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Solar Based Seed Sowing Robot

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***Abstract* - Agriculture has been and will be the cornerstone and backbone of the Indian economy for a very long time. Environmental and climatic change effects have a significant impact on agricultural productivity, and expectations are always increasing as a result of growing demand and population. The agricultural industry is now understaffed in the majority of Indian cities, which has an influence on the development of emerging countries. Therefore, farmers must use contemporary technologies to do agriculture-related operations. In the manual process, fertilizer is also sprayed and seeds are sown by hand. Therefore, the sector has to be automated in order to decrease human effort and address these problems. The creative concept behind this project is to carry out various processes, such as evaluating if the soil is appropriate for farming, planting seeds, covering the area, and fertilizer spraying.**

Keywords: agriculture, contemporary technologies, seed sowing, fertilizer spraying, farming, automated etc.

I. INTRODUCTION

Agriculture has long been the backbone of the Indian economy. Today, the focus is on the environmental impact of agricultural production, placing increasing demands on the industry. In the current scenario, most Indian cities do not have a sufficiently skilled workforce in the agricultural sector, hampering progress in the developing world. Therefore, farmers need to use improved techniques for cultivation activities. Manual is a method of sowing seeds and fertilizers by hand. Therefore, it's time to automate the sector to overcome these problems. The innovative idea of this project is to check whether the soil is suitable for cultivation and automatically carry out the processes such as seeding, covering the land and applying fertilizer, reducing human labor. The system is used for detection, monitoring, control, and communication purposes. Various sensors are used to record parameters such as soil moisture and obstacle detection. Depending on the output of the sensor, the microcontroller performs the required action. The moisture sensor output helps determine if the soil is suitable for cultivation. Sowing can be done as soon as the soil is suitable. In addition, fertilizer application work can be performed at a desired time. The robot's movements can be controlled via an Android app.

II. LITERATURE SURVEY

Tanmay Barnal. In the paper, “Development of iot based smart security and monitoring devices for agriculture”, we had referred the design, tested and analyzed an ’internet of things’ based device which was capable of analyzing the obtained information and then transmitting the gathered information to user. The device can be operated from remote location and can be used in agricultural fields, grain stores and cold stores for security purpose [1].

J .Kishore. In the paper, “Automatic control of irrigation system in paddy using WSN”, water level sensors and moisture sensors are placed in the entire field to measure the water level and moisture level of soil in the field. Then the system automatically water the field through the valves present, when the level of water is lower than the required level and also according to the moisture level of the soil [2].

Abhishekh Khanna. In the paper Solar- powered Android based Speed Control of DC motors through Secure Bluetooth, smartphones use wireless technology to send and receive data to and from microcontrollers via his Bluetooth. An Android based application is created and downloaded to a phone that acts as a display panel for sending/receiving/displaying DC motor outputs and inputs [3].

M. Usha Rani. In the article "A web-based service for monitoring automated irrigation systems in the agricultural field using sensors", his two xbee radios used in a network in combination with his Arduino microcontroller as master and slave is explained. When the moisture reaches a certain level, depending upon the moisture level value, water is allowed to flow through the pipes and flow areas, and the water pressure is updated over time in the database and the data is then displayed on the web portal [4].

Mahesh R. Pundkar. In the paper” A seed sowing machine: A review”. For a variety of crops and a wide range of seed sizes, high precision pneumatic planters have been designed, resulting in uniform seed distribution throughout the travel route and seed spacing. The primary purpose of a sowing is to spread the seeds and spray fertilizer in rows at the appropriate depth, maintain gap between the seeds, and provide correct compression on the seed. [5].

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Amit Wandhare. In the article “Solar powered seed sowing machine”, from Global Journal of Advanced Research, we referred for The machine's speed is determined by the DC motor and the amount of energy stored in the battery. By spinning the digging tool with the help of a DC motor, the prototype made can dig the soil in rows up to 5 inches deep. The speed of digging is determined by the moisture level of soil and the drill material. At the same time, seed is dropped into all three rows at a distance of four inches [6].

Swetha S. In the article “Solar Operated Automatic Seed Sowing Machine” it illustrates a creative multifunctional device for quickly and effectively completing various farming tasks. This machine is suggested to perform a variety of farming tasks, including planting, digging, and spraying. It is a solar-powered gadget that is environmentally beneficial. In order to achieve this, we are employing a solar panel as a power source that transforms solar energy to electrical energy. By using a motor, this converted electrical energy is again transformed the form of mechanical energy. In this approach, the phrase "Autonomous Agriculture" is introduced, which refers to the ability to carry out agricultural operations at the appropriate time and in the required location that is predetermined by the operator. The benefits of increasing productivity in agricultural production improve application precision and handler safety [7].

III. SYSTEM DESIGN

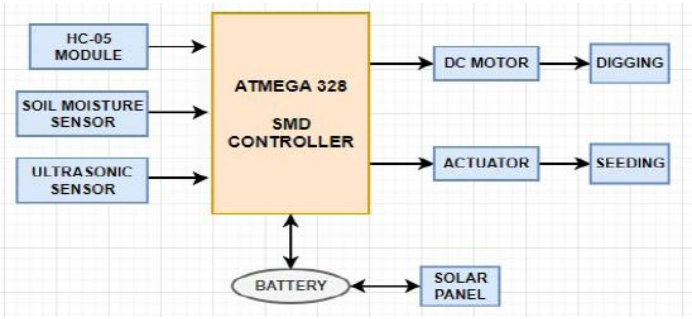

Figure 1: Block Diagram

The block diagram consists of Arduino, HC05 Bluetooth Module, Soil Moisture Sensor, Ultrasonic Sensor, DC Motor, Actuator, Battery and Solar Panel.

Battery will be charged using solar panel. Android app is used to give commands to the system which is connected via HC05 Module.

After receiving command from Bluetooth module, robot will start moving. First it will check for soil moisture. If sensor value is appropriate, then it will proceed further for obstacle detection. Obstacle is detected using Ultrasonic sensor. If any obstacle is detected, robot will stop moving. Otherwise it will start the Dc motor, in order to dig the hole for sowing. Once digging is done, Actuator will get ON and Seed is dropped in hole. This process is repeated till the farm ends.

ATMEGA328 Microcontroller

It serves as the system's central hub and is interconnected with all the sensors and other hardware components needed to carry out the intended task. As a hardware platform, it is utilized. All other components are interfaced with it because it is the controlling unit. It is an improved RISC architecture based 8-bit high performance microcontroller of the AVR family that operates at low voltage and consumes little power. It has 131 potent instructions. Most instructions are carried out in a single machine cycle. It can operate at a frequency as high as 16MHz. The microcontroller features 40 pins and 32 I/O lines.

Soil Moisture Sensor

The amount of water in the soil is essentially measured by its moisture content. The HL-69 soil moisture sensor, which has two conducting probes, may be used to measure this. Based on the difference in resistance of the two conducting plates, it can calculate the soil moisture level and content. The resistance will decrease and the conductivity between the plates will improve when the sensor is submerged in water. Here, we'll use this sensor to check whether the soil has the right amount of moisture for the growth of the crops.

Ultrasonic Sensor

Ultrasonic sensor HC-SR04 is a 4-pin module. It is a widely utilized sensor that is used in measuring distance and sense object. The sensor operates using the straightforward equation Distance = Speed Time. The ultrasonic transmitter sends out an ultrasonic wave into the atmosphere, where it is picked up by objects and reflected back towards the sensor and ultrasonic reception module. In this situation, the sensor will be used to look for any potential obstructions.

HC-05 Bluetooth Module

The HC-05 is a Bluetooth module designed for establishing clear wireless connections. The HC-05 Bluetooth Module is an excellent option for wireless communication since it can be used in either a Master or Slave configuration. A Bluetooth device called the HC-05 is used for wireless connection with other Bluetooth-enabled devices (like smart phone). It uses serial 7 2019–20 communication to talk to microcontrollers (USART). Since we will be using a smartphone to monitor the robot's operations, Bluetooth is necessary.

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Motor Driver (L293D)

The devices known as actuators are those that really provide movement or carry out a duty, much as motors. There are many different motor types and voltages accessible in the real world. Therefore, a motor driver is required to drive them through the controller. In our circuit, we utilize the L293D motor driver IC as the link between the motor and microcontroller. The DC motors can be controlled simultaneously in either direction using the 16-pin IC L293D. It means that a single L293D IC can control two DC motors.

DC Motor (30 rpm)

A motor driver L293D supplies power to four 30 rpm motors through supply voltage. A motor driver is necessary because a microcontroller cannot supply the 12V required by the motor because of its supply voltage.

DC Motor (10 rpm)

A DC motor of 10 rpm is required for the drilling process it is attached to the shaft of actuator. It is turned on for the operation of drilling.

Solar Panel

To meet the system's power needs, a solar panel with a 5 watt, 12 V output is used as the source of supply. The generated power is stored using a 12 V lead-acid battery. When a solar panel is exposed to sunlight and the voltage across it exceeds the voltage of the battery, the solar energy begins to be stored in the battery.

Actuator

An actuator is a device that transforms energy and signals into the system to produce motion. Actuator is used for the process of drilling, the actuator moves the shaft up and down when drilling process is required.

IV. IMPLEMENTATION

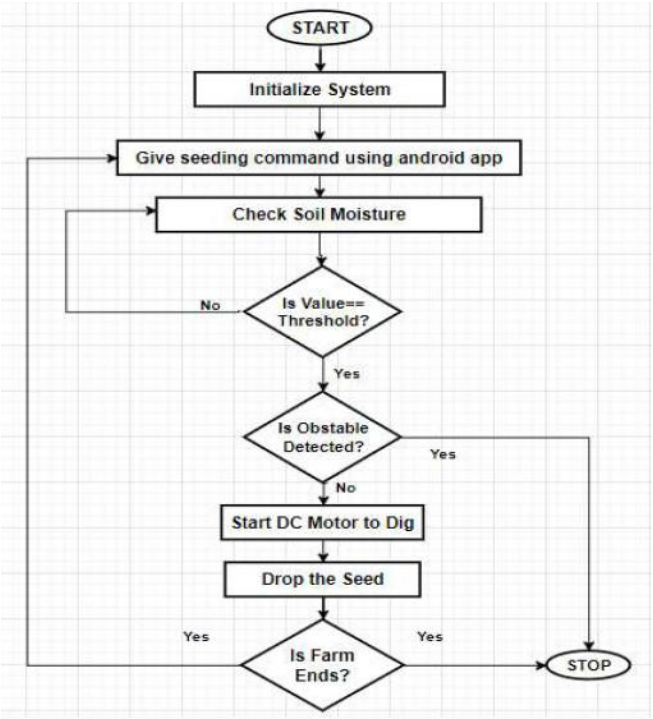

Figure 2: Flowchart

Power on and start the robot. Power is supplied here from a solar panel. Convert the resulting 12V output to 5V with a voltage regulator. Then establish connection between Bluetooth app and the robot, and send the seed drop command to the robot.

Check moisture sensor output first. Check to see if the soil is appropriate for growing the particular crop. If the soil is unsuitable, cease future operations; if the soil is acceptable, go on with them. The resistance will decrease and the conductivity between the plates will improve as the sensor is

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put into the soil. Here, we'll use this sensor to check whether the soil has the right amount of moisture which supports the growth of the crops. Once the appropriateness of the soil has been established, examine the ultrasonic sensor's output.

We will use this sensor to detect if there are any obstacles in the path of the robot. An ultrasonic transmitter emits ultrasonic waves, which propagate through the air and are reflected back to the sensor when they come into contact with matter. The ultrasonic receiver module checks for reflected wave. If an obstacle is present, use the compass sensor to set direction, otherwise continue.

Now, use a dc motor to conduct the digging process. Here, the depth is 5 cm for the designated crops. So, using the drill bit, remove up to 5 cm of earth. Drop the agricultural seeds into the holes that have been dug when the digging is finished. Once dropping is complete, go on. If the farm is finished, stop.

V. RESULTS AND DISCUSSIONS

The functionality of the system was tested on a made model after the hardware components were successfully put together and the software components were configured.

To start the robot on Power. Power is supplied here from a solar panel. It converts the resulting 12V output to 5V with a voltage regulator. We have configured the Android application on our smartphone and selected the seeding option. This command is then sent to the robot. Robot reads the soil moisture sensor's output first. Checks to see if the soil is appropriate for growing the desired crop. If the soil is unsuitable, ceases future operations; if the soil is acceptable, go on with them.

The resistance will decrease and the conductivity between the plates will improve as the sensor is put into the soil. Here, we'll use this sensor to check whether the soil has the right amount of moisture for the growth of the crops. If the soil is appropriate, examine the ultrasonic sensor's output. We will use this sensor to detect if there are any obstacles in the path of the robot. An ultrasonic transmitter emits ultrasonic waves, which propagate through the air and are reflected back to the sensor when they come into contact with matter. The ultrasonic receiver module checks for reflected wave. If an obstacle is encountered, stop, otherwise continue.

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Hardware assembly of project:

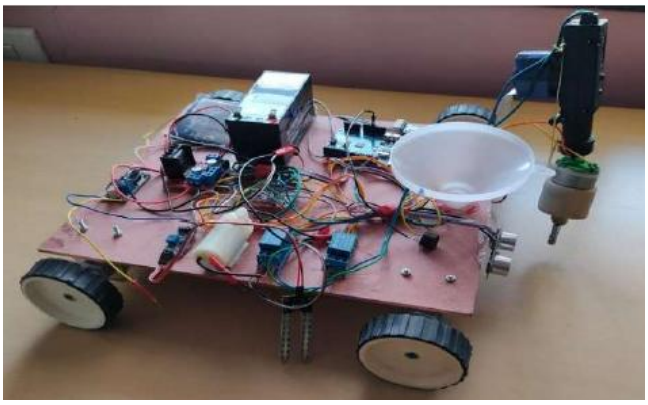

Figure 3: Hardware Assembly

VI. CONCLUSION

In conclusion, the integration of various components such as the Arduino Uno microcontroller, servo motor with flap, actuator, HC-05 Bluetooth module, soil moisture sensor, 12-volt battery, and ultrasonic sensor in the solar-powered seed sowing robot has demonstrated significant advancements in automating and optimizing seed sowing processes. The precise seed placement, control over seed flow, drilling capabilities, wireless control, adaptability to soil conditions, obstacle detection, and efficient power supply contribute to sustainable and efficient agricultural practices. The successful implementation of these components paves the way for further developments in autonomous agricultural robots, ultimately revolutionizing farming practices.

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