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Krishi Yantrarora – A Modern Agro Robot

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ABSTRACT

Agriculture has been the backbone of the Indian economy and it will continue to remain so for a long time. A man without food for three days will quarrel, for a week will fight and for a month or so will die. Agriculture is a branch of applied science. Agriculture is the science and art of farming including cultivating the soil, producing crops and raising livestock. It is the most important enterprise in the world. Over the years, agricultural practices have been carried out by small-holders cultivating between 2 to 3 hectares, using human labour and traditional tools. Agriculture is an essential thing for survival of the humans and the farmers who do agriculture spend so much of time in ploughing the field and irrigating the field etc. The proposed system is a boon to farmers which combines the robotics with agriculture and capable of moving around the field like a farmer and testing the soil, irrigating to the plants or field, Plough the field and sow the seed in the pre-determined row and irrigate the field along the rows autonomously.

Keywords: Ploughing, Irrigation, Obstacle Detection, Soil Testing, Seed Sowing.

I. INTRODUCTION

Agriculture is the practice of cultivating plants and livestock. Agriculture was the key development in the rise of sedentary human civilization, whereby farming of domesticated species created food surpluses that enabled people to live in cities. The history of agriculture began thousands of years ago. Plants were independently cultivated in at least 11 regions of the world. Industrial agriculture based on large-scale monoculture in the twentieth century came to dominate agricultural output, though about 2 billion people still depended on subsistence agriculture. The development of agriculture enabled the human population to grow many times larger than could be sustained by hunting and gathering. Agriculture began independently in different parts of the globe, and included a diverse range of tax, in at least 11 separate centres of origin. Agriculture is considered to be the basis of life for the human species as it is the main source of food grains and other raw materials. It plays a vital role in the growth of country's economy. It also provides large ample employment opportunities to the people. Growth in agricultural sector is necessary for the development of economic condition of the country. Unfortunately,

the traditional methods of farming are still used by many farmers which results in low yielding of crops and fruits. But wherever automation had been implemented and human beings had been replaced by automatic machineries, the yield has been improved. Hence there is need to implement modern science and technology in the agriculture sector for increasing the yield.

The idea of applying robotics technology in agriculture is very new. In agriculture, the opportunities for robot-enhanced productivity are immense - and the robots are appearing on farms in various guises and in increasing numbers. The applications of instrumental robotics are spreading every day to cover further domains, as the opportunity of replacing human operators provides effective solutions with return on investment. This is especially important when the duties, that need be performed, are potentially harmful for the safety or the health of the workers, or when more conservative issues are granted by robotics. We can expect the robots performing agricultural operations autonomously such as ploughing, seed sowing, mud closing and water spraying. Watching the farms day & night for an effective report, allowing farmers to reduce the environmental impact, increase precision and efficiency, and manage individual plants in novel ways.

In the early 1920's itself there were attempts to implement robotics to help improve agriculture. These were primitive models that required use of cable connection to operate the machine. Revolutionary attempts in the field of applying robots to agriculture continued to develop especially after 1980s as technological advancement in the field of computer science and engineering made machine vision (MV) guidance possible.

Agricultural robots have been regarded as a solution to reduce labour intensity, improve operation efficiency and operation safety. Most of the past researches focused on navigation control and a specific task to be performed by robots in agriculture. However, it is difficult to popularize these single-purpose robots due to low efficiency and high cost. On the other hand, multipurpose robot is more versatile since they can be used to carry out a variety of agricultural task. The advantage of this multi-tasking agricultural robot is that it does not require any fuel or petrol to work, the circuit model is less complex.

II. LITURATURE SURVEY

Pratiksha K. Deshmukh1, Prafull S. Mhatre, Suyash C. Kokane, Pavan E. Joshi – **"Multi-Tasking Agricultural Robot"** [1]. The basic aim of this paper is to develop a robot to perform plough, electric grass cutters are also hazardous and cannot be easily used by all. Solar based multi-tasking agricultural robot is a robotic vehicle powered by solar energy that is capable of cutting grass, ploughing and sowing by a very high-speed motor. As its name implies 'multitasking', so along with grass cutter it also provides fertilizer and pesticide spraying, ploughing and sowing.

M.Arun, R. Prathipa, Priyanka S, Akshaya Anand, Chandrika N (2019)- **"SMART AGRICULTURE ROBOT"** [2]. This paper aims at making agriculture smart using automation and IoT technologies. The proposed system concentrates on performing functions like ploughing, sowing seeds, irrigation, detection of obstacles and obstacle clearance.

Ashika A.K., Chaithra C.P., Bhavya S.N., G.R. Bharani, Vinutha C.M – **"Design and Implementation of Multitasking Robotic"** [1]. The implementation of Multitasking Robotic system into defence field as an advancement over application specific robot systems is named as the Multitasking defence robot. As the name suggests it does multiple tasks such as: Surveillance, Defence and Attack.

Gowtham Kumar S N, Anand G Warrier, Chirag B Shetty, Gerard Elston Shawn D' Souza – **"Multipurpose Agricultural Robot"** [3]. The basic aim of this paper is to develop vehicle to perform the

functions such as seed sowing, mud- levelling, these functions can be integrated into a single vehicle and then performed.

Ms. Aditi D. Kokate, Prof. Priyanka D. Yadav – **"Multipurpose Agricultural Robot"** [5]. In this project paper, it is shown that the farm cultivation process in autonomous agriculture system which is controlled by ARDUINO. The technique of seed operation in sowing is based on row per column depending on the types of cultivation. The irrigation process slowly applies water to the sown seeds in all the rows and columns of the farming plot. In fertilization process, fertilizer is sprayed on all the plants.

Shivakumar M C, Sunil Y S, Yamuna A S, Shruthi M **"Smart Phone Operated Multipurpose Agricultural Robot"** [4]. The basic aim of this paper is to develop a multipurpose machine, which is used for digging the soil, seed sowing, and leveller to close the mud and water sprayer to spray water with least changes in accessories with minimum cost. This whole system of the robot works with the battery and the solar power. Micros, Spectrum ZX and Commodore 64 machines that people of an earlier generation learned to program on, the base frame is made for the robot with 4 wheels connected and driven the rear wheel is dc motor. One end of the frame, cultivator is fitted which is also driven by dc motor and design is made to dig the soil. Water pump sprayer to spray the water. Solar is placed on top of the robot and is connected to the battery for charging the battery. The whole robot requires the 12v battery to operate the system. Thus, the max efficiency is utilized from the sun by the solar panel and to the battery.

Jin-lin XUE*, Bo-wen FAN, Xin-xin ZHANG and Yong FENG- **"An Agricultural Robot for Multipurpose Operations"** [6]. This paper aims at develop a multipurpose robot platform for several tasks, such as spraying (water, liquid fertilizer or pesticide) and weeding, which can be implemented by adding or removing the sensing component(s), replacing actuator(s) and switching control software. In this work, taking two tasks of spraying water and weeding by machine as examples, vision- based guidance and operations were conducted to assess the performance of two tasks in a green vegetable greenhouse, and to validate if the different operations can be achieved on the same mobile platform.

N. Kishore, V. Avinash, Chennakeshwar – **"Multi-Purpose Agricultural Robot"** [2]. This paper aims at develop by Using different robot for the different tasks can consume more time and power, and cost of each one is also more. To avoid these kinds of problems we were using the single robot to perform a different kind of agricultural tasks. And the cost same when compared other robots. Our Robot can perform tasks like Seeding.

III. PROPOSED METHODOLOGY

In this Project, We have 6v Rechargeable battery at the current retain of 5 AMph (Ampere per hour).

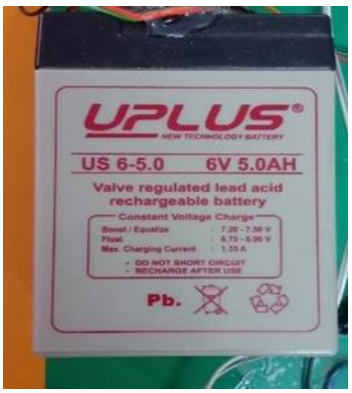

Figure 1: Rechargeable Battery

Here Step down Transformer which convers 230AC voltage into 9 volt. And rectifier which converts AC into DC with diodes then we charge a battery.

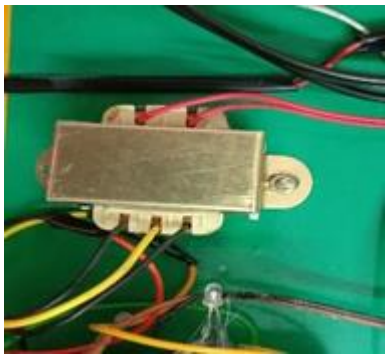

Figure 2: Step Down Transformer

The battery part is connected to all the sections, And we have one regulator called 5volt (7805) regulator, which is IOT Node MCU Module will communicates from mobile or webpage to cloud server, with internal Wi-Wi, internal communication takes place.

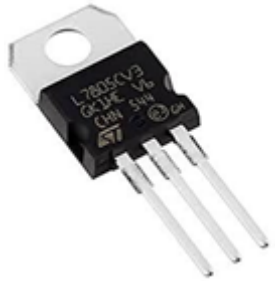

Figure 3: 5v Regulator

We are using 2 L298 IC modules for robotic movements and operations, these are helpful to rotate the motor in both clockwise and anticlockwise directions. and it contains 2 output pins used to move the robot and another 2 pins for seed sowing and soil testing motors respectively.

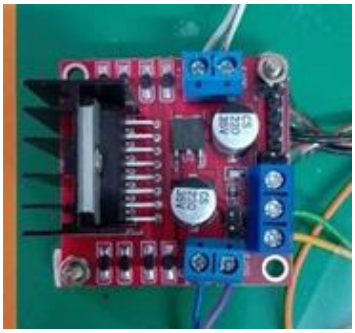

Figure 4: L298 Motor Driver

Apart from this we have one device called as Electro magnetic Relay, it act as a Switch is for the purpose of to turn on or turn off the Pump just to irrigate the field.

Figure 5: Electromagnetic Relay

Figure 6: Soil Moisture Sensor

Soil Moisture Sensor :- Soil moisture level of the soil is calculated repeatedly to check whether farm requires water or not. The soil moisture is measured using resistive immersion type soil moisture sensor. This sensor produces an analog signal corresponding to wetness of the soil in the nearby area where the sensor is immersed in soil.

BLOCK DIAGRAM

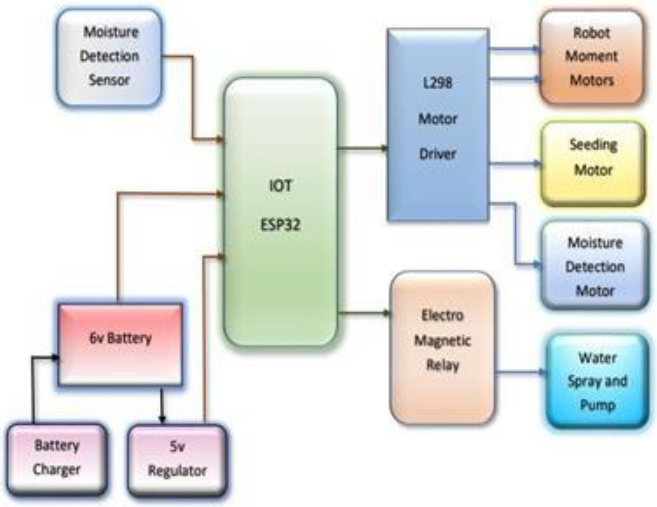

Figure 7: Block Diagram of Smart Agricultural Robot

For the front Obstacle we have obstacle sensors, one is IR - LED and photo diode, IR LED emits the light when it hit to the object this is reflected back and the output is connected to the buzzer.

And one more motor we have connected for Arm like a structure, for this we attached moisture level sensor. this is going to detect the moisture contents in the soil and is connected to the circuit, this circuit provides as an input for the IoT.

Then at the Backside we have seed dispensing unit(seed-sowing) it's a mechanical device, we have a motor there is opening – closing for the sowing. if we give more time to delay -more number of seed will dispense, if we give less time to delay -less number of seeds will dispense.

And for the main power on – off ,we have one switch and there are two motors connected ,which are operated 30 rpm speed, 2 free motors just connected to the bearings.

The submersible pump is connected to electromagnetic relay, same as our switch will operates. this is connected with the electronic signal, so this is also one of the output connected to the relay, when relay get on, it takes extra power from the battery.

We splitted the power supply here, one small battery for the pump and rest of the battery for the circuit device.

IV. REQUIREMENT ANALYSIS

A. HARDWARE REQUIREMENTS

The section of hardware configuration is an important task related to the software development insufficient random-access memory may affect adversely on the speed and efficiency of the entire system. The process should be powerful to handle the entire operation. The hard disk should have capacity to store the file and application.

- Printed Circuit Board (PCB)
- Node MCU
- 7805 Regulated Power Supply
- LM7805
- Geared DC Motors
- Electromagnetic Relay
- IP Proximity Sensor
- Moisture sensor
- ESP32

B. SOFTWARE REQUIREMENTS

A major element in building a system is the section of compatible software since the software is the market is experiencing in geometric progression. Selected software should be acceptable by the firm and one user as well as it should be feasible for the system. This document gives a detailed description of the software requirement specification. The study of requirement specification is focused specially on the functioning of the system.

- Blynk IOT 1.5.1
- Arduino Sketch 1.8.15

V. EXPERIMENTAL RESULTS

Figure 8: Connection to Server

The Figure 8, shows that code for connecting to server. The hardware components should be connected to the wi-fi and the server will be initiated. As soon as the server gets connected the shows it is online mode.

Figure 9: Irrigation by the Robot

The figure 9, shows that the Irrigation. This robot can be operated using two different modes, by using RF remote in which it will help to move the robot manually in which we can turn on sprinkler wirelessly whenever we want.

Another mode is an autonomous mode in which robot will move automatically and it will detect obstacle using ultrasonic sensors. In this automatic plant watering system is being used by keeping the water pump on.

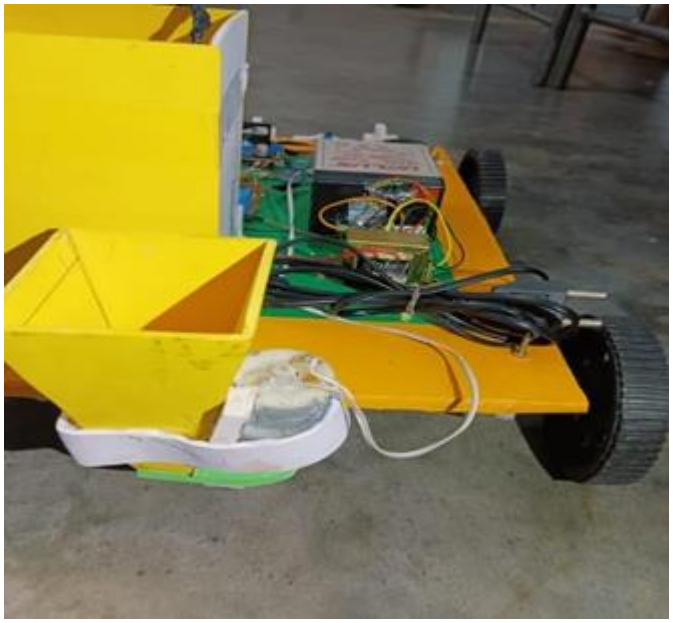

Figure 10: Seed Sowing

The figure 10, shows that the Seed Sowing. Here is one container with opening and closing nozzle. When we give the input from the mobile phone then nozzle will opens and seed are dropped out from the nozzle.

Figure 11: Ploughing by the Robot

The figure 11, shows that the Ploughing. Initially the robot tills the entire field and proceeds to ploughing its break's the soil, simultaneously we can dispensing seeds side by side.

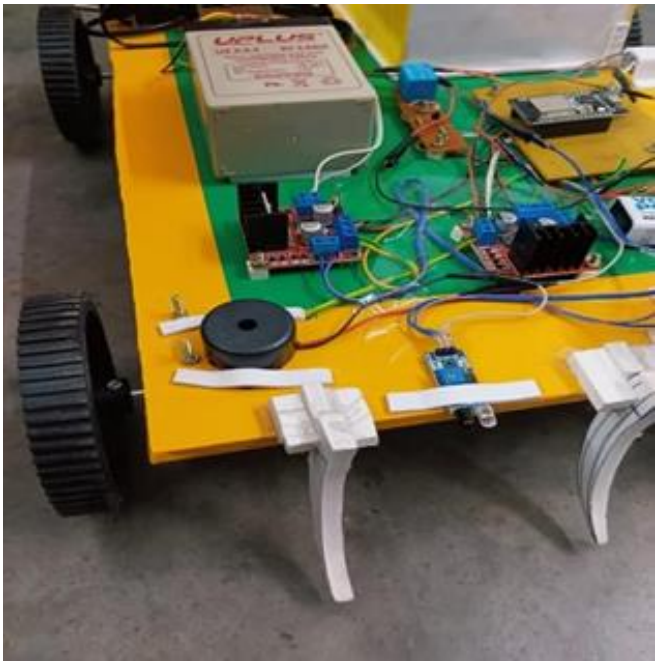

Figure 12: Obstacle Detection by the Robot

The figure 12, shows that the Obstacle Detection. In autonomous mode the robot will move automatically and it will detect the obstacle using IR proximity Sensor. And when sensor sense the obstacles the buzzer will be make sound.

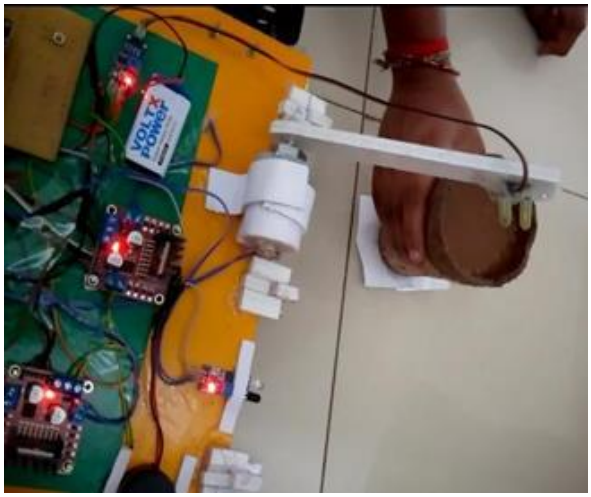

Figure 13: Soil Testing

The above figure 13, shows that the Soil Moisture Sensor uses capacitance to measure dielectric permittivity of the surrounding medium. In soil, dielectric permittivity is a function of the water content. The sensor creates a voltage proportional to the dielectric permittivity, and therefore the water content of the soil.

Figure 14: Outfit of All the Functions performed by the Robot using Blynk IOT

The figure 14, shows that the open – Close for the function seed-sowing. And Up-down for the function soil testing. And on-off for the irrigation purpose.

Figure 15: Robotic Movements

The above figure 15, shows that the bearings will move Forward, Reverse. Left and Right sides in all the directions respectively.

VI. CONCLUSION

We have designed an Agricultural Robotic device which is IOT based that contains the different sensors to monitor the Soil Moisture, Obstacle detection and also this device performs the functions like Ploughing, Seed- sowing, Irrigation. This device is very helpful for the farmers because there is no loss of money. He can yield the crops based on the parameter monitored results and helps the increase in agricultural production.

VII. FUTURE SCOPE

In future We may add more number of seed sowing container's and obstacle clearance function to this device.

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