5 IN ONE MULTIPURPOSE AGRICULTURAL ROBOT

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ABSTRACT

More than 40 percent of the population on the planet picks agribusiness as the essential occupation. Lately, expanded interest has been developed for the development of the self-ruling vehicles like robots in the agribusiness. In traditional strategy for farming works, the types of equipment used to perform various activities are costly and badly designed to deal with. In this way, farmers need advanced equipment to perform farming procedures. The proposed work aims to build up the robot which can perform activities like ploughing, seed sowing, grass cutting and water sprinkling. The proposed robot gets power supply from solar photovoltaic (pave) panels, so it needn't bother with any outer power supply. The entire framework is constrained by android application utilizing Bluetooth interfacing with PIC18F4520 which imparts the signs to the robot for required operations.

The ploughing of firm and sowing of seeds is consequently done by utilizing dc motors. Steady separation is kept up for planting of seed. Sprinkler with rotating nozzles is utilized to sprinkle the water on crop. The grass cutting instrument comprises of rotating blades having a sharpened knife edge on both sides to cut the waste grass effectively.

This mechanical vehicle will limit the work cost, speed up and increase the exactness of the work. It incorporates various tasks, so it is financially savvy. Vitality required for this machine is less as contrasted to tractors or other farming instruments like electric pumps. The abstract of a 5-in-1 multipurpose agricultural robot presents a

cutting-edge solution to modern farming challenges. This innovative robot seamlessly integrates five essential agricultural functions into one versatile system: planting, watering, weeding, fertilizing, and harvesting. By consolidating these tasks into a single robotic platform, farmers can streamline operations, reduce labour costs, and enhance overall efficiency. Incorporating advanced technologies such as artificial intelligence, sensors, and autonomous navigation, this robot offers precision and adaptability tailored to diverse crop types and field conditions. With its potential to optimize resource utilization and maximize crop yields, the 5-in-1 agricultural robot represents a significant advancement in sustainable and productive farming practices.

1.INTRODUCTION

In India there are 70 percentage of population chooses agriculture as a primary occupation. In the current generation we do not have sufficient skilled man power specifically in agricultural sector. A manual farming consumes more time & leads to more pollution. The main purpose for developing Automation in Agricultural field is decreasing labour and decreasing time required to perform the processes on crops so that human efforts will get reduce up to 90 percent. Automation is required for safety and health of workers especially when worker must perform harmful duties. Some of the previously developed robotics applications are Crop Seeding it involves autonomous precision seeding combines robotics with geo-mapping. Crop Monitoring and Analysis is provided by drone companies like Precision Hawk offers farmer combined packages which include robotic hardware and analysis software. system uses basic components like Solar panel, DC motor, Battery, Relay, Motor driver, Relay driver, Bluetooth Module and PIC18F4520 controller.

The whole process is controlled by microcontroller. The solar panel is used to charge the battery. This battery used to power vehicle movement as well as to the motor that is used for grass cutting. The ploughing of field and plantation of seed is done by using DC motor. Distance between the two seeds is controlled and varied by using microcontroller. When the robot reaches the end of the field, we can change the direction with the help of Bluetooth command. The advantage of this solar powered multi-function Agri robot is that it does not require any fuel or petrol to work, as it works on the solar energy. The circuit

model is less complex and compact due the use of node MCU controller. However, slabs have several drawbacks. Because it causes an increase in the size of all the other structural components, such as beams, columns, and footings, the high weight-to-strength ratio is the most critical concern.

2.BLOCK DIAGRAM

2.1 BLOCK DIAGRAM

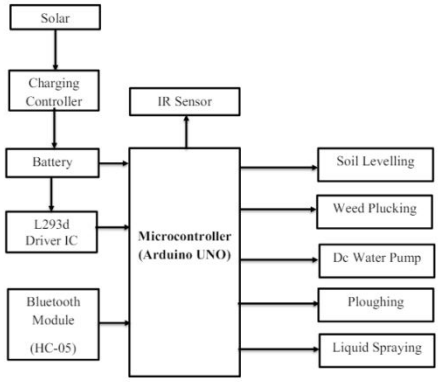
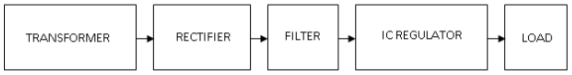


Figure-2.1 Block Diagram

3.HARDWARE SPECIFICATIONS

3.1 POWER SUPPLY

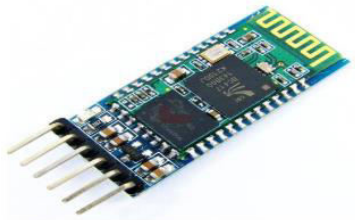
The power supply section is the section which provide +5V for the components to work. IC LM7805 is used for providing a constant power of +5V. The ac voltage, typically 220V, is connected to a transformer, which steps down that ac voltage down to the level of the desired dc output. A diode rectifier 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 retains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.



3.2 HC-05 Bluetooth Module

HC-05 is a Bluetooth module which is designed for wireless communication. This module can

be used in a master or slave configuration.



Bluetooth serial modules allow all serial enabled devices to communicate with each other using Bluetooth

HC-05 module Information HC-05 has red LED which indicates connection status, whether the Bluetooth is connected or not. Before connecting to HC-05 module this red LED blinks continuously in a periodic manner. When it gets connected to any other Bluetooth device, its blinking slows down to two seconds. This module works on 3.3V. We can connect 5V supply voltage as well since the module has on board 5 to 3.3 V regulator. As HC-05 Bluetooth module has 3.3V level for RX/TX and microcontroller can detect 3.3 V level, so, no need to shift transmit level of HC-05 module. But we need to shift the transmit voltage level from microcontroller to RX of HC-05 module. The data transfer rate of HC-05 module can vary up to 1Mbps is in the range of 10 meters.

3.3 DC PUMP

DC powered pumps use direct current from motor, battery, or solar power to move fluid in a variety of ways. Motorized pumps typically operate on 6, 12, 24, or 32 volts of DC power. Solar-powered DC pumps use photovoltaic (PV) panels with solar cells that produce direct current when exposed to sunlight.

DC Water Pump Works

DC water pumps operate on a direct current and can powered by either a 12V or 24V DC power supply. You can also use a solar panel and a dry battery to power a lower-rated DC water pump. A USB interface can also power a battery-powered mini water pump. The next step is to select a DC power supply.

3.4 RELAY

This is a 5V 4-Channel Relay interface board, be able to control various appliances, and other equipment's with large current. It can be controlled directly by Micro-controller (Arduino, 8051, AVR, PIC, DSP, ARM, ARM, MSP430, TTL logic).

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3.5 SOLAR PANEL

Solar panels absorb the sunlight as a source of energy to generate electricity or heat. Photovoltaic solar panels use sunlight as a source of energy to generate direct current electricity through the photovoltaic effect. The majority of modules use wafer-based crystalline silicon cells or thin-film cells. The cells are connected electrically in series, one to another to a desired voltage, and then in parallel to increase amperage. The wattage of the module is the mathematical product of the voltage and the amperage of the module. Cells must be protected from mechanical damage and moisture.

3.6 MICROCONTROLLER

A Microcontroller (or MCU) is a computer-on-a-chip used to control electronic devices. It is a type of microprocessor emphasizing self-sufficiency and cost-effectiveness, in contrast to a general-purpose microprocessor (the kind used in a PC). A typical microcontroller contains all the memory and interfaces needed for a simple application, whereas a general-purpose microprocessor requires additional chips to provide these functions. A microcontroller is a single integrated circuit with the following key features: central processing unit - ranging from small and simple 8-bit processors to sophisticated

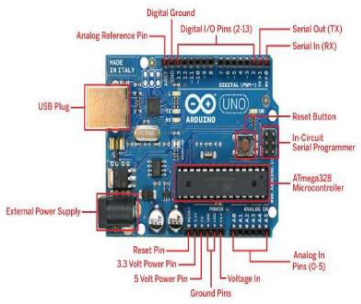
- or 64-bit processors input/output interfaces such as serial ports
- RAM for data storage
- ROM, EEPROM or Flash memory for program storage
- clock generator - often an oscillator for a quartz timing crystal, resonator or RC circuit

• Microcontrollers are inside many kinds of electronic equipment (see embedded system).

They are most of all processor chips sold. Over 50% are "simple" controllers, and another 20% are more specialized digital signal processors (DSPs) (ref?).

Arduino Uno Board

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz 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 an AC-to-DC adapter or battery to get started. You can tinker with your UNO without working too much about doing something wrong, worst-case scenario you can replace the chip for a few dollars and start over again.



3.7 BATTERY

Battery Basic battery, which converts chemical power into electricity. The battery stores energy in electrochemical form and is the most widely used tool for storing energy in branching packs. The main types of electrochemical batteries are: It cannot reverse the electrochemical reaction in a primary battery, and the battery is discarded after a complete discharge. For this reason, it represents applications where high-power density is required for single use. A secondary battery is also called a rechargeable battery. This form of battery converts chemical energy into electrical energy. The electrochemical reaction inside the secondary battery is reversible. Once discharged, can recharge it from an external supply with immediate modern-day injection. The internal output of a typical electrochemical mobile is shown in the picture. It has nice and awesome electrode plates with insulating separators and a chemical electrolyte in the middle. The two groups of electrode plates are connected to two external terminals in the housing.

The cell stores electrochemical electricity at low electrical capacity, usually a few volts. Cell capacity, denoted by C, is measured in ampere-hours (Ah), meaning it can provide C A for one hour or C / n A for n hours.

4.WORKING

This paper consists of an agricultural-based robot. In this robot, we are using the sensor to find the conditions of agriculture land and L293D IC is using to operate the robot forward, backward, right side and left side the ultrasonic sensor is using find an obstacle in way of moving time and soil moisture sensor is using to find the dry and wet conditions in agriculture land. If we find any dry plant pick and place is help to remove the Dey plant and we sowing the seed in that place after that supply the water to the seed in this method this all process is controlled by Arduino Uno.

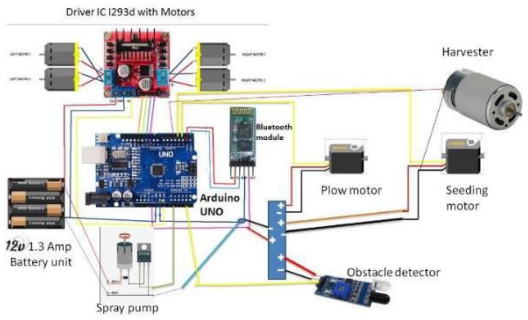
All the instructions are given through Bluetooth form android application. The automation in the agriculture could help farmers to reduce their efforts. The vehicles are being developed for the processes for Ploughing, seed sowing, Grass cutter, Sprinkler. All these functions have not yet performed using a single vehicle. In this the robots are developed to concentrate in an efficient manner and it is expected to perform the operations autonomously. This idea implements the vehicle to perform the functions such as ploughing, seed sowing, grass cutting and water spraying. Energy required for this machine is less as compared with tractors and agricultural instrument pollution is also a big problem which is eliminated by using solar plate. As there are no efficient equipment's to aid the farmers. There is a need for new techniques to be implemented. Previously the idea was formulated, design options were finalized. Few of them are described here.

In Automated Seed Sowing Agribot using Arduino", Saurabh Umarkar and Anil Karwankar, discussed that the process of seed sowing is a key component of agriculture field. For many varieties of crops, high precision planting has been developed for a wide range of seed sizes, resulting to uniform seed distribution in seed spacing along the travel path. WIFI is used as receiver. Main drawback of the system is robot moves in only one direction. Whenever there is obstacle power supply is automatically turned off [4]. In "Agribot: Arduino Controlled Autonomous Multipurpose Farm Machinery Robot for Small to medium scale cultivation", M. D. I.

Sujon, R. Nasir and Jayasree Baidya determined the effects of various seeding techniques and machines. The robot is performing farming using analogy of ultrasonic detection to change its position. The main disadvantage of this system is it does not work well on all types of soil [5].

In "Autonomous seed sowing agricultural robot", P. V. S. Jaikrishna, et.al, discussed that the robot capable of performing operations like automatic ploughing, seed sowing. It also provides manual control when required. It checks the humidity with the help of humidity sensors. The main component here is the AVR at mega microcontroller that controls the entire Solar Powered Multi-Function Agri-Robot process. Initially the robot tills the entire field and proceeds to ploughing, simultaneously sowing seeds side by side [6]. Disadvantage of this robot is on the field the robot operates on automated mode, but outside the field is strictly operated in manual mode. In "GPS based Autonomous Agriculture Robot" developed by S. Kareemulla et.al, the system benefits farmers by performing basic operation of seed sowing. This machine's operation is simple. It is possible to increase the total yield percentage effectively. Labour problem can be reduced. As compared to the manual and tractor-based sowing, time and energy required for this robot machine is less [7]. Also, wastage of seed is less. The disadvantage of model is it consists of only sowing operation.

5. CIRCUIT DIAGRAM



6.RESULT

The result of a 5-in-1 multipurpose agricultural robot would depend on its specific capabilities, but generally, it could include tasks such as:

1. Plowing and Tilling: The robot could prepare the soil for planting by plowing and tilling the land, ensuring optimal conditions for crop growth.

2. Seeding and Planting: It could also sow seeds or plant seedlings with precision, optimizing spacing and depth for each crop type.

3. Weeding: Once the crops are planted, the robot could autonomously identify and

remove weeds, reducing the need for herbicides and manual labor.

4. Fertilizing: The robot could distribute fertilizers or nutrients as needed, based on soil analysis or crop requirements, promoting healthy plant growth.

5. Monitoring and Data Collection: Additionally, the robot could monitor various parameters such as soil moisture, temperature, and crop health, collecting valuable data for farmers to make informed decisions about irrigation, pest control, and overall farm management. By performing these tasks efficiently and autonomously, a 5-in-1 multipurpose agricultural robot could significantly enhance productivity, reduce labor costs, and contribute to sustainable farming practices.

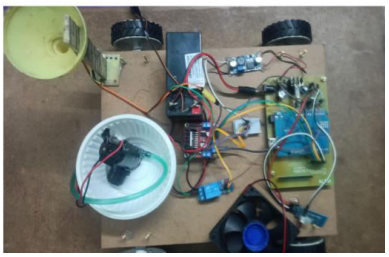


Fig-6.1 Project at Off State

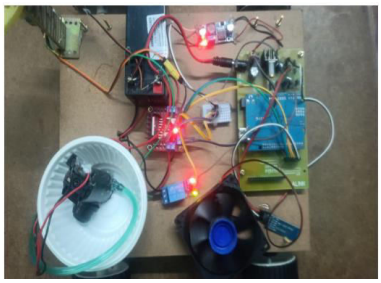


Fig-6.2 Project at On State

7.CONCLUSION

Multipurpose farming robot has effectively actualized and tried for operations like ploughing, seeding, grass cutting and water sprinkling. An underlying result of this examination shows that the greater part of these frameworks that work with self-governing, are more adaptable than customary frameworks. The upsides of multipurpose horticultural robots are lessening human intercession, guaranteeing appropriate water system and proficient use of assets. In future, it can be reached out by utilizing ultrasonic sensors and cameras for playing out similar activities without human administrator for estimating the different parameters like soil condition, region secured by the robot and levelling.

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