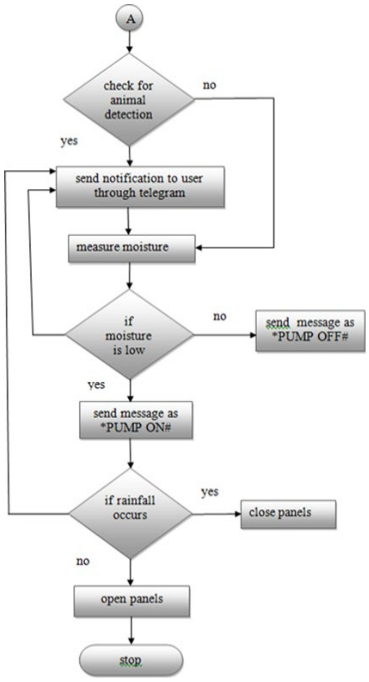

Fig.4.2. Flowchart represents a automatic mode of control

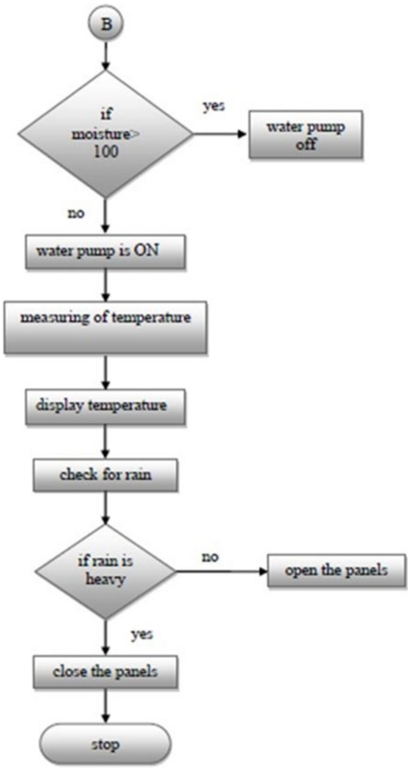

Fig.4.3. Flow chart represents a basic manual mode of control.

V. HARDWARE & SOFTWARE REQUIREMENTS

A. HARDWARE REQUIRED

ArduinoUno: it can connect analog sensors that provide continuous data, such as temperature and humidity sensors.In addition, the Arduino Uno has a variety of digital input and output pins that can be used to control other components, such as motors, pumps, and relays. These pins can be programmed using the Arduino programming language, which is based on C++. The low power consumption of the Arduino Uno makes it ideal for use in a greenhouse setting, where energy efficiency is important. The ease of setup and programming also makes it a good choice for farmers who may not have extensive technical expertise. Overall, the Arduino Uno microcontroller provides a flexible and efficient platform for controlling the various components in a greenhouse system, including sensors, actuators, and other devices. By programming the microcontroller to respond to different inputs and conditions, the farmer can create a customized system that maximizes the yield and quality of their crops.

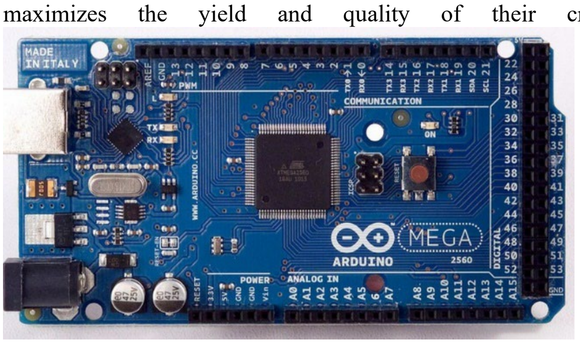

Fig.5.1. Arduino UNO.

Sensors: Different environmental conditions essential in an agricultural monitoring system can be measured by using three types of sensors:

1) The Grove Soil Moisture Sensor is accomplished of determining humidity contented in earth. Usage of electric confrontation amongst two pokes it could exactly ration volumetric liquid contented in earth indirectly. In agricultural systems its useful as humidity stages in earth is identified as grounds would require to be moistened when essential and might bound progress & scattering of microbes.

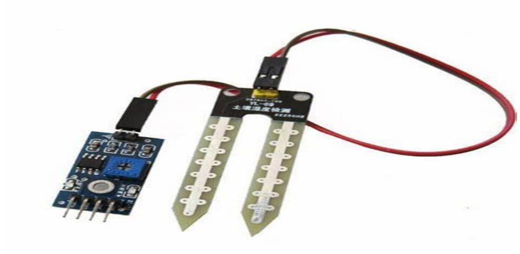

Fig.5.2. soil moisture detection sensor.

2) The DHT11 humidity sensor accomplished of calculating ecofriendly data with fluctuating idea accurateness, up to2% aimed at relative humidity. Maximum harvests will yield highest produce as soon as humidity is within an idealrange so the sensor was selected. As open-air circumstances critically encouragement those privileged greenhousesso greenhouses measurements are significant.

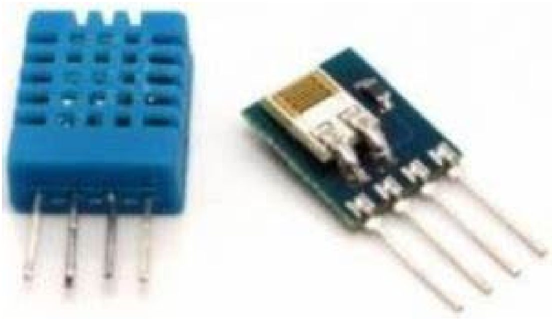

Fig.5.3. DHT11 humidity sensor.

3) The LM35 is a temperature calculating device having equivalent output voltage proportionate to temperature. LM35 delivers output voltage in Celsius or Centigrade.

Fig.5.4. LM35 temperature sensor.

4) Object detecting sensor it is used to detect any object touch in the field. It will detect any object with in 3ms and it will give beep sound so that farmer can enter in to the land and he can protect the field.

Fig.5.5. Object detecting sensor.

WIFI: Use WSN to collect data collected from different sensors such as temperature, humidity and other information. It will be directly up dated for authorized users**.**

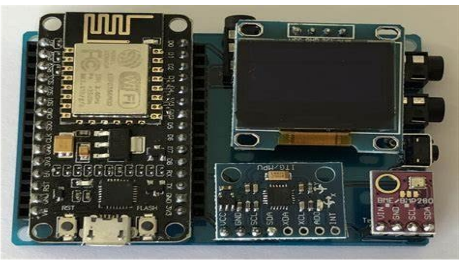

Fig. 5.6. Wireless sensor network.

Solar Panel: Solar panels mainly performs opening and closing function during the crop protection. The panels are positioned 2-3 meters off the ground and sit at an angle of 30 degrees, providing shades and offering crop protection from weather.

Fig.5.7. Solar panels.

Battery: We use battery to supply the power to run the motor. It provides a voltage in the range of 220v.It continuously monitor the farmer by supply the power when it is required to supply the power in a field.

Fig.5.8. Battery.

B. SOFTWARE REQUIRED

- Arduino IDE
- EMBEDDED C
- Adafruit IO

VI. RESULTS AND DISCUSSIONS

It is important to ensure that the greenhouse has a rainwater harvesting system. To summarize, the main control parameters to consider for growing serrano pepper in the given area are:

1. Temperature: Maintain a temperature range of 24ºC to 27ºC inside the greenhouse. This can be achieved by using a heating and cooling system that is controlled by a thermostat.

2. Soil: Use sandy loam soil that drains well and is rich in organic matter. This can be achieved by adding compost or other organic matter to the soil.

3. Moisture: Maintain soil moisture at an appropriate level for the crop. In this case, the moisture level is set to 100. If the humidity level exceeds 100, the irrigation system should be automatically turned off to prevent over-watering.

4. Rain protection: Install a rain sensor to detect the presence of rain. If heavy rainfall occurs, the greenhouse roof should be automatically closed to protect the crops and stop irrigation. It is also important to have a rainwater harvesting system in place to collect and use rainwater for other purposes.

By controlling these parameters, the farmer can optimize the growth and yield of serrano pepper even during the rainy season.

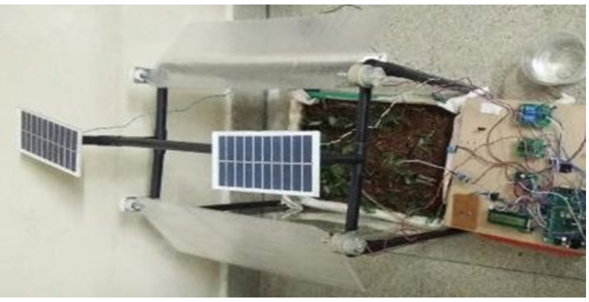

Fig.6.1. Opening the panels.

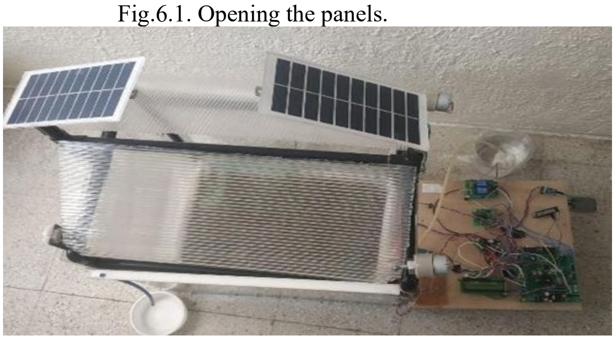

Fig.6.2. closing the panels.

In manual control mode,farmers can monitor and control theirfield operations through the Adafruit IO app. All information about soil moisture, open and closed panelsis sent to the farmerThe farmer also controls the on andoff of the pump by commanding * PUMP ON # to turnthe pump on and * PUMP OFF # to turn the pump off.

Fig.6.3. Adafruit IO app messaging screen.

VII. CONCLUSION

In conclusion, the solar-powered modernization of agriculture and crop protection using IoT (Internet of Things) technology has significant potential to improve the efficiency, productivity, and sustainability of farming practices. With the use of solar energy, farmers can reduce their dependence on traditional fossil fuels and can save on energy costs while reducing their carbon footprint. Additionally, IoT devices such as sensors and drones can help farmers monitor crop health, soil moisture levels, and weather conditions in real-time, allowing for precision farming and targeted application of resources.

The integration of solar energy and IoT technology in agriculture can help address many of the challenges faced by farmers today, including climate change, water scarcity, and food security. It can also lead to more profitable and sustainable farming practices while improving the quality and quantity of crop yields.

However, there are still challenges to be addressed, such as the high cost of implementing IoT systems and the need for adequate training and support for farmers to use them effectively. Additionally, there may be concerns around data privacy and security, which must be addressed to ensure the safe and ethical use of IoT technology in agriculture.

Overall, the solar-powered modernization of agriculture and crop protection using IoT technology holds significant promise for the future of farming, and continued research and investment in this area is crucial to its success.

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