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Design and Manufacturing of Multifunctional Agriculture robot with IOT based

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Abstract : More than 60 percent of the population in the India do agriculture as the primary sector occupation. At present, due to increase in shortage of labour interest has raised for the development of the autonomous vehicles like robots in the agriculture field. A robot called agribot has been designed to minimize the labour of farmers in addition to increasing the speed and accuracy of the work. The Proposed system aims at designing multipurpose autonomous agricultural robotic vehicle which can be controlled through IOT for seeding and spraying of pesticides. These autonomous vehicles are implemented to reduce human intervention, ensuring high yield and efficient utilization of resources.

Keywords : Agribot, Dynamic autonomous agricultural robotic vehicle, IOT, Human intervention, Efficient utilization.

I. INTRODUCTION

Farmers are the backbone for food production. In India, about 56% people are dependent upon agriculture to earn livelihood. But technical advancement in agriculture is lesser as compared to other field. Farming has been done by the human being with the help of pair of bullocks and after that by tractors. Therefore, farming system deals with impression of direct implementation, which provide wide range to appropriately defined systems with greater flexibility and mobility. Now due to increasing population the demands are also increasing, so to minimize the use of resources and to maximize the output farmers should involve technology (to reduce the wastage of seeds, water, pesticides and fertilizers, etc.) in field of agriculture. Agricultural Robot is one such machine with the capabilities to perform efficient work which is possible with the help of different computation algorithm. The improved specification helps to design, smartly control, and to make agriculture safe and suitable for everyone. In this paper the author suggested that robot will start seeding and maintain soil moisture simultaneously.

II. PROBLEM STATEMENT

Lots of machine which perform a single task in agriculture but there is no machine which electric and perform multiple task at a time.
Manual sowing is slow and not proper also require more human power.
Manual pesticide is slow and not properly sprayed in all over field. Plus, there are side effect on human also.
Former has no proper idea about the plant disease therefore it can't detect easily

III. OBJECTIVE OF PROJECT

1. To Design and develop an agricultural robot which is able to sow seeds like operations carried out in agricultural field.
2. To control of this prototype should be wireless and can be able to show above operations.
3. To propose a low cost but effective agro system.
4. Wireless controlling system will help the farmers to have proper control over operation like sowing, seeding , digging and fertilizing which will indirectly reduce the process cost in agriculture feild.

IV. LITERATURE SURVEY

1] Multi purpose agricultural robot Nitin P V1, Shivaprakash S2 1UG Student, Mechanical Engineering, NH, Bengaluru, Karnataka, India 2Assistant Professor, NHCE, Karnataka, India, International Journal of Engineering Research, 20 may 2016. The paper aims on the design, development and the fabrication of the robot which can dig the soil, put the seeds, leveler to close the mud and sprayer to spray water, these whole systems of the robot works with the battery and the solar power. More than 40% of the population in the world chooses agriculture as the primary occupation, in recent years the development of the autonomous vehicles the agriculture has experienced increased interest. The vehicle is controlled by Relay switch through IR sensor input. The language input allows a user to interact with the robot which is familiar to most of the people. The advantages of these robots are hands-free and fast data input operations. In the field of agricultural autonomous vehicle, a concept is been developed to investigate if multiple small autonomous machine could be more efficient than traditional large tractors and human force.

2] Seed sowing robot, Abdul Rahman, Mangeshkori, Umeshkori, Ahmadakbar, Department of computer science and engineering , Them college of engineering, Boisar(East), Dist. Palghar, Maharashtra , India, International Journal of Computer Science Trends and Technology (IJCST) , Mar – Apr 2017. The states Maharashtra, Punjab, and Kerala, Assam are highly involved in agriculture. It all started due to the impact of, "Green Revolution" by means of which farmers came to know about the various techniques involved in farming and the advantages in it. As centuries passed, certain modern techniques were invented in agriculture due to the progress in science. These modern techniques included the use of tractors for ploughing the field, production of pesticides, invention of tube- wells etc.

3] An IoT Based Multifunction Agribot A. R. Uday1, D. Nisarga2, Syeda Arshiya3, A. Deepak4 , J. Sudha5 ISSN ONLINE published on Feb 2022.In this paper The proposed system aims at designing multipurpose autonomous agriculture Robotic vehicle which performs the tasks such as ploughing, seed sowing, watering the crops. This robotic vehicle is an agricultural machine of a considerable power and great soil clearing capacity. This multipurpose system gives an advance method to sow, plow, water the crops with minimum man power and labour making it an efficient vehicle. The machine will cultivate the farm by considering particular rows and specific column at fixed distance depending on crop. Moreover, the paper aims at making use of evolving technology i.e., IoT and Bluetooth which results in Smart agriculture. The whole process calculation, processing, monitoring is designed with motors & sensor interfaced with microcontroller.

4] IOT-enabled smart agriculture robot Vu Khanh Quy 1, Nguyen Van Hau 1, Dang Van Anh 1, Nguyen Minh Quy 1, Nguyen Tien Ban 2,Stefania Lanza 3, Giovanni Randazzo 4 and Anselme Muzirafuti 4, online published on MDPI Published date 27 March 2022. In this paper The growth of the global population coupled with a decline in natural resources, farmland, and the increase in unpredictable environmental conditions leads to food security is becoming a major concern for all nations worldwide. These problems are motivators that are driving the agricultural industry to transition to smart agriculture with the application of the Internet of Things (IoT) and big data solutions to improve operational efficiency and productivity. The IoT integrates a series of existing state-of-the-art solutions and technologies, such as wireless sensor networks, cognitive radio ad hoc networks, cloud computing, big data, and end-user applications. This study presents a survey of IoT solutions and demonstrates how IoT can be integrated into the smart agriculture sector. To achieve this objective, we discuss the vision of IoT-enabled smart agriculture ecosystems by evaluating their architecture (IoT devices, communication technologies, big data storage, and processing), their applications, and research timeline. In addition, we discuss trends and opportunities of IoT applications for smart agriculture and also indicate the open issues and challenges of IoT application in smart agriculture. We hope that the findings of this study will constitute important guidelines in research and promotion of IoT solutions aiming to improve the productivity and quality of the agriculture sector as well as facilitating the transition towards a future sustainable environment with an agroecological approach.

5] IoT Based Smart Agriculture Monitoring System Harika Pendyala1 , Ganesh Kumar Rodda2 , Anooja Mamidi3 , Madhavi Vangala4 Sathyam Bonala5 , Keerti Kumar Korlapati online published on ISSN In every country agriculture is done from ages which are considered to be science and also art of cultivating plants. In day today life, technology is updating and it is also necessary to trend up agriculture too. IoT plays a key role in smart agriculture. Internets of Things (IoT) sensors are used to provide necessary information about agriculture fields. The main advantage of IoT is to monitor the agriculture by using the wireless sensor networks and collect the data from different sensors which are deployed at various no des and send by wireless protocol. By using IoT system the smart agriculture is powered by Node MCU. It includes the humidity sensor, temperature sensor, moisture sensor and DC motor. This system starts to check the humidity and moisture level. The sensors are used to sense the level of water and if the level is below the range then the system automatically stars watering. According to the change in temperature level the sensor does its job. IoT also shows the information of humidity, moisture level by including date and time. The temperature level based on type of crops cultivated can also be adjusted.

6] IOT Based Autonomous Multi-Purpose Agri BOT S. MARY PRAVEENA 1 , R. KISHORE KUMAR 2 , R. JEEVA 3 , J. KARTHIKEYAN 4 online published on ISSN date April 2019 IN this paper More than 60 percent of the population in the India do agriculture as the primary sector occupation. At present, due to increase in shortage of labour interest has raised for the development of the autonomous vehicles like robots in the agriculture field. A robot called agribot has been designed to minimize the labour of farmers in addition to increasing the speed and accuracy of the work. The Proposed system aims at designing multipurpose autonomous agricultural robotic vehicle which can be controlled through IOT for seeding and spraying of pesticides. These autonomous vehicles are implemented to reduce human intervention, ensuring high yield and efficient utilization of resources.

7] IOT based farming system Deepak sarpal, Raka Sinha, Madhavi Jha, padmini TN online published on science direct on march 2022 In this paper The agricultural sector in India accounts for a significant part of the country's GDP and is the primary income source for many farmers in rural areas. While it creates employment opportunities and offers food security for the entire nation, the lack of infrastructure and resources might be limiting its potential to thrive further. One of the aspects addressed in this paper is low yield production. With the aid of a sensor-based irrigation model, data is collected and analysed in the cloud to enable real-time monitoring. It is then integrated with an Android application for displaying results in an user-friendly interface. Through the application, farmers can control the farm manually, or with a timer in minutes. The Machine Learning model predicts the suitable crops, in accordance with varying weather parameters. The application has a classified portal for farmers and customers to buy/sell directly, eliminating any involvement of mediators. One of the novelties in this research includes monitoring/controlling farm

equipment and predicting field crops from a locally installed LCD display and keypad present in farmer's respective homes. The proposed work aims to create an energy-efficient, user friendly framework for the agricultural workforce, yielding better crop production, improving farmers' living standards, and contributing effectively to the nation's economic growth. The prototype shows a reduction of water usage in fields by more than 60%. In order to incorporate the model with the best behaviour in Android Application, different Machine Learning algorithms have been studied, among which Random Forest has been selected with a test accuracy of 91.59%.

8] IOT based Smart Agriculture system G. Sushanth, S.Sujata online published on ieee date 18 Nov 2018 In this paper Smart agriculture is an emerging concept, because IOT sensors are capable of providing information about agriculture fields and then act upon based on the user input. In this Paper, it is proposed to develop a Smart agriculture System that uses advantages of cutting edge technologies such as Arduino, IOT and Wireless Sensor Network. The paper aims at making use of evolving technology i.e. IOT and smart agriculture using automation. Monitoring environmental conditions is the major factor to improve yield of the efficient crops. The feature of this paper includes development of a system which can monitor temperature, humidity, moisture and even the movement of animals which may destroy the crops in agricultural field through sensors using Arduino board and in case of any discrepancy send a SMS notification as well as a notification on the application developed for the same to the farmer's smartphone using Wi-Fi/3G/4G. The system has a duplex communication link based on a cellular Internet interface that allows for data inspection and irrigation scheduling to be programmed through an android application. Because of its energy autonomy and low cost, the system has the potential to be useful in water limited geographically isolated areas.

9] IOT based precision Agriculture using agri robot V Gourishankar, K Venkatachalam online published on ISSN date April 2018 In this paper more than 60 percent of the population in the India, agriculture as the primary sector occupation. In recent years, due increase in labour shortage interest has grown for the development of the autonomous vehicles like robots in the agriculture. An robot called agribot have been designed for agricultural purposes. It is designed to minimize the labour of farmers in addition to increasing the speed and accuracy of the work. It performs the elementary functions involved in farming i.e. spraying of pesticide, sowing of seeds, and so on. Spraying pesticides especially important for the workers in the area of potentially harmful for the safety and health of the workers. This is especially important for the workers in the area of potentially harmful for the safety and health of the workers. The Proposed system aims at designing multipurpose autonomous agricultural robotic vehicle which can be controlled through IoT for seeding and spraying of pesticides. These robots are used to reduce human intervention, ensuring high yield and efficient utilization of resources.

10] Multifunctional Robotic Vehicle for Agriculture Application Arunprasanna, Manickavasagam, Lawrence Justin and Parthasarathi this paper published on ISSN date 1/6/2017 In this research paper Mobile application controlled agriculture robot is a device used in agricultural activities with the aim to reduce manual activity, as labour shortage is the crisis of the recent agricultural production. Agricultural productivity relies on various factors such as water availability, soil fertility and quality of seeds, labour, availability and allied agricultural machineries. The labour shortage is the major concern for the cause of reduced productivity. In this research, a mechanical device with the aid of the mobile control is proposed to engage for multiple agricultural activities. This mechanized robot is expected to overcome the labour shortage and likely to enhance the agriculture productivity. Agricultural robotics is machine programmed to do agricultural task. The robot which is controlled by the mobile application or by a program which is used for harvesting, Plough, spraying and cutting and also includes camera monitoring manner with the help of this mobile application. The robot will be operated by a battery which is connected with a solar panel for recharging.

11] Research and development in agricultural robotics: A perspective of digital farming Ramin Shamshiri1,2,3* , Cornelia Weltzien2 , Ibrahim A. Hameed3 , Ian J. Yule4 , Tony E. Grift5 , Siva K. Balasundram1 , Lenka Pitonakova6 , Desa Ahmad7 , Girish Chowdhary this published on www.ijabe.org date July 2018: Digital farming is the practice of modern technologies such as sensors, robotics, and data analysis for shifting from tedious operations to continuously automated processes. This paper reviews some of the latest achievements in agricultural robotics, specifically those that are used for autonomous weed control, field scouting, and harvesting. Object identification, task planning algorithms, digitalization and optimization of sensors are highlighted as some of the facing challenges in the context of digital farming. The concepts of multi-robots, human robot collaboration, and environment reconstruction from aerial images and ground-based sensors for the creation of virtual farms were highlighted as some of the gateways of digital farming. It was shown that one of the trends and research focuses in agricultural field robotics is towards building a swarm of small scale robots and drones that collaborate together to optimize farming inputs and reveal denied or concealed information. For the case of robotic harvesting, an autonomous framework with several simple axis manipulators can be faster and more efficient than the currently adapted professional expensive manipulators. While robots are becoming the inseparable parts of the modern farms, our conclusion is that it is not realistic to expect an entirely automated farming system in the future

12] DESIGN AND FABRICATION OF MULTIPURPOSE AGRO SYSTEM Chetan Patil 1, Vishal Deshmukh 2, Shailesh Deshmukh 3, Govind rai4, Parag Bute5 this is published on troindia.in. In this paper This project strives to develop a robot capable of performing operations like automatic ploughing, seed dispensing and pesticide spraying. It also provides manual control when required and keeps tabs on the humidity with the help of humidity sensors. The main component here is the microcontroller that supervises the entire process. Initially the robot tills the entire field and proceeds to ploughing, simultaneously dispensing seeds side by side. Keywords: Agriculture, microcontroller, Plough, Seeder.

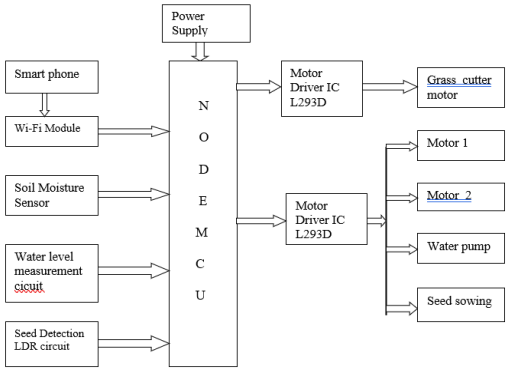
13] A Review paper on Design and Implementation of Agriculture Robot Yuvraj Vilas Deshmukh1, Vaishnavi Sudhir Ghodke2, Yamini Bharat Deore3, Abhilash Netake4 published on ISSN In this paper The idea of applying robotic technology in agriculture is very innovative, the opportunities for robot enhanced productivity is vast. Our prototype agriculture robot performs agriculture operations like seed sowing, ploughing and water spraying. Here we are using a regulated DC power supply (12V) to power the Arduino and DC motors which are connected to the wheels of the robot also with the help of Bluetooth; we will connect all the instructions through our mobile phone. We believe that this low cost and portable multipurpose robot will help the farmers and reduce their labour costs.

14] IOT Based Agribot for Agricultural Farming Vasudha Hegde[1]*, Sumathi M[2], Varsha Nagarajaiah3, Yeshaswini M.C4, Prof. Chandan Raj B R published on ISSN date 25 May 2019. In this paper Every living being requires energy for which it depends on food. Human population rely on agriculture, one of the main sources of food. In this project the main focus is to aid agricultural activities using IOT techniques in an effective and user-friendly manner. The system here consists of an agricultural robot which

performs grass cutting, ploughing, seeding along with obstacle detection. All these functions of Agribot is chosen using user friendly mobile application. Agribot uses Renesas microcontroller, DC motors for wheel rotation, to rotate cutting blades, to open or close seeding valve and to move the ploughing arm. Ultrasonic sensor is used for obstacle detection and android app is the mobile application. Bluetooth module is used to communicate between the app and Agribot. The function selected by the user is also displayed on the LCD of the Agribot. Agribot thereby helps to increase profit margins of farmers with minimal investments.
15] Design and Implementation of Agribot by Using IoT Shikha Sharma, Prateek Singh, Vaibhav Singh, Prabhat Kumar Srivastava paper published on IJCRT In this paper Agribot is an autonomous robot that performs the farming techniques and will help farmers in the farming land. This robot will be controlled by Arduino that will perform the farming processes such as ploughing, seed dispensing and harvesting. It could replace conventional farming mechanism in the third world century. As we know in conventional farming domestic animals are still used in rural villages and they suffer a lot. They use old instruments, they use biofertilizers manually and they do not produce high productions. The growing human population has shrunken the agricultural sources which results in less people in farming field and more in urban areas. Thus, it is necessary to find new ways to improve efficiency of agriculture all around the world. This led to increased interest and spending in field of Agriculture Robotics. This new way of farming in which robots will be used to overcome all those problems that occurs in traditional farming. It includes machines and new instruments and they will be going to produce high productions. This Agribot is also designed in such a way that it can perform all the farming processes on its own with consuming low man power and increasing the productivity rate. The main advantage of using this autonomous farming robot is that it not only increases the productivity but also check the environmental conditions like humidity, wetness of soil etc

V. BLOCK DIAGRAM

Block diagram of Multifunctional Agriculture Robot:



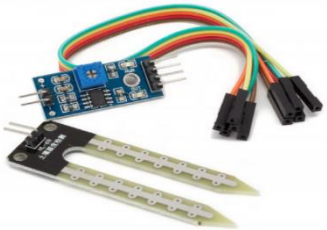
Block diagram of system

shows complete block diagram of Agriculture robot developed for farming operations. LDR circuit to check conditions for seed tank and field detection. Output is obtained through mechanical parts to perform seeding operation and movement of these parts controlled using DC motors. Power supply given to Node MCU board is through 12V Lead-acid rechargeable battery, but node MCU requires 5v so we have used voltage regulator IC7805 to regulate this high voltage. First, we have to check moisture level in soil by using soil moisture sensor. Moisture level is then display on blink app; user can switch on the water motor as per their need. Seed sowing in proposed system is as follows: digging the soil at a crop specific depth, dropping of seeds in the hole, covering it by soil and then pouring water on it. Node MCU have Wi-Fi module so we connected to our smart phone by using blink app which is a big IOT platform

VI. COMPONENTS

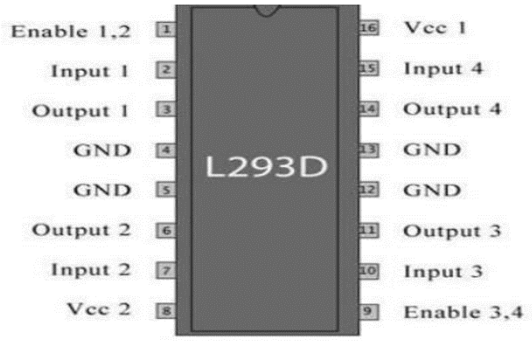
1. Soil moisture sensor

This sensor can be used to test the moisture of soil, when the soil is having the water shortage, the module output is at high level, else the output is at low level.
By using this sensor one can automatically water the flow plant, or any others plants requiring automatic watering. technique.



2. IC L293 D-DC Motor controller

L293D is a dual motor driver integrated circuit (IC).
Motor driver act as current amplifiers since they take a low current control signal and provide a higher current signal.
L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction



3. Water level measurement circuit

Water level indicator is used to detect the level of water, we have simply used transistors and four LEDs to indicate water level at four different stages.
Sensing is done by using set of 4 probes which are placed at 4 different levels on tank walls.
The level 4 represent the condition “tank full” and Level 1 represent the condition “tank empty”.

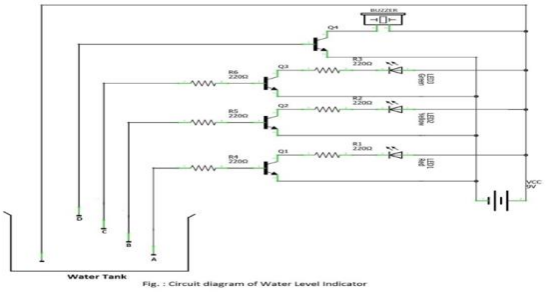


Fig. : Circuit diagram of Water Level Indicator

4. Power supply

In order to provide supply to the controller unit battery is used.
Lead acid battery is used in this project.
The lead-acid battery is a rechargeable battery. Along with their low cost, make them attractive for use in motor vehicles to provide the high current required by automobile starter motors

5. DC motor

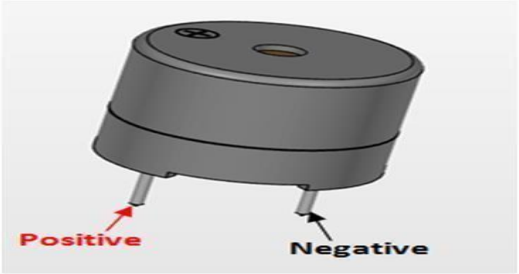
DC motors are part of the electric motors using DC power as energy source.
These devices transform electrical energy into mechanical energy.
The basic principle of DC motors is same as electric motors in general, the magnetic interaction between the rotor and the stator that will generate spin.
DC motors are widely used in speed and direction control because control of these motors are easier than other motors.

6. Water pump motor

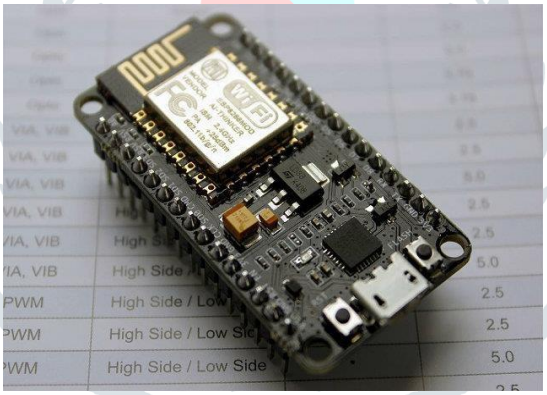
A Water pump motor is a DC motor device that moves fluids.
A DC motor converts direct current electrical power into mechanical power.
DC or direct current motor works on the principal, when a current carrying conductor is placed in a magnetic field, it experiences a torque and has a tendency to move. This is known as motoring action.
Pumps operate via many energy sources, including manual operation, electricity, engines, or wind power, come in many sizes, from microscopic for use in medical applications to large industrial pumps.

7. Buzzer

The buzzer consists of an outside case with two pins to attach it to power and ground.
Inside is a piezo element, which consists of a central ceramic disc surrounded by a metal (often bronze) vibration disc.
When current is applied to the buzzer it causes the ceramic disk to contract or expand



8. NODE MCU MODEL:



9. NODE MCU PIN OUT

WORKING OPERATION

1. BLOCK DIAGRAM

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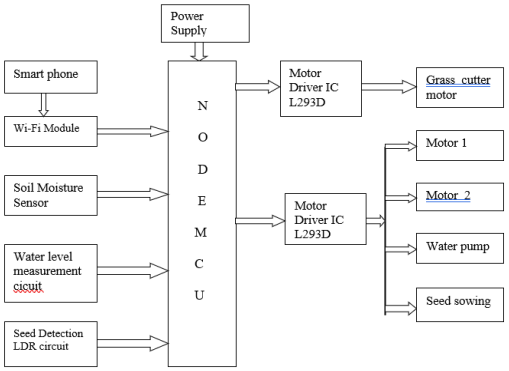

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2. CAD MODEL

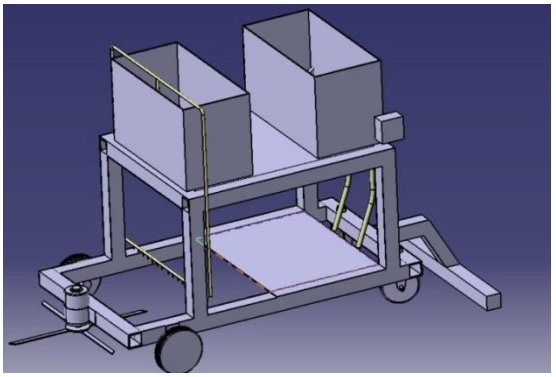
Design Computer-aided design (CAD) is the use of computer systems (or workstation to aid in the creation, modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing. CAD output is often in the form of electronic files for print, machining, or other manufacturing operations. The term CADD (for Computer Aided Design and Drafting) is also used. Its use in designing electronic systems is known as electronic design automation (EDA). In mechanical design it is known as mechanical design automation (MDA) or computer-aided drafting (CAD), which includes the process of creating a technical drawing with the use of computer software.

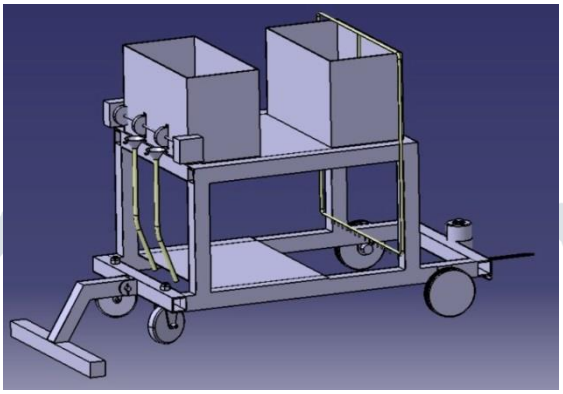
CAD software for mechanical design uses either vector-based graphics to depict the objects of traditional drafting, or may also produce raster graphics showing the overall appearance of designed objects. However, it involves more than just shapes. As in the manual drafting of technical and engineering drawings, the output of CAD must convey information, such as materials, processes, dimensions, and tolerances, according to application-specific conventions. CAD may be used to design curves and figures in two-dimensional (2D) space; or curves, surfaces, and solids in three-dimensional (3D) space. CAD is an important industrial art extensively used in many applications, including automotive, shipbuilding, and aerospace industries, industrial and architectural design, prosthetics, and many more. CAD is also widely used to produce computer animation for special effects in movies, advertising and technical manuals, often called digital content creation.

parameterization, and high-level constraints. The construction history can be used to look back into the model's personal features and work on the single area rather than the whole model. Parameters and constraints can be used to determine the size, shape, and other properties of the different modelling elements. The features in the CAD system can be used for the variety of tools for measurement such as tensile strength, yield strength, electrical or electromagnetic properties. Also its stress, strain, timing or how the element gets affected in certain temperatures, etc.

TYPES: There are several different types of CAD, each requiring the operator to think differently about how to use them and design their virtual components in a different manner for each. There are many producers of the lower-end 2D systems, including a number of free and open-source programs. These provide an approach to the drawing process without all the fuss over scale and placement on the drawing sheet that accompanied hand drafting since these can be adjusted as required during the creation of the final draft 3D wireframe is basically an extension of 2D drafting (not often used today).

Each line has to be manually inserted into the drawing. The
final product has no mass properties associated with it and cannot have features directly added to it, such as holes. The operator approaches these in a similar fashion to the 2D systems, although many 3D systems allow using the wireframe model to make the final engineering





VIII. APPLICATION

1. It is use in agricultural purposes .

IX. ADVANTAGE & DISADVANTAG

ADVANTAGES

1. Elimination of labor - The farmer is freed from the milking process and associated rigid schedule. and labor is devoted to supervision of animals, feeding, etc.

2. It brings us an opportunity of self employment for those who are unemployed and thinks the farming profession as nightmare.

3. It is one time investment then the expenditure of the farming will drastically

4. The use of fertilizer, pesticides, insecticides, herbicides and water consumption can be reduced in very large percentage.

DISADVANTAGES

1. It is costlier to implement

2. Complexity is increase

X. FUTURE SCOPE

1. More specific mechanisms can be developed.
2. Precision can be improved.
3. Design can be optimized.
4. Integrated with IOT to completely remove human interaction.
5. Sustainable power supply systems can be integrated into the system itself.
6. With some minor design changes, large scale production may also be possible.

XI. CONCLUSION

The smart agri-bot has improved productivity in agriculture functions. Multitasker Agri Bot is successfully developed and all attachments are implemented. It helped to reduce human effort by doing automatic functions like automatic seed sowing, automatic pesticides and fertilizers sprayer, plant disease detection, etc. More innovation can be done on the charging system of battery, such as Solar energy can be used for the charging purpose which would significantly reduce maintenance as well as the cost of an electric bill. We can also identify how to increase the productivity of certain plants based upon the amount and type of fertilizer to be used. The plant disease detection can be done as per the requirement of the farmer. Precision in seed sowing and spraying can be improved by developing different nozzles as per size and requirements

An attempt has been made to develop an app operated agricultural robot which performs fertilizing, water sparing, seed sowing and operations. The proposed system is battery operated and controlled by WIFI 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.

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