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IoT Based Multipurpose Agribot with Field Monitoring System

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ABSTRACT: The objective of this paper is to design, development and the fabrication of the Agribot which is a multipurpose bot can perform all the farming operations including ploughing the soil of the field, sowing seeds in the ploughing area, making the field in plain by using leveler, watering the crops, fertilizing them and monitor the agribot by using camera. The traditional farming methods consume a lot of manual labour. Some of the operations are manual, while others are operated using manually operated machines. Therefore, there are no such robots, which can perform all these operations autonomously. In addition with this when the major fieldwork is done, the farmer has to keep a check on the field for various reasons. This is achieved by the monitoring system. Various parameters such as drip irrigation, fertilizing, maintaining temperature (for green house farming), removal of extra water (during floods) and keeping track of crop growth by camera will be taken care by using monitoring system.

KEYWORDS: Agribot, ploughing, sowing seeds, leveler, fertilizing, Monitoring system.

I. INTRODUCTION

India is a developing country having the second largest arable land in the world. About 60% population of India is depending on agriculture. Because of this only India can survive even during recession period. Therefore, agriculture is a backbone of India. Agriculture contributes in India's nationalincome as well as it helps in generating employment in the country. Only because of the agriculture, India can meet the food demand of ever-increasing population. Now-a-days, modern ways of yielding Argo products have changed the old ways of agriculture in the world and the increasing population has met the need to feeding all the people in the world.

The below charts shows SHARE OF THE LABOR FORCE EMPLOYED IN AGRICULTURE ACROSS WORLD

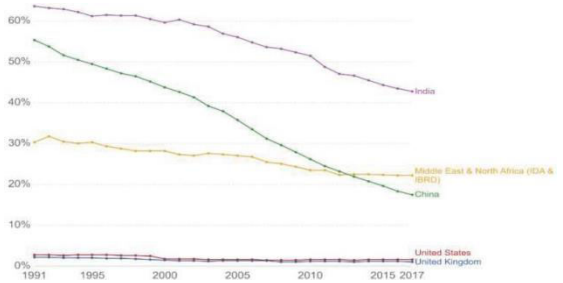

Fig. 1. Share of the Labor Force Employed In Agriculture across Worldhttps://ourworldindata.org/employment-in-agriculture

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The below charts shows AGRICULTURE VALUE ADDED PERWORKER

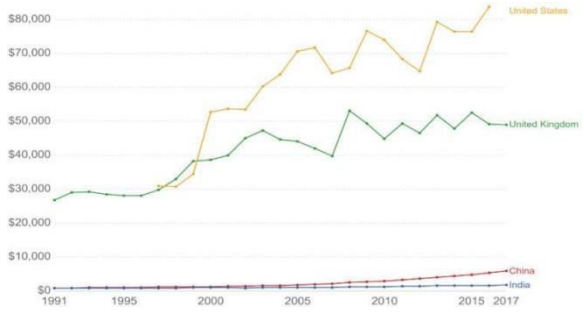

Fig. 2. Agriculture Value Added Per Worker https://ourworldindata.org/employment-in-agriculture

II. PROPOSED SYSTEM

All the field operation such as ploughing, sowing, rolling, watering and fertilizing will be conducted autonomously usingan android application. The bot can be controlled in two ways, manual and autonomous mode. All the operations will be performed simultaneously in the autonomous mode, while the system can control any operation using the manual mode.

a *Ploughing:*
The traditional method for ploughing involves strenuous labour wherein the farmer along with animals or tractor (machine) ploughs the entire field manually. The drill plough along with a servo motor is present on the bot. The microcontroller commands the servomotor, which is attached to the drill plough and can be operated according to the user's need. To operate the process of ploughing, the servomotor is given commands in which is rotates up to 180 degrees and the drill plough enters the ground. When the drill enters the ground, the bot is moved according to the path using sensors and ploughing is being performed. In the manual mode, the agribot can perform ploughing only on the required places. While in the autonomous mode, the bot follows the path already specified by the user. *Sowing:*

The next operation involves sowing the seeds in the field. Traditionally, sowing is done manually that is the farmer or his workers sow seeds by scattering them on the soil. In this project, a servomotor along with a tank containing seeds is placed on the agribot with appropriate openings. For sowing, the shaft is rotated up to a desired angle and as the robot moves, the seed falls down in the soil from the openingspresent on robot. In the manual mode, the frequency of the seeds falling on the ground can be controlled by rotating the shaft of the motor accordingly.

b *Leveling:*
Leveling the field is the basis of the third object. When the seed is sowing manually, it is inserted into the soil. This operation consumes manual labour and time. While sowing the field, the seeds were not dug into the soil. Therefore, this operation named leveling, which levels the land and the seeds are sown properly. The roller is connected to the servo motor and placed on the bot. The initial position of servomotor is such that the roller is above the ground. The shaft is rotated such that the roller is exposed to the field and when the agribotmoves, the field is being levelled. It can save the time and energy of the farmer by performing the operation autonomously. This operation goes hand in hand with sowing. In manual mode, the freedom to control this operation separately.

c *Watering:*
Watering the field is done using drip irrigation. Drip irrigation uses the pipelines (with appropriate openings) whichare spread across the field and water is fed to the crops according to the requirement. The water is fed in the pipelines by a water pump inside the water tank, which is present on theagribot. In manual mode, the freedom to control this operation separately.

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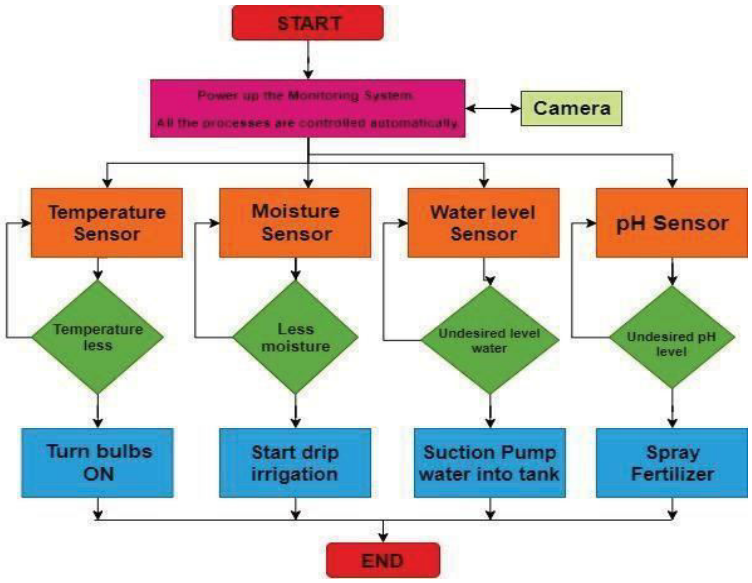
d *Fertilizing:*
Fertilizing the field is the next operation in the line, which is necessary to ensure proper growth of the crops. According to the traditional farming methods, manual labour is used to fertilize the field. This process again, consumes time and energy of the farmer. A tank (with appropriate openings) filledup with fertilizers along with the servo motor is placed on the agribot. Initially, the opening is closed as the shaft of the motoris present on the opening and no fertilizing is done. For fertilizing, the shaft is rotated up to a desired angle to let flow the fertilizer from the openings present on the tanks. In the manual mode, frequency of the fertilizers can be controlled.

e *Monitoring system*
In the monitoring system camera module is placed at the backside of the agribot, which is used to monitor the end resultof the agribot work from any remote location due to the connectivity with the Wi-Fi of the agribot. So that the correction in the operation can be taken after it and improve theperformance of the agribot.

III. AGRIBOT FLOWCHART



IV. HARDWARE COMPONENTS

This idea for the integration of two modules into a singleunit comprises of following hardware components:

- AGRUINO MEGA (2560)
- NODEMCU(ESP8266)
- SERVOMOTOR
- INFRARED SENSOR
- DC MOTOR
- ESP32 CAMERA MODULE
- TEMPERATURE SENSOR
- WATER LEVEL SENSOR
- pH SENSOR
- MOISTURE SENSOR
- ULTRASONIC SENSORS (HC-SR04)

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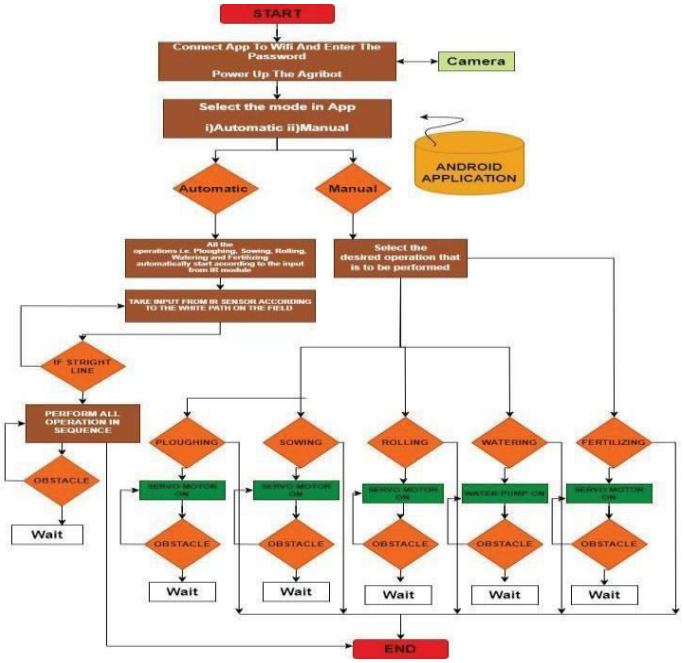
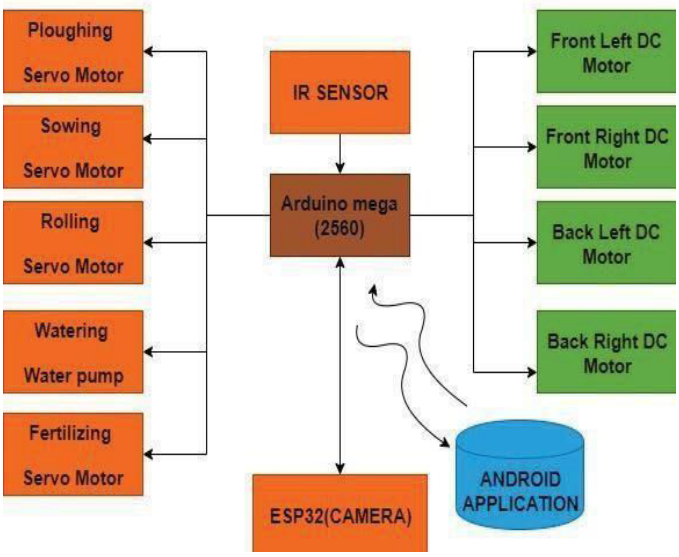


Fig. 5. Flowchart of Monitoring System

V.WORKING PRINCIPLE

This idea comprises of two unit Agribot Unit andMonitoring System Unit: -

Agribot Unit



Arduino Mega (2560) controls the four wheels of the agribot according to the input from the IR sensor. The android application takes the command from the user such as selectionof the mode (automatic and manual) or which operation to be performed and it is further sent to the Wi-Fi module. The controller in turn gets command from the Wi-Fi module (Esp32866). Arduino Mega is also used to give commands to the respective motors that will carry out the operations including ploughing, sowing, levelling, watering and fertilizingof the crops.

- Agribot get connect to Wi-Fi
- Commands from app on the mobile will sent
- According to it that particular task will get performed

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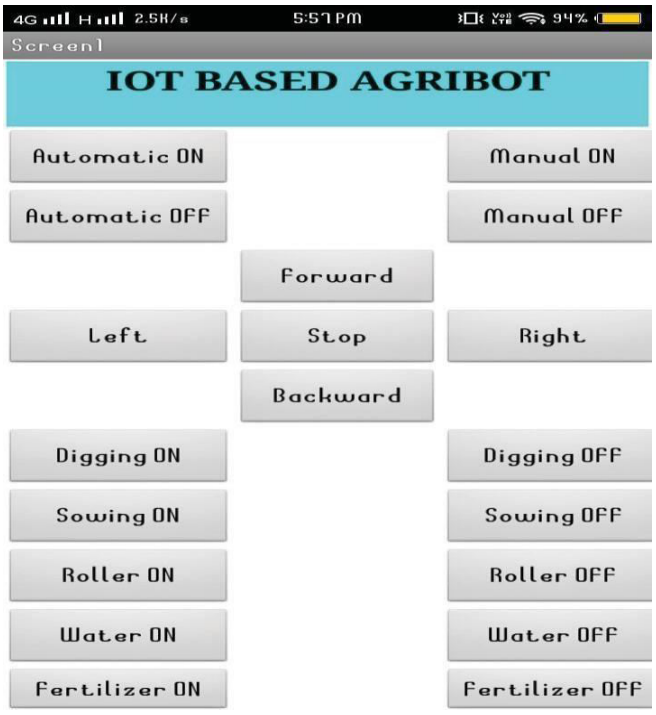

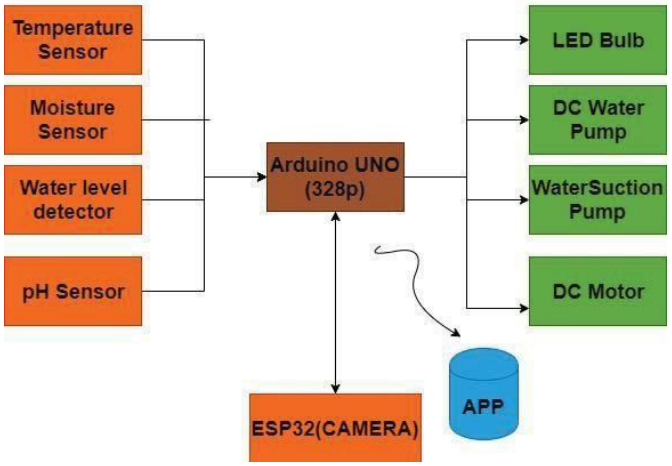

fig. 8. Block Diagram of Monitoring System

In Monitoring system when the major fieldwork is done, the farmer has to keep a check on the field for various reasons. This is achieved by the monitoring system. Various parameterssuch as drip irrigation, fertilizing, maintaining temperature (forgreen house farming), removal of extra water (during floods) and keeping track of crop growth will be taken care by using monitoring system. Drip irrigation can be done according to the requirements of the crops. According to the frequency of insects, fertilizers can be sprinkled over the crops. The temperature can be maintained according to the crop requirements (for green house farming system). The extra water during floods can be removed and stored in tanks for future use (water harvesting). Proper track of crops will be keptusing surveillance system.

VI. ADVANTAGE

- This fully automatic robot which works on open architecture principle and does a lot of work in farms,so it reduces human labour. Due its quick action timewill be saved.

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- Agribot can able to work in any environmentalcondition.
- The robots can work continuously without any error.
- Protection against harmful effects of chemicals.

VII. APPLICATION

- It is used for agricultural purposes to do multiple taskat a time.
- The system observes different environmental conditions (temperature, soil moisture) & take actions accordingly which humans can't do accurately.
- An autonomous robot works on open architecture principle and does a lot of work in farms so it reduces human labour.
- It is used as a Monitoring bot in the agriculturalfields.
- It can also use in the Green house farming and in nursery.
- It can alter to any type of crops in the fields.
- It is cost efficient and highly reliable one.

VIII. FUTURE SCOPE

The solar panel can replace the battery power supply to reducing the recharge cost and get power on the field itself. Then it also includes the weeding and harvesting in this system.

IX.CONCLUSION AND FUTURE WORK

In agriculture, the opportunities for robots are becoming thepart of the today world. The causes associated with farm equipment can probably be overcome with technology. This equipment may be in the future, but there are important reasonsfor thinking that it may not be just replacing the human driver with a computer. Crop production may be done better and cheaper. From the above study of IoT technology application and the implementing it on the field with the help, Arduino with the proper monitoring system of sensors and camera combined together make an efficient proposed system. The precision monitoring and collecting data from the surroundings using IoT made a greater improvement in the way of doing farming. The sensor collects valuable data and camera are usedwell at the same time using the proper Server as the System Inaddition, the proposed system offers a good user interface, easy way for implementation and real time environment in the farming. In addition, have a good reliability, high performances and improve the environmental monitoring in the field of farming. This paper also optimizes the laboring cost for the farmers and it conserves the valuable time to invest in some other things like so, the agriculture can be made more efficient and in accurate manner with the help of Agribot. Finally, the proposed system will change the mundane ways of doing the farming and led to arose a new era in the future.

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