IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 12, May 2023

Design and Developement of a Robot based System for Precision Farming

Prof. M. S. Gadak[1], Miss. Ghule Sakshi[2], Miss. Zanzurne Radhika[3], Mr. Warke Dhiraj[4], Mr. Zope Dipesh[5]

Prof, Dept. of Electrical Engineering, Amrutvahini College of Engineering, Sangamner, India [1]
Students, Dept. of Electrical Engineering, Amrutvahini College of Engineering, Sangamner, India[2,3,4,5]

Abstract: *Many advances in technology have made the agriculture business a much less labor-intensive industry to be a part of. If we think back even only 50 years, farmers were just beginning to incorporate technologies into their farming techniques. It has been said that individuals that are involved in the farming industry are some of the least susceptible to change. They are very set in the ways of those came before them. When we take a look at the farming industry now, we can see that this is rapidly changing. Farmers are looking for new ways to implement technology to cut costs and reduce labor hours. One of the ways that farmers are beginning to explore new technologies in farming come from the autonomous tractor. The RF based tractor is something that is very new to the agriculture industry, but is quickly gaining popularity from agriculture research companies around the United States. These tractors are described by Farm Industry News as a tractor that drives its solve with a computer in control. Although still in the research phase of development, autonomous tractors are rapidly becoming more of a reality than an idea. When the tractor is moving on a surface, it is controlled by a user Mobile app. This can be moved forward and reverse direction using geared motors of 60RPM. Also this robot can take sharp turnings towards left and right directions.*

Keywords: Battery bank, Microcontroller, Bluetooth module (HC-05), DC motor, Ultrasonic Sensor, Motor Driver Android app

I. INTRODUCTION

The Agricultural robots are the fastest growing technology developed to perform various complex tasks that are difficult for humans to achieve. This “Dream project” was planned to involve unmanned tractors working in the farm on the disaster site. The robotic farmers are capable of cultivating vegetables, fruits, soybeans, wheat and rice, which are then packed in boxes and shipped across the country by this robotic technology. This process is accompanied by recycling of carbon dioxide using machinery in an attempt to reduce the use of fertilizers.

A single solution to implement precision agriculture is the development of a single gantry robot that can perform several precision agriculture related operations. The main objective of this system is to implement soil monitoring and precision irrigation on each crop, perform de-weeding and design a cultivated field using accurate robotic crop planning.

The idea of robotic agriculture (agricultural environments serviced by smart machines) is not a new one. Many engineers have developed driverless tractors in the past but they have not been successful as they did not have the ability to embrace the complexity of the real world. Most of them assumed an industrial style of farming where everything was known before hand and the machines could work entirely in predefined ways – much like a production line. The approach is now to develop smarter machines that are intelligent enough to work in an unmodified or semi natural environment. These machines do not have to be intelligent in the way we see people as intelligent but must exhibit sensible behaviour in recognized contexts. In this way they should have enough intelligence embedded within them to behave sensibly for long periods of time, unattended, in a semi-natural environment, whilst carrying out a useful task. One way of understanding the complexity has been to identify what people do in certain situations and decompose the actions into machine control. This is called behavioural robotics and a draft method for applying this approach to agriculture is given in Blackmore.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 12, May 2023

The approach of treating crop and soil selectively according to their needs by small autonomous machines is the natural next step in the development of Precision Farming (PF) as it reduces the field scale right down to the individual plant or Phytotechnology (Shibusawa 1996). One simple definition of PF is doing the right thing in the right place at the right time with the right amount. This definition not only applies to robotic agriculture (RA) and Phytotechnology but it also implies a level of automation inherent in the machines. Automatic sensing and control (on-the-go) for each task is also important and many research papers have shown that these systems are feasible but most are too slow, and hence not economically viable, to be operated on a manned tractor. Once these systems are mounted on an autonomous vehicle, they may well suddenly become commercially viable.

II. LITERATURE SURVEY

The development of our agricultural robot and the idea used to implement them, started with the study of various Papers. Designing, employing, and examining an autonomous multipurpose vehicle [1] with safe, reliable and limits [21].

Economic operation. This autonomous vehicle goes through the crop lines of Agricultural land and performs duties that are tiresome and/or unsafe to the farmers. First, it's been prepared for spraying, but other configurations are also Designed, such as: a seeding, plug system to reach the most notable area of the plants to execute different tasks (pruning, harvesting, etc.), and a truck to move the fruits, crops and crop waste products. The wheels of this robot are designed so that it can travel easily in soft and wet soil. An automatic robot for agricultural purposes[2]. As one of the styles of development on automation and cleverness of agricultural equipment in the 21st century, all

types of agricultural robots have been explored and developed to apply lots of agricultural development in many countries. This bot carries out primary functions like picking, harvesting, weeding, pruning, planting, grafting. They developed a robot to perform various activities in farm like cutting and picking. Image processing is used to

identify grass in the field and also the height of the crop. A container is used to place the cut grass and harvested crops. Pesticide spraying is also equipped in the robot. Improvement in agriculture techniques like automatic planting of seed products on ploughed land by using automatic robot[3]. A robotic vehicle having four tires and steered by DC motors was developed. The seed planting device is fixed on the automobile to seed the seed products in even manner. The device will cultivate the plantation by considering particular rows and specific column at predetermined distance depending on different seed products. The obstacle recognition is considered and sensed by an infrared sensor. The complete assemblage is driven by a 12V rechargeable battery pack. The battery pack can be recharged by using solar power which is also attached to robot. This robot can perform bed preparation, seed mapping, seed placement and reseeding operations. The design, development and the fabrication of the automatic robot [4] which can dig the ground, put the seed products, leveler to close the soil and sprayer to apply water, these complete systems of the automatic robot works together with the power supply and the solar powered energy. Steering operation of robot is done using rack and pinion mechanism. Relay switch regulates power input for motor. Obstacle detection is done using IR sensor. A lot more than 40% of the populace on earth selects agriculture as the principal occupation; lately the introduction of the autonomous vehicles in the agriculture has experienced increased interest. An automatic robot [5] capable of carrying out procedures like programmed seeding, irrigation, and fertilization. In addition, it provides manual as well as auto control. The primary component is ARDUINO that supervises the complete process. Currently, robots are significantly being built-into working tasks to displace humans especially to execute repetitive job. Seeding is main steps in farming. In this process seeding is carried out in every row of the farming plot. In irrigation process, the soil

sensor is used for monitoring environmental condition. It checks this level and alerts the farmer, then gradually applies little bit of water to the planted seed in every rows of the farming plot. The fertilization process is identical to irrigation process however, many plants need fertilizers when the seed germinates and the seed starts to develop. The automatic robot works on solar technology. An automatic robot which targets employing all the farming process especially on onion crop [6] within a bot by using firebird V automatic robot. The fire bird V robot uses ATMEGA 2560 as master controller, ATMEGA 8 as slave controller, IR, gripper design and other accessories. The suggested system prototype is applied by selecting an area which taking into consideration the agricultural field of any sort of onion crop. The automatic robot picks up the planting area by using detectors and seed products to be planted in the related field using gripper set up of the automatic robot.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 12, May 2023

III. PROPOSED SYSTEM

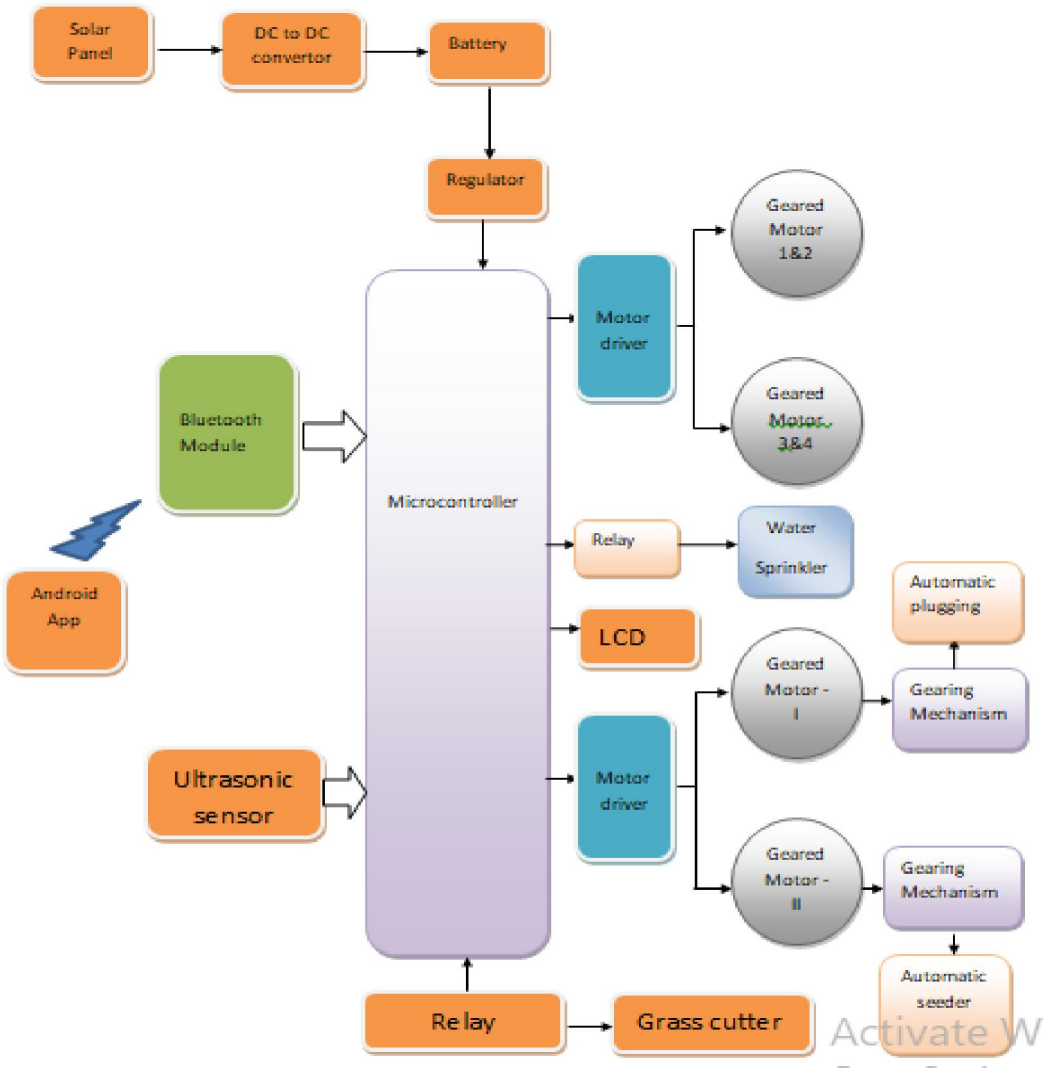

Fig.1. Block Diagram

This approach is on the designing of agricultural robot for various tasks. Certainly, robots are playing an important role in the field of agriculture for farming process autonomously.

In agriculture, the opportunity for robot is enhancing the productivity and the robots are appearing in the field in large number. The proposed system focuses on implementing all the farming process especially in the field of ploughing and seeding by using microcontroller, HC-05 and H06 Bluetooth models, various sensors etc,

The robot detects the planning area by using sensors and seeds need to be planted in the corresponding field using gripper arrangement of the robot. In a continuation, the rest of remaining process could be done automatically.

PIC 18f4520 Microcontroller

It is an 8-bit enhanced flash PIC microcontroller that comes with nanowatt technology and is based on RISC architecture. Many electronic applications house this controller and cover wide areas ranging from home appliances, industrial automation, security system and end-user products. This microcontroller has made a renowned place in the market and becomes a major concern for university students for designing their projects, setting them free from the use of a plethora of components for a specific purpose, as this controller comes with inbuilt peripheral with the ability to perform multiple functions on a single chip.

Data Memory up to 4k bytesn Data register map - with 12-bit address bus 000-FFF

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 12, May 2023

Divided into 256-byte banks
There are total of F banks
Half of bank 0 and half ofbank 15 form a virtual (oraccess) bank that is accessibleno matter which bank isselected – this selection isdone via 8-bit
Program memory is 16-bits wide accessed through a separate program data bus and address bus inside the PIC18.
Program memory stores the program and also static data in the system.
On-chip External
On-chip program memory is either PROM or EEPROM.
The PROM version is called OTP (one-time programmable) (PIC18C) The EEPROM version is called Flash memory (PIC18F).
Maximum size for program memory is 2M n Program memory addresses are 21-bit address starting at location 0x000000

Fig. 2. PIC18F4520

Ultrasonic sensor

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:
Using IO trigger for at least 10us high level signal,
The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.
Test distance = (high level time velocity of sound (340M/S) / 2,

Fig. 3 Ultrasonic Module

Dc Motor

30RPM 12V DC geared motors for robotics applications. Very easy to use and available in standard size. Nut and threads on shaft to easily connect and internal threaded shaft for easily connecting it to wheel. A DC motor is a mechanically commutated electric motor powered from direct current (DC). The stator is stationary in space by definition and therefore so is its current. The current in the rotor is switched by the commutator to also be stationary in space. This is how the relative angle between the stator and rotor magnetic flux is maintained near 90 degrees, which generates the maximum torque. DC motors have a rotating armature winding (winding in which a voltage is induced) but non-rotating magnetic field and a static field winding (winding that produce the main magnetic flux) or permanent magnet. Different connections of the field and armature winding provide different inherent speed/torque regulation

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 12, May 2023

characteristics. The speed of a DC motor can be controlled by changing the voltage applied to the armature or by changing the field current. The introduction of variable resistance in the armature circuit or field circuit allowed speed control. Modern DC motors are often controlled by power electronics systems called DC drives.

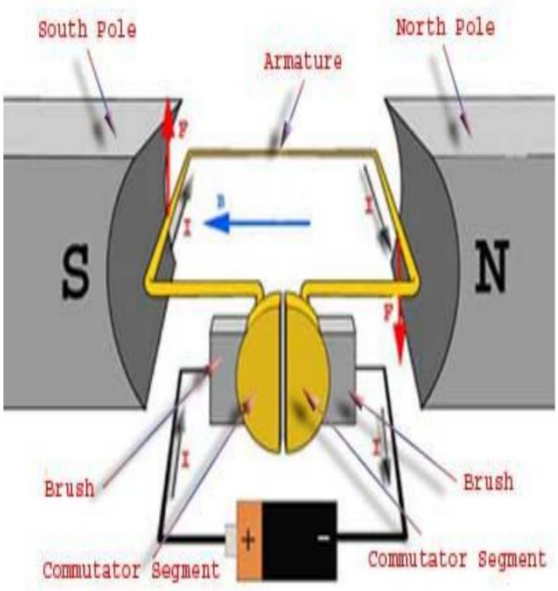

Fig. 4. DC Motor Mechanism

DC motors can operate directly from rechargeable batteries, providing the motive power for the first electric vehicles. Today DC motors are still found in applications as small as toys and disk drives, or in large sizes to operate steel rolling mills and paper machines. DC motors are configured in many types and sizes, including brush less, servo, and gear motor types. A motor consists of a rotor and a permanent magnetic field stator. The magnetic field is maintained using either permanent magnets or electromagnetic windings. DC motors are most commonly used in variable speed and torque. Motion and controls cover a wide range of components that in some way are used to generate and/or control motion

HC -05 (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)

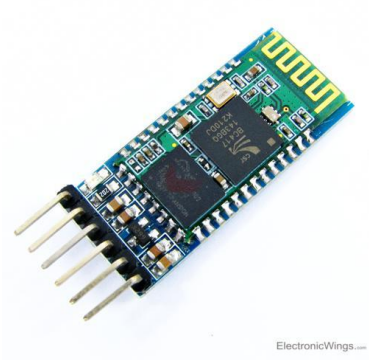

Fig. 5HC -05

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 12, May 2023

LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.

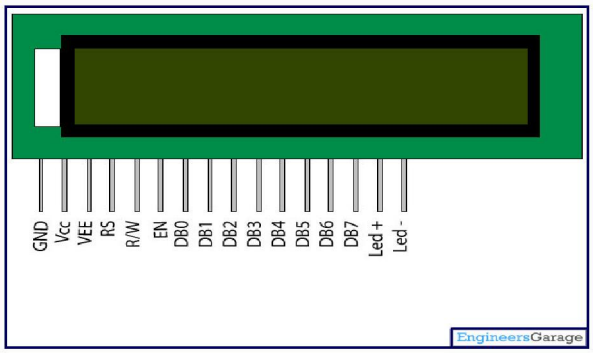

Fig. 6. LCD Display

IV. RESULT

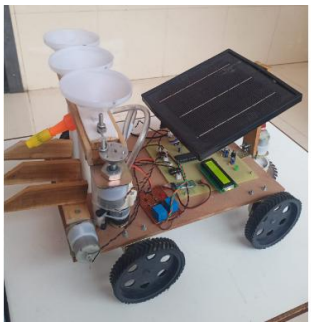

Fig. 7.Model

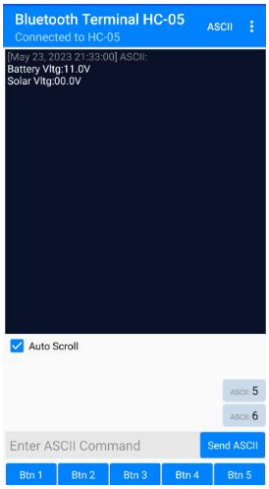

Fig. 8.Android app

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 12, May 2023

This project demonstrates the implementation of robotics and mechatronics in the field of agriculture. This being a test model the robustness of the vehicle is not very high. The performance is satisfactory under laboratory condition. The model gave a fairly good rate of area coverage and the cost of operation as calculated was also reasonably low.
Facilitate charging of the battery using a solar charger thus bringing the costs even further down. Battery energy can be saved by using PWM scheme for driving pump.

V. CONCLUSION

In attempt has been made to develop a Bluetooth operated agricultural robot which performs plugging, seed sowing, Grass cutter, Sprinkler operations. The proposed system is battery operated and controlled by Bluetooth device. Using this robot, farmer can carry out other secondary activity along with operating the robot. By carrying out multiple activities at the same time, farmer can increase his income which results in development of Indian economy.

VI. ACKNOWLEDGMENT

It gives us great pleasure in presenting the paper on “Design and Development of a Robot Based System For Precision Farming”. We would like to take this opportunity to thank our guide, Prof.M.S.Gadak Professor, Department of Electrical Engineering, AmrutvahiniCollege of Engg. Sangamner for giving us all the help and guidance we needed. We are grateful to him for his kind support, and valuable suggestions were very helpful

REFERENCES

[1]. Vishnu Prakash K, Sathish Kumar V, Venkatesh P, Chandran A, “Design and fabrication of multipurpose agricultural robot”, International Journal of Advanced Science and Engineering Research, Volume: 1, Issue: 1, June 2016, ISSN: 2455 9288

[2]. Ankit Singh, Abhishek Gupta, AkashBhosale, SumeetPoddar, “Agribot: An Agriculture Robot”, International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 1, January 2015 ISSN (Online): 22781021 ISSN (Print): 2319-5940.

[3]. Mr.Sagar R. Chavan, Prof. Rahul D. Shelke, Prof. Shrinivas R. Zanwar, “Enhanced agriculture robotic system”, International journal of engineering sciences & research technology, ISSN: 2277-9655.

[4]. Nithin P V, Shivaprakash S, “Multipurpose agricultural robot”, International Journal of Engineering Research, ISSN: 2319- 6890)(online),2347-5013(print) Volume No.5 Issue: Special 6, pp: 1129 - 1254.

[5]. Ms.Aditi D. Kokate, Prof. PriyankaD.Yadav, “Multipurpose Agricultural Robot”, International Advanced Research Journal in Science, Engineering and Technology National Conference on Emerging trends in Electronics & Telecommunication Engineering (NCETETE 2017), ISSN (Online) 2393-8021 ISSN (Print) 2394- 1588.

[6]. Redmond RaminShamshiri, Cornelia Weltzien, Ibrahim , Hameed, Ian J. Yule, Tony E. Grift, Siva K. Balasundram, LenkaPitonakova, Desa Ahmad, GirishChowdhary “Research and development in agricultural robotics: A perspective of digital farming” , International Journal of Agricultural and Biological Engineering (IJABE), Vol 11, No.4, July 2018, pp.3-8

[7]. NidhiAgarwal, Ritula Thakur “Agricultural Robot: Intelligent Robot for Farming” International Advanced Research Journal in Science, Engineering and Technology ISO 3297:2007 Certified Vol. 3, Issue 8, August 2016, pp. 177-181.

[8]. AmrutaSulakhe, M.N. Karanjkar “Design and Operation of Agriculture Based Pesticide Spraying Robot” International Journal of Science and Research (IJSR) ISSN (Online) Volume 4, Issue 12, December 2015: 2319-7064, pp.1286-1289.

[9]. Fernando A. AuatCheein and RICARDO CARELLI “Agricultural Robotics Unmanned Robotic Service Units in Agricultural Tasks” IEEE industrial electronics magazine,Volume 7, Issue 3, September 2013. Digital Object Identifier 10.1109/MIE.2013.2252957, pp.48-58

[10]. Amrita Sneha.A, Abirami.E, Ankita.A, Mrs. R. Praveen, Mrs. R. Srimeena “Agricultural Robot for Automatic Ploughing and Seeding” 2015 IEEE, International Conference on Technological Innovations in ICT (TIAR 2015), pp. 17-23.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 12, May 2023

[11]. P.Usha, V. Maheswari, Dr. V. Nandagopal "Design and Implementation of Seeding Agricultural Robot" (JIRAS), ISSN (Online), Volume no.1, Issue no.1, July 2015, pp. 138-141.

[12]. Abdullah Tanveer, AbhishekChoudhary, Divya Pal, Rajani Gupta, Farooq Husain "Automated Farming Using Microcontroller and Sensors" (IJSRMS) ISSN: 23493371, Volume 2, Issue 1, Page 21-30.

[13]. Nikesh Gondchawar1, Prof. Dr. R. S. Kawitkar "IOT Based Smart Agriculture" IJARCCE, Volume 5, Issue 6, June 2016, pp. 839-841