ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 12, Iss 1, Jan 2023

# SOLAR POWERED AUTOMATED MULTITASKING AGRICULTURAL ROBOT USING IOT

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## ABSTRACT
In excess of 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 fromsolar photovoltaic (pv) panels, so it needn't bother with any outer power supply. The entire framework is constrained by android application utilizing Bluetooth interfacing with Arduino micro controller 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 isless as contrasted to tractors or other farming instruments like electric pumps.

## 1. INTRODUCTION
In India there are 70 percentage of population chooses agriculture as a primary occupation [1]. 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 labor 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 have to perform harmful duties. Some of the previously developed robotics applications are Crop Seeding it involves autonomous precision seeding combines robotics with remapping. Crop Monitoring and Analysis is provided by drone companies like Precision Hawk offers farmer combined packages which include robotic hardware andanalysis software. Other applications are Fertilizing and irrigation system, Crop weedingand spraying system, Autonomous tractors, Picking and harvesting system [2]. The system uses basic components like Solar panel, DC motor, Battery, Relay, Motor driver, Relay driver, Bluetooth Module, Esp32 cam and ARDUINO 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

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for grass cutting. The ploughing of field and plantation of seed is done by using DC motor. Distance between the two seeds are 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 [3]. 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 ARDUINO controller.

## 2. LITERATURE SURVEY

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 of these functions have not yet performed using a single vehicle. In this the robots are developed to concentrate in an efficient manner and also 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 finalised. 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, highprecision 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 in order to change its position. The main disadvantage of this system is it does not work well on all types of soil [5].

## BLOCK DIAGRAM

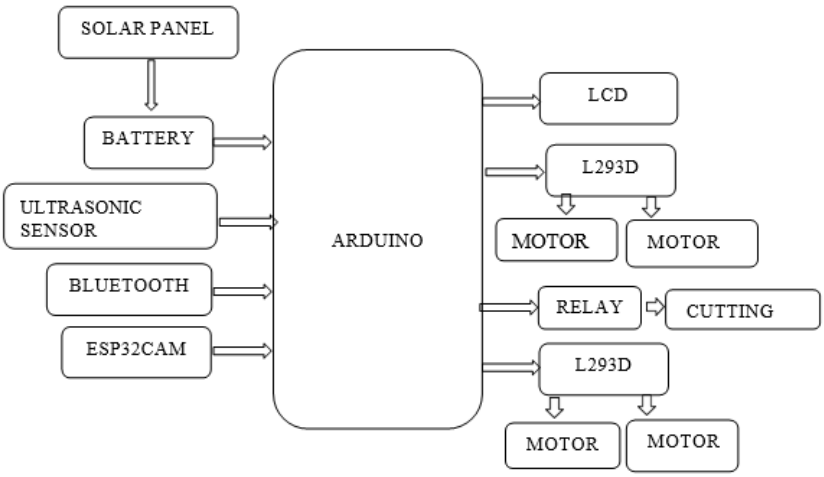


**FIG 3.1** BLOCK DIAGRAM

## 3. EMBEDDED SYSTEMS

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An embedded system is a system which is going to do a predefined specified task is the embedded system and is even defined as combination of both software and hardware. A general-purpose definition of embedded systems is that they are devices used to control, monitor or assist the operation of equipment, machinery or plant. "Embedded" reflects the fact that they are an integral part of the system. At the other extreme a general-purpose computer may be used to control the operation of a large complex processing plant, and its presence will be obvious. All embedded systems are including computers or microprocessors. Some of these computers are however very simple systems as compared with a personal computer.

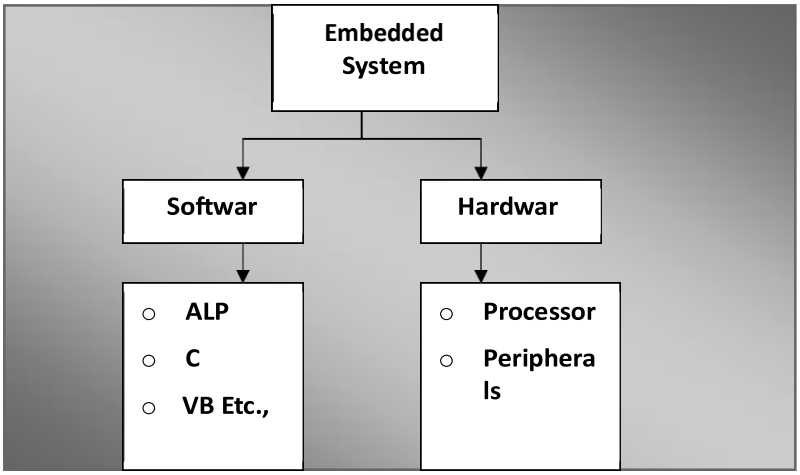


**Figure 4.1:** Block diagram of Embedded System

### 3.1 ARDUINO

Arduino Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button. The ATmega328 microcontroller contains 32 general purpose working registers. As shown in the below figure these registers are directly connected to ALU. Two registers can carry one single instruction consequently in one clock cycle.

### Specification

**Table 4.1:** Atmega328 specifications

| Microcontroller | ATmega328P – 8 bit AVR family microcontroller |
|---|---|
| Operating Voltage | 5V |
| Recommended In put Voltage | 7-12V |
| Input Voltage Limits | 6-20V |
| Analog Input Pins | 6 (A0 – A5) |
| Digital I/O Pins | 14 (Out of which 6 provide PWM output) |
| DC Current on I/O Pins | 40 Ma |
| DC Current on 3.3V Pin | 50 Ma |
| Flash Memory | 32 KB (0.5 KB is used for Boot loader) |
| SRAM | 2 KB |

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| | |
|---|---|
| EEPROM | 1 KB |
| Frequency (Clock Speed) | 16 MHz |

### 3.2 ESP32 CAM

The ESP32-CAM is a very small camera module with the ESP32-S chip that costs approximately $10. Besides the OV2640 camera, and several GPIOs to connect peripherals, it also features a microSD card slot that can be useful to store images taken with the camera or to store files to serve to clients.

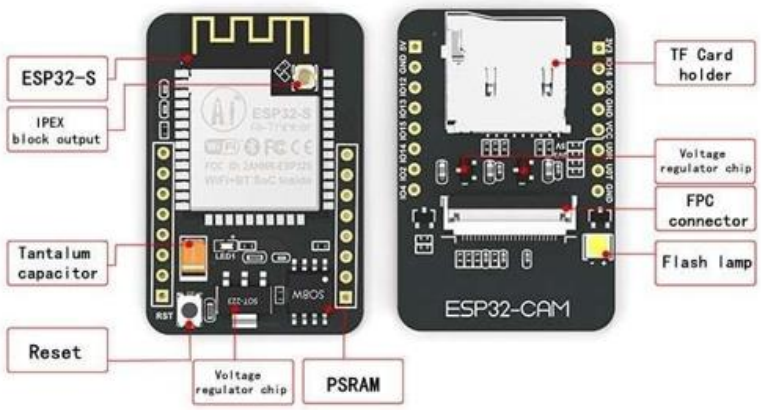


**Figure 4.2:** Image source – Seed Studio

### 3.3 ULTRASONIC SENSOR

Ultrasonic sensors (also known as transceivers when they both send and receive) work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. This technology can be used for measuring: wind speed and direction (anemometer), fullness of a tank and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure the amount of liquid in a tank, the sensor measures the distance to the surface of the fluid. Further applications include: humidifiers, sonar, medical ultrasonography, burglar alarms and non-destructive testing. Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed.


**Figure 4.3:** Ultrasonic sensor

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### 3.4 BLUETOOTH MODULE

- It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard and many more consumer applications.
- It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions.
- It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network (PAN). It uses frequency-hopping spread spectrum (FHSS) radio technology to send data over air.
- It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART).

### 3.5 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.

**Figure 4.4:** HC-05 Bluetooth Module

## 4. 16 * 2 ALPHANUMERIC LCD

### 4.1 Description

Liquid crystal display is very important device in embedded system. It offers high flexibility to user as he can display the required data on it. A liquid crystal display (LCD) is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals (LCs). LCs do not emit light directly. LCDs therefore need a light source and are classified as "passive" displays. Here the lcd has different memories to display data, those are discussed below.

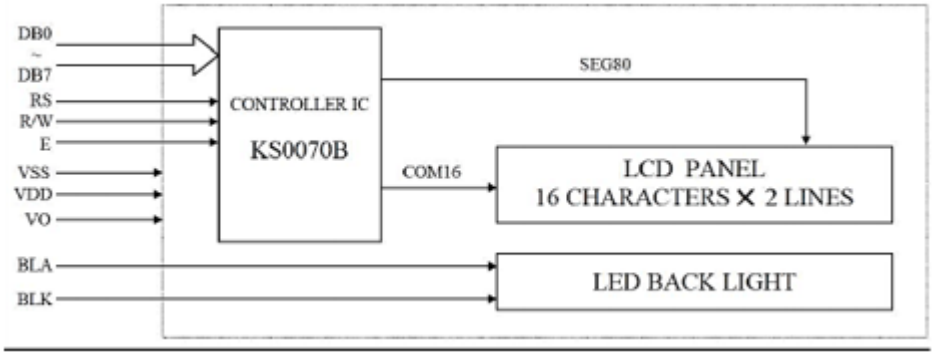


**Figure 5.1:** block diagram of lcd display

### 4.2 L293D MOTOR DRIVER

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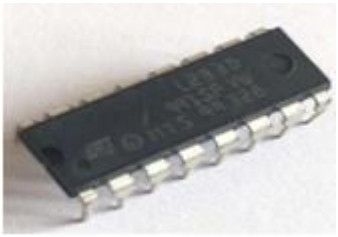

### 4.3 L293D Pin Configuration

| Pin No | Pin Name | Description |
|---|---|---|
| 1 | Enable 1,2 | This pin enables the input pin Input 1(2) and Input 2(7) |
| 2 | Input 1 | Directly controls the Output 1 pin. Controlled by digital circuits |
| 3 | Output 1 | Connected to one end of Motor 1 |
| 4 | Ground | Ground pins are connected to ground of circuit (0V) |
| 5 | Ground | Ground pins are connected to ground of circuit (0V) |
| 6 | Output 2 | Connected to another end of Motor 1 |
| 7 | Input 2 | Directly controls the Output 2 pin. Controlled by digital circuits |
| 8 | Vcc2 (Vs) | Connected to Voltage pin for running motors (4.5V to 36V) |
| 9 | Enable 3,4 | This pin enables the input pin Input 3(10) and Input 4(15) |
| 10 | Input 3 | Directly controls the Output 3 pin. Controlled by digital circuits |
| 11 | Output 3 | Connected to one end of Motor 2 |
| 12 | Ground | Ground pins are connected to ground of circuit (0V) |
| 13 | Ground | Ground pins are connected to ground of circuit (0V) |

## 5. MOTORS

### 5.1 DEFINITION

Motor is a device that creates motion, not an engine; it usually refers to either an electrical motor or an internal combustion engine.

It may also refer to:

- Electric motor, a machine that converts electricity into a mechanical motion
- AC motor, an electric motor that is driven by alternating current
- Synchronous motor, an alternating current motor distinguished by a rotor spinning with coils passing magnets at the same rate as the alternating current and resulting magnetic field which drives it
- Induction motor, also called a squirrel-cage motor, a type of asynchronous alternating current motor where power is supplied to the rotating device by means of electromagnetic induction
- DC motor, an electric motor that runs on direct current electricity
- Brushed DC electric motor, an internally commutated electric motor designed to be run from a direct current power source
- Brushless DC motor, a synchronous electric motor which is powered by direct current electricity and has an electronically controlled commutation system, instead of a mechanical commutation system based on brushes
- Electrostatic motor, a type of electric motor based on the attraction and repulsion of electric charge
- Servo motor, an electric motor that operates a servo, commonly used in robotics
- Internal fan-cooled electric motor, an electric motor that is self-cooled by a fan, typically

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used for motors with a high energy density

### 5.2 RELAY

A relay is an electrically operated switch. These are remote control electrical switches that are controlled by another switch, such as a horn switch or a computer as in a power train control module, devices in industries, home based applications. Relays allow a small current pin, 4-pin, 5-pin, and 6-pin, single switch or dual switches. Relays are used throughout the automobile. Relays which come in assorted sizes, ratings, and applications, are used as remote-control switches. A typical vehicle can have 20 relays or more.

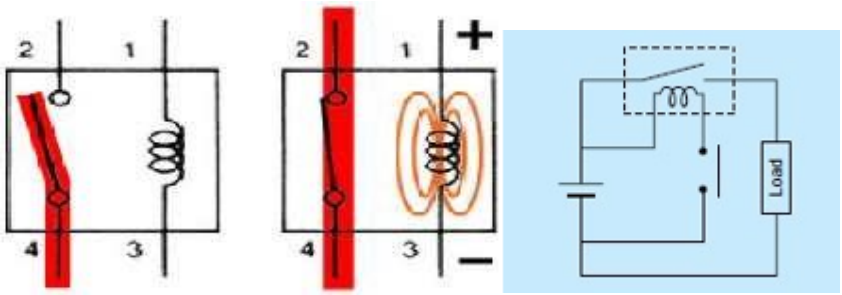


**Figure 6.1:** Circuit diagram of Relay

## 6. SOFTWARE EXPLAINATION

### 6.1 ARDUINO SOFTWARE

Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing. Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike. Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open- source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

### 6.2 CONNECTING A BATTERY

For stand-alone operation, the board is powered by a battery rather than through the USB connection to the computer. While the external power can be anywhere in the range of 6 to 24 V (for example, you could use a car battery), a standard 9 V battery is convenient. While you could jam the leads of a battery snap into the Vin and Gnd connections on the board, it is better to solder the battery snap leads to a DC power plug and connect to the power jack on the board. A suitable plug is part number 28760 from www.jameco.com. Here is what this looks like.

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**Figure 7.1:** Arduino with battery

Disconnect your Arduino from the computer. Connect a 9 V battery to the Arduino power jack using the battery snap adapter. Confirm that the blinking program runs. This shows that you can power the Arduino from a battery and that the program you download runs without needing a connection to the host PC.

**Moving On**

Connect your Arduino to the computer with the USB cable. You do not need the battery for now. The green PWR LED will light. If there was already a program burned into the Arduino, it will run.

Start the Arduino development environment. In Arduino-speak, programs are called “sketches”, but here we will just call them programs.

In the editing window that comes up, enter the following program, paying attention to where semi-colons appear at the end of command lines.

```
void setup()
{
Serial.begin(9600); Serial.println("Hello World");
}
void loop() {}
```


MC PROGRAMMING LANGUAGE: EMBEDDED C –

This is the most widely used programming language for embedded processors/controllers. Assembly is also used but mainly to implement those portions of the code where very high timing accuracy, code size efficiency, etc. are prime requirements. Embedded C is perhaps the most popular languages among

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Embedded Programmers for programming Embedded Systems. There are many popular programming languages like Assembly, BASIC, C++ etc. that are often used for developing Embedded Systems but Embedded C remains popular due to its efficiency, less development time and portability.

### 6.3 PROTEUS

Proteus is a simulation and design software tool developed by Lab centre Electronics for Electrical and Electronic circuit design. It also possess 2D CAD drawing feature. It deserves to bear the tagline "From concept to completion".

### ABOUT PROTEUS:

It is a software suite containing schematic, simulation as well as PCB designing. ISIS is the software used to draw schematics and simulate the circuits in real time. The simulation allows human access during run time, thus providing real time simulation.

ARES is used for PCB designing. It has the feature of viewing output in 3D view of the designed PCB along with components.

The designer can also develop 2D drawings for the product

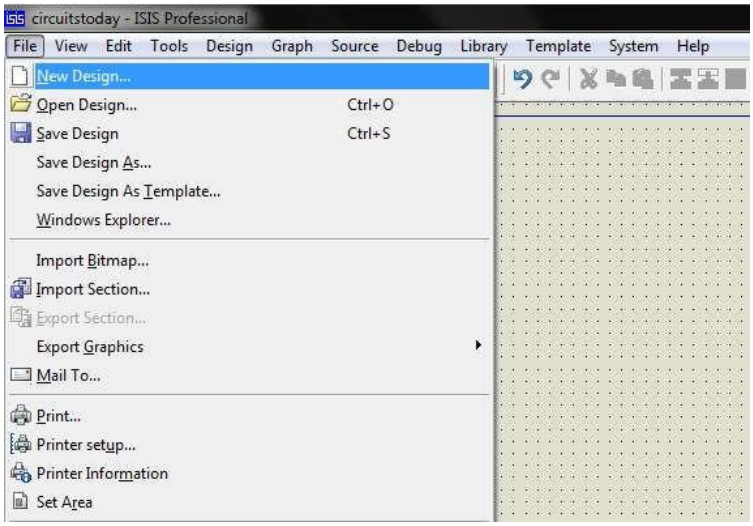


Fig13.2: Proteus File Menu

## 7. OUTPUT

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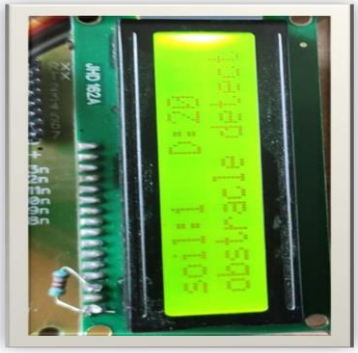
LCD OUTPUT FOR DRY DETECTION

AGRICULTURAL ROBOT




LCD OUTPUT FOR OBSTRACLE DETECTION

## 8. 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 leveling.

## REFERENCES

[1] [Online]. Available:http://www.fao.com/india/faoin-india/india-at-a-glance/en/ [Accessed Nov 2019].

[2] [Online]. Available: http://blog.robotiq.com/top10-robotic-application-in-agriculturalindustry. [Accessed December 2019].

[3] [Online].Available:https://components101.com/wireless/hc-05-bluetoothmodule. [Accessed Nov 2019].

[4] S.Umar kar and A. Karwankar, “Automated Seed Sowing Agribot using Arduino", IEEE Conference on Communication and Signal Processing, April 2016, pp.1379-1383.

[5] M.D.I. Sujon, R. Nasir, M.M.I. Habib, M.I. Nomaan J. Baidya and M.R. Islam “Agribot: Arduino Controlled Autonomous Multipurpose Farm Machinery Robot for Small to medium scale cultivation", IEEE conference on intelligent autonomous systems,March 2018, pp.155- 159.

[6] P.V.S. Jayakrisna, M.S. Reddy, N.J. Sai, N. Susheel and K.P. Peeyush, “Autonomous Seed Sowing Agricultural Robot”, in IEEE Conference on advances in computing, communications and informatics (ICACCI),2018, pp.2332-2336.

[7] S. Karee Mulla, E. Prajwal, B. Sujesh Kumar, B. Mahesh, and V Reddy, “GPS based Autonomous Agriculture Robot”, IEEE International conference on design innovations for 3Cs compute communicate control, 2018, pp.100-105.

[8] Ranjitha B. Nikhitha M. N. and Aruna K, “Solar Powered Autonomous Multipurpose Agricultural Robot Using Bluetooth/Android App”, IEEE Conference on Electronics Communication and Aerospace Technology [ICECA], June 2019, pp.872-877.

[9] B. S. Shiva prasad, M. N. Ravi Shankara, B. N. Shoba, “Design and Implementation of Seeding and Fertilizing Agricultural Robot”, International Journal of Application or

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 12, Iss 1, Jan 2023

Innovation Engineering and Management(IJAIEM), Volume 3, Issue6, June 2014.

[10] S. Konam, N. Srinivasa Rao and K. Mohan Krishna, "Design encompassing mechanical aspects of ROTAAI: Robot to aid agricultural industry", in IEEE International conference on soft computing and machine intelligence, 2014, pp.15- 19.