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AGRIBOT – IMPLEMENTATION OF ROBOT IN THE FIELD OF AGRICULTURE

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ABSTRACT:

Agriculture is the backbone of our country. Farming in the near future has to produce more food and fibre to feed the growing population with the smaller rural labor force and contribute to the overall development of countries. Robotics in agriculture has the potential to improve the competitiveness and increase the crop productivity compared to the current methods, thus becoming an increasingly active area of research. In this project, robotics and its application in agricultural fields are discussed, that help to increase the accuracy and precision in agriculture. The robot is used to develop the agricultural land with less use of manpower. The aim of the 'Agribot' is to reduce manpower, time and increase the productivity rate. All the basic agricultural processes such as ploughing the land, sowing the seeds, watering the field, sensing the water content in the soil and harvesting of the crops are performed by Agribot. The above processes are controlled using a PIC Microcontroller 16F877A. The transmission and reception of signals are carried out using a ZigBee module. The overall process is simulated with the help of a software called Proteus Isis 7.7.

INTRODUCTION:

➢ PURPOSE OF THE PROJECT:

The purpose of this project is to minimize the labor of farmers in addition to increasing the speed and accuracy of the work. In the present scenario, there are many recent developments in the field of robotics and agriculture on a large scale. Here we are integrating both the technologies. The robot is controlled by a keypad, through which we can operate the machine on a large scale over a large distance. This will help the farmer to perform his agricultural works from a far distance without actually going into the field with an ease in control. This robot can perform elementary functions involved in farming i.e. it can plough the field, sow seeds, sense the soil moisture according to which the robot will irrigate the field as well as harvest as per the commands given by the farmer.

➢ SCOPE OF THE PROJECT:

The robot enables the farmer to perform the agricultural activities without going into the field. With the development of robot farming system, food production can be increased considerably and economically.

➢ ESTABLISHMENT:

1. PLOUGHING

Ploughing is one of the most important primary cultivation processes and has been carried out since the start of civilization. It is

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effectively the inversion or mixing of topsoil to prepare a suitable seed bed. The seed requires contact with the soil moisture to allow uptake of water and nutrients, it requires stability to hold the growing plant and a structure that allows the roots to develop and the shoots to grow.

2. SEED SELECTION AND SOWING: Healthy, good quality seeds are the root of a healthy crop. Hence selection of seeds is crucial. Selection helps to obtain healthy seeds; sustain and optimize the quality of crop strain. Based on plant size, quantity of grains, fruit size or color, disease resistance etc. seeds can be selected.After the preparation of soil, the previously selected seeds are scattered in the field. This is called sowing. Sowing should be done carefully and uniformly. If seeds are not sown uniformly, overcrowding of crop happens. For sufficient sunlight, water and other requirements congestion needs to be prevented. Selection and sowing of seeds are two agricultural practices which demand extreme attention and care.

3. IRRIGATION:

Irrigation refers to the process of supply of water through artificial means such as pipes, ditches, sprinklers, etc.The irrigation system helps the farmers to have less dependency on rain-water for the purpose of agriculture. The necessity of irrigation is because of the variety of climate and irregular and uncertain monsoon.

4. IMPORTANCE OF SOIL MOISTURE SENSOR:

Monitoring soil moisture is the key to getting the right amount of water to crops at the right time.Monitoring soil moisture can help growers manage soil moisture. Choosing the right times and the right amounts to irrigate can lead to:

- Higher yields
- Better product quality
- Improved plant vigor
- Reduction in disease
- More effective use of water (water efficiency)
- Reduced irrigation costs.

Water and nutrients are used most efficiently when an irrigation event applies only the amount of water the crop needs and the soil can hold. Considering the time it takes to irrigate, it makes sense to spend time taking soil moisture measurements to improve irrigation decisions.

5. HARVESTING:

Harvesting is the act or process of gathering a ripe crop from the fields. Reaping is the cutting of grain or pulse for harvest, typically using a scythe, sickle, or reaper. On smaller farms with minimal mechanization, harvesting is the most labor-intensive activity of the growing season. On large mechanized farms, harvesting utilizes the most expensive and sophisticated farm machinery.

AGRICULTURAL ROBOT:

➢ **SEQUENTIAL PROCESS:**

- The Agribot is moved in the direction accordingly with the help of the controller to reach out the area where the agricultural practices must be done.

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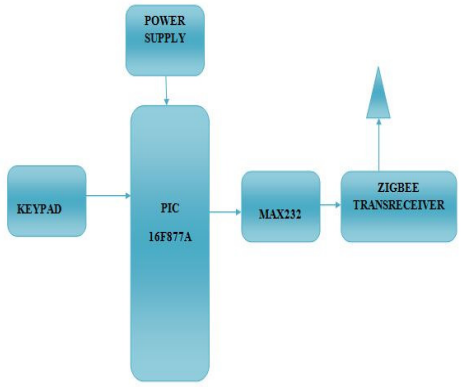
- With the help of the Plougher, the land is ploughed.
- The seeds are sowed with the help of sprinkler mechanism in such a way that the surrounded area of the robot is covered to a certain extent.
- The reverse operation of the ploughing tool is used to cover the seeds with the soil
- Next comes the irrigation process. Where the robot is programmed to do two operations:
  i. After the previous step, the irrigation is done to assist in the growing of agricultural crops.
  ii. With the help of the soil moisture sensor, the presence of liquid content (moisture content) in the soil is found. Depending on that, the irrigation is done to protect plants against frost and prevents soil consolidation.
- The last process is harvesting i.e cutting the grown crops using a Cutter.

➢ WORKING OF BOT:

✓ TRANSMISSION SECTION (TXD)



The power supply is connected to pin 11 of PIC microcontroller. The operations are controlled using a keypad which transmits the data to the PIC controller. The MAX 232 typically converts RX, TX, CTS, RTS (pins 9, 10, 8, 7). The transmitter takes input from controller's serial transmission pin 11 and sends it to the receiver pin 14 which in turn send it to the ZigBee transreceiver.

MAX 232 has a higher baud rate and uses a smaller external capacitor which makes it compatible. The pins 15 & 16 along with pins 33 – 40 of the PIC are connected to the switch 1 - 10 of the keypad for controlling the various agricultural processes such as forward, reverse, left turn, right turn, seed spraying, water irrigation, soil moisture and harvesting.

Pins 25 & 26 are connected to the RXD & TXD of the ZigBee transreceiver for receiving and transmitting of data wirelessly at 2.4GHz. Pins 8 – 10 of PIC are connected to RS, RW & E of the LCD for read/write and to enable the process. Pins 19 – 22 and 27 – 30 of PIC microcontroller are connected to 16 X 2 LCD which can display 16 characters per line and has 2 lines.

✓ RECEIVER SECTION (RXD):

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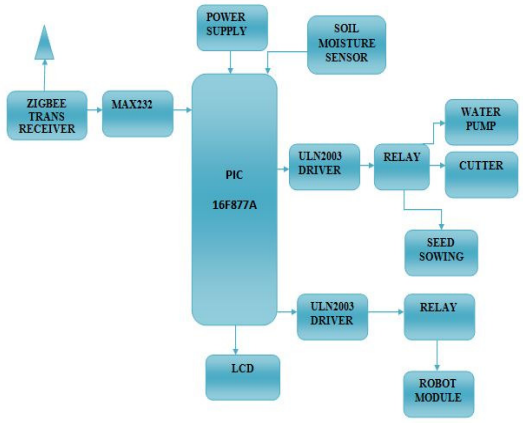

As the power supply is connected to pin 11 the circuit is activated. Pins 25 and 26 are connected to the ZigBee transreceiver, which receives the data and sends it to MAX 232 for serial communication of data to take place. Once the data is received they are sent to the PIC Microcontroller. The pins 33 – 39 of PIC Microcontroller are connected to the ULN 2003 driver of pins 1 – 7 for communication of data.

From ULN 2003 the main operation begins i.e. the driver is connected to the relay switches which can control the motor process that is required to execute the operation. The remaining pins of the ULN 2003 driver (9 – 16) are connected to the relay switch for different process. Each relay switch is connected to a DC motor.

The process that has to take place is executed by pressing the keypad and the data is transmitted via ZigBee to the receiver section. The signal is transmitted to the relay switch and the corresponding relay switch is activated which makes the motor to run, thus accomplishing the desired task.

Each relay switch is connected to a motor and each operation is performed. The first relay switch is connected to the motor and it is used to move the bot forward, the second one is used to move the bot in the reverse direction.

The third relay switch is used to turn the bot towards the left and the fourth towards the right side of the field.

The fifth relay switch is used to plough the field and the sixth is used to spray the seeds in the field.

The seventh relay switch is used to sprinkle water in the field from the tank and this tank has to be re-filled with water as it is not an automatic process. The eighth one is used for harvesting. i.e. cutting of the grown crops using a cutter.

The last operation is the soil moisture sensing, the sensor (VH400) is moved up and down in the field to check the moisture content and it is connected to pin 2 of the PIC Microcontroller.

As the operation is done it is displayed on the LCD screen, as the pins 19 – 22 & 27 – 30 are connected to the LCD. The pins 8 – 10 are used for read/write or enable operation. Once the work is over the process is stopped and with a few seconds of delay the motor stops working.

Between each process a delay is created for a pause in the previous action and the next action to take place which makes the work flow smoothly. If there is failure of signal, we have a reset button on the system to restart the operation without any stop in the work. Thus the agricultural work is done using the Agribot.

RESULT:

- **WORKING MODULE:**

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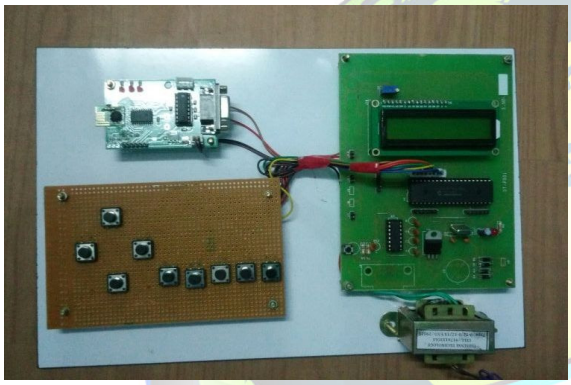
- **CONTROLLER:**



CONCLUSION:

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 robot may be just replacing the human driver with a computer but it means how production can be increased in the future generations. The exploitation of robots in agriculture will rally around in near future and guarantees increased food production. As the demand for the food production increases, the farmers face a shortage in labor. To reduce the shortage problem we can use this Agribotas it saves both money and time.

The control of the Agribot is easy and user friendly to the farmers as it does not need any skilled workers. Robotics can, in many situation increase productivity , safety, efficiency, quality, consistency of products as well as work continuously even in an unfavorable condition without any human needs and illness. The Agribot is designed for agricultural purposes such ploughing, seeding, watering, monitoring the soil moisture and harvesting.

FUTURE SCOPE:

In future, the Agribot can be made autonomous for performing the various agricultural operations. It is evident from the research that there is a significant potential for applying the autonomous system in various agricultural processes, where it is possible to impose adequate control and safety regulation system at a reasonable cost.

The robot can be implemented as a climbing robot in future for spraying the pesticides in trees. Features like weed plucking can be used. It can act as a security for the farms. Due to lack of human resources we can use this robot to reduce human work and labor problems in the agriculture field.

Swarm robotics is a new type of robotics that allows simple individual robots to work together to perform complex tasks. It can be used for precision agriculture. The aim of precision agriculture is to apply agrochemicals (fertilizers, pesticides, herbicides) to the areas where they are most needed, at a given time, instead of the traditional approach to spray whole fields uniformly almost every day.

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