Smart Irrigation System Using Robots

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Abstract*- To limit the most efficient soil dampness supervise process in an sensible remotely monitored system. It also show the domestic viability of an integrated system of production were water demand, nutrients and pH are kept optimum automatically. The plan is designed to overcome water wastage, nutrition lack and pH imbalance. This proposed smart agriculture technology is environmentally favorable, effectual, cost effective and gives the farmer the influence to control and supervise work in real time. This technology supply optimum and efficient solution for vast ranges of production with their merits and demerits. This robotic system is called as agricultural robot. This paper provides a detail review of the Robot.*

Keywords*-* Movement, Moisture Sensor, Water level Detector, Robot Architecture, Agricultural Functions

I. INTRODUCTION

Farmers are the firmness for food production. In India,around 56% people are subordinate upon farming to obtain livelihood as shown in the figure (Fig. 1).In irrigation system, depending upon the soil type, water is provided to plant. In agriculture, two things are very important, first to get the information about the soil and second thing is to measure moisture content of the soil. As before farming will be done by the human being with the help of bullocks and the tractors. But now a days we cannot do that because population are growing and people are not interested in agriculture because of less rainfall and shortage of water. And people far from field cannot take care of the crops properly. As there are very few water resources and due to scarcity of water we had upgraded our technology and invented many different techniques for sustainable use of water for agricultural crops. Plant Evapotranspiration(ET). ET is affected by weather parameters, including solar radiation, temperature, relative humidity, wind speed, and crop factors, such as stage of growth, variety and plant density, management elements, soil properties, pest, and disease control. 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 makeagriculture

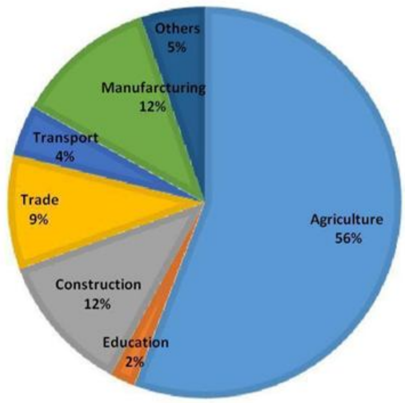


Fig 1.1

This paper the author suggested that robot will start and maintain soil moisture simultaneously.

II. LITERATURE SURVEY

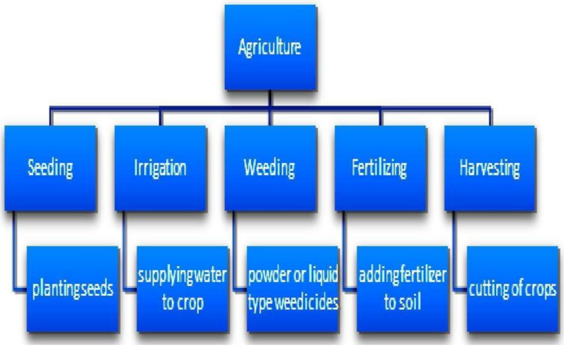
Guan Wang, Yu Sun, and Jianxin Wang[1] gives programmed and precise estimation of ailment seriousness is fundamental for sustenance security, illness administration, and yield misfortune forecast. Profound taking in, the most recent leap forward in PC vision, is promising for fine-grained ailment seriousness grouping, as the technique stays away from the work escalated include designing and limit based division. Utilizing the apple dark decay pictures in the Plant Village dataset, which are additionally commented on by botanists with four seriousness arranges as ground truth, a progression of profound convolutional neural systems are prepared to analyse the seriousness of themalady.

GaddipathiBharathi, ChippadaGnanaPrasunamba[2] discussed here is PLC controlled Water Distribution System. The conventional method used before in older times, results into problems like empty running, overflow, leakage. The automation of the process thus helped to overcome this problems based on level, pressure, flow parameters and it minimizes human efforts for the same. The automation thus implanted at the PCMC Water Treatment Plant has proved to be effective. In this project, we have successfully studied the following objectives. Thus, we have successfully studied the programming by using ladder diagram using online simulators. We have used Nexgine 2000 PLC and programming software is Coveys. We have also introduced to central monitoring system using SCADA and HMI for thisapplication.Vishal D Raut[3] explains the Remote Measurement & Control of Greenhouse based on GSM –SMS for controlling the Devices by SMS in greenhouse. The main purpose of this system conception is the remote control of the climatic parameters that influence the production in greenhouse. Several sensors and Control Devices are Used. These sensors provide relevant information that is used to control their different Devices Such as D.C Fan, Bulb,Water pump by SMS. The procedure used in our system provides the owner with a remote control avoiding the needed to perform the control actions on site. The developed system in this paper is ideally suited for agricultural greenhouses. It is simple useful for farmers. Besides, most people use their cell phones to communicate and send messages. Thus, in our system, with a simple message, all farmers can control their greenhouses from a distance. They can know the status of their greenhouse climate (temperature, humidity) and can control theDevices.

BoyingWen ,GuohuoGao IEEE, Genghuang[4] Yang by Considering the characteristic of irrigation in the rural area of China, this paper brings forward new devices based on GSM (global system mobile) network and radio communication. Three levels are included: the PC control platform or common cell phone for surveillance, the controller and the action unit. Simple GSM modules are available in the PC control platform and the controller. Orders can be sent from the PC control platform or cell phone to the controller and the information such as temperature, soil moisture and air humidity sampled by the controller can also be sent to the PC platform or cell phone by GSM message. Emitter and receiver of short-wave radio are embedded in the controller and the action unit respectively. Radio communication works between the controller and the action units. Database of spot information sampled can be analyzed and browsed by friendly interface in PC. Cha´vez, J. L., Pierce, F. J., Elliott, T. V., Evans, R. G., Kim, Y., &Iversen,W. M.[5] done Precision irrigation systems can have inherent errors that affect the accuracy of variable water application rates controllers, as well as affect the controllers' performance when evaluated on different continuous move irrigation systems configurations. The objective of this study was to assess the performance of a remote irrigation monitoring and control system (RIMCS) installed on two separate linear move (LM) irrigation systems. The RIMCS varies water application rates by pulsing nozzles controlled by solenoids connected via relays to a single board computer (SBC) with wireless Ethernet connection to a remote server. The system also monitors irrigation system flow, pressure, position and wireless field sensor networks. The system was installed on a LM irrigation system in Prosser, Washington, USA and on a LM in the Nesson Valley of North Dakota, USA. For the LM at Prosser, four pre-defined irrigation patterns were imposed and variable rates were applied as a percentage of the nozzle base application rate. Each nozzle was pulsed across the span length and along the LM travel direction. For the LM at the Nesson Valley, a quadratic pattern was imposed pulsing banks of nozzles along the LM travel direction. Standard catch can tests were performed and the system performance was evaluated by comparing measured catch can water depths with pre-determined target values. The RIMCS accuracy was found to be in the range of the LM uniform water depth application uniformity coefficients of 88–96%. The RIMCS was successfully transferred to another LM in North Dakota as indicated by the relatively low variable rate application errors of –8.8 ± 8.1% and −0.14 ± 6.7% for the twospans.Daniel K. Fisher and HirutKebede done a prototype system was developed and constructed for automating the measurement and recording of canopy-, soil-, and air temperature, and soil moisture status in the field, The system consists of a microcontroller-based circuit with solid-state components for handling clock/calendar, sensor power, and data storage and retrieval functions. Sensors, including an analog soil moisture sensor, analog and digital temperature sensors, and a digital infrared thermometer, are widely available and inexpensive. The circuit board and sensor assemblies require approximately 4 h to construct and test, and material costs totaled approximately US$84. Systems were built and tested during the 2009 growing season in a corn field to evaluate performance and suitability under local conditions. The sensors performed according to manufacturers' specifications, with accuracies of ±0.4 °C, ±1.4 °C, and ±0.3 °C for air-, soil-, and canopy-temperature measurements, respectively. Soil moisture sensors were calibrated and provided measurements within ±2 kPa of the manufacturer's values. Reliability of data collection and storage averaged 91%, with most bad or missing data occurring during periods of inclement weather and electrostatic interference.

III. AGRICULTURE BASICS

Farming by the traditional manual methods is in the commercialization of agriculture. But with the of population growth rate, increasing scarcity ofagriculture should see a boom, instead it has been observed that more and more people are leaving agriculture as an option for earning livelihood.



Fig

Prominent reasons for this, are envisioned as below:

3.1 Land: The amount of land is inversely proportional to population. And as a result the availability of agricultural land is diminishing. So the necessity of the time is to grow the yield with decrease input on a limited amount of land.

3.2 Urbanization: India is speeding towards globalization, reducing the interest of youth in farming and moreover a difficulty faced by people living in cities to monitor crops on regular basis is a major downfall.

3.3 Disabilities: Disabled people and women found it difficult to manage crops and even people far from field are unable to monitor their crop on regular basis.

3.4 Ease: Change in human mind set and lifestyle, with more demand of comfort and to reduce man power needed in farming.

3.5 Labor: Lack of availability of labor, leading to reduced care of crops.

Health Problems: Health problems by manual sprinkling of pesticide in the fields.

3.6 Seed: Uneven spreading of hybrid seeds leading torandomized growth of crops. For seedingmore manpower is required and also it is a slow process whenthey are spreading seeds.

Robots used in agriculture are intelligent machines designed to replace humans in the progressions of crops(like seeding, manuring, weeding etc.)

3.2 Various merits associated with robotics involvement in agriculture are as:

- Harvesting and picking
- Weed control
- Phenotype
- Sorting and packing

3.2.1 Harvesting and picking:

Harvesting is nothing but removing of the ripe crops from the field. It is one of the most popular robotic application in agriculture. Due to accuracy and speed it reduces waste crops.

3.2.2 Weed control:

Controlling of unwanted plants along with the cultivated plants

3.2.3 Phenotype:

It is the classification system used to categorize organism based on their appearance.

3.2.4 Sorting and packing:

Undesirable types of vegetables i.e. diseased, damaged, deformed are removed. It can be done primarily to reduce spread of infection to other vegetables. Arranging the healthy vegetables by removing the infected vegetables and send it for packing.

The robotic vehicle is implemented using control unit, relay, motor driver and various types of sensors. It is usedfor development in productivity and multitasking.Agriculture robot can be control by on system mountedcontrol board .The mobile robot, drops seeds and iscapable of sensing the watering needs of the soil.

IV. AGRICULTURAL ROBOT MODEL

Multifunctional system element mean faster return on investment. The smart mechanization system ofagriculture robot helps the people to establish efficientagriculture system.For establishment of seedbed preparation, seed mappingdepth of seed placement. Simple system is designed torecord the position of seeds dropped on land .

4.1. Module A: Hardware (Transducers & Actuators)The model is used for dispensing out the solid and liquidat a particular rate and interval with the help of sensors asshown below.

4.1.1 Ultrasonic Sensors:

The system utilizes four ultrasonic sensors (HC-SR04) forfour direction detection. The back sensor is mounted on a9g micro-servo to be able to rotate 180 for aligning.

4.1.2 Orientation Sensor:

The orientation reading (Yaw, pitch, roll) form orientationsensor in android mobile are taken which is mounted onthe robot itself.

4.1.3 Soil moisture sensor:

The soil moisture sensor measures the water content in the soil.

4.1.4 Driving Motors Driver (L298N based):

Motor driver board based on L298N is used to drive themotors for motion.

4.1.5 Voltage Divider:

Voltage divider is used to provide two voltage lines for 5V and 12V distinctive operations.

4.1.6 Solid Dispensing Mechanism:

A uniquely designed mechanism for seed and fertilizer dispensing is made. It consist of two rotating mounted for proper dispersal.

4.1.7 Liquid Dispensing Mechanism:

The dispensing mechanism consists of pump. The pump controls the rate of flow of liquid out from the container.

4.2 Module B:Software (Processing in Arduino)

Arduino is programmed using Arduino IDE. The software consists of different algorithms and dedicated methods to perform various operations required. The algorithms take processed data from sensors through Arduino and produce desired output which in turn helps in controlling of actuators. The real time speed control comparing this algorithm with the other ones, this algorithm is better than the others with respect to the accuracy of speed, but at the same time it is slower Arduino unit, stepper motor .

The sensors process the data for reactive output as for ground detection, alignment, row motion, dispensing of materials. The most important driving skill is row motion control with orientation and turning of Agricultural roboting next row.

V. METHODOLOGY

Seed planting mechanism is implemented using DC motor which is placed on the vehicle. Rotating mechanism is used to have uniform distance between two seeds. When the vehicle is going in straight line it works and it will not work while turning the vehicle and changing the row. Detection moisture content in the soil by soil moisture sensor is done and it is capable of taking the decision of switching ON/OFF water pump. According to instructions and the specified rate, fertilizers are spread on soil by same mechanism. The similar goes for using theweedicides on the crop. The weedicides are spayed according to a pre-set rate. The aim of the designed system is check moisture of soil. Instead of using line follower, obstacle detecting sensor is used for live streaming.

VI. OPERATIONS

Yield potential is preserved during the whole farming process using the hardware described above. Immediate detection of seeding deviations (over or under desired rates), operator is instantly alarmed enabling a more advanced, real time control.

6.1 Operation – Moisture Test

Agricultural robot is designed to intelligently maintain the required ratio by using peculiar analog soil moisture sensor (so that moisture content can be varied, unlike digital sensor).The soil moisture sensor is used to test the moisture content of soil , is as shown in Fig. 3. This device shows high, when shortage of moisture in the soil, else the output is low. This sensor can be used for automatic watering of the plants and crops or to show the output on screen.

6.2 Operation – Selection and Rate

The keypad or any other input device is used to select operation as (Seeding, Irrigation, Manuring, and Weeding) from it by pressing the button or performing any other activity for selection depends on the type of input device and corresponding rate for dispensing of solid and liquid.

6.3 Operation - Seeding

For planting seeds the soil must be at some particular moisture value. It first checks the soil moisture content. By soil moisture sensor and data is given to the Arduino board.

If the content of water is low as set by user the water is supplied to the soil. After it seeds are dropped using a complexly self-designed seed dispensing mechanism in a particular rate mentioned by the user..

6.4 Operation – Irrigation

Irrigation is limited to first few times due to growth of crops. The moisture content of soil is checked by analog sensor. And the water is feed using a PWM controlled water pump till moisture content reaches the level set by user through application

6.5 Operation –Manuring

Manuring here refers to providing soil with manure or fertilizer.. The both types of organic and inorganic manure (fertilizers) can be used for agriculture. It can be used to provide most commonly used vermicting and urea.

6.6 Operation –weeding

Agricultural robot supports the weeding operation to kill the weeds that are unwanted plants with the crop. The agricultural robot helps the user to avoid manual spraying of weedicides which may cause toxicity if sprayed manually.

Weedicides are in powdered from which are mixed with water to be used. The weedicides are sprayed by using pressurized water pump. The amount of weedicide that is to be sprayed is set by user.

In all scenarios, the comparison of costs and benefits of commercial use of autonomous vehicle with conventionaloperations. The changes in investments, daily workinghours, labour costs, and changes of speed of work are included for developing the autonomous vehicle.

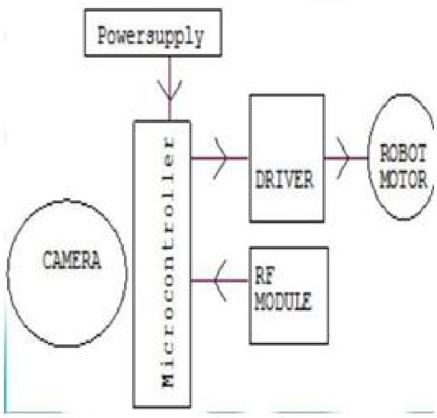
VII. SMART IRRIGATION SYSTEM

Smart Irrigation System uses valves to turn irrigation ON and OFF. These valves could also be simply machine-driven by victimization controllers and solenoids. Automating farm or nursery irrigation permits farmers to use the proper quantity of water at the proper time, despite the supply of labor to show valves on and off.

S. No	Factors	Manual	Tractor	Agricultural robot
1	Man Power	More	Moderate	Less
2	Time Required	More	Less	Less
3	Sowing Technique	Manually	Manually	Automatically
4	Distance between seeds	Not Fixed	Not Fixed	Fixed
5	Wastage of Seed	More	Moderate	Less
6	Required Energy	High	High	Less
7	Pollution	No	Yes	No
8	Display	No	No	Yes

VIII. PROPOSED SYSTEM

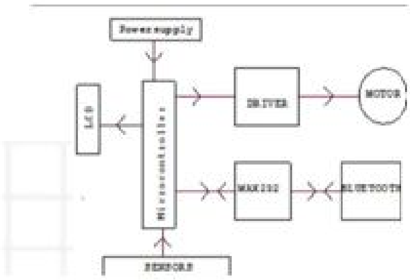
Water directly to the root zone, thus keeping the soil surface dry. Real-time soil moistureand weather monitor former through microwave remote sensing are emerging technologies that can potentially help improve the scheduling ofirrigation. Rainfall harvesting, efficient means of irrigation and use of reclaimed water.



Fig

The moisture sensor is used to measure the moisture content in the soil or plant. It displays the moisture content value in the LCD monitor. If the water content in the soil is minimal, the notification is reflected to the server which is basically a Cloud-Based. The cloud server named "Think Speak". The system has been success fully designed for monitoring the condition of the crop by using robot it continuously moves within the field and we can see the condition of the crop.

This paper proposes irrigation system which describes the combination of the IOT communication technology and cloud server to accomplish performance of system and data storage. The proposed system provides remote monitoring and automated controlling of irrigation with real time sensing of atmospheric and soil conditions like air temperature, humidity and soil moisture. IOT based irrigation improves farm production without any human interloping.



IX. CONCLUSION

This paper present Agricultural robot robotic system for agriculture which can be modeled by various purposes using algorithm for comfort to farmers and can be interfaced by using Arduino board and various types of sensors. Various aspects shows Agricultural robot serves better result than manual system. It is expected that recent trends in robots shall make it to be used in enhanced role in future. In agriculture, Agricultural robot can be experienced for several advancements. Implementation of Agricultural robot has significant saving in terms of time, efficiency and saving the wastage of resources and reduced utilization of manpower should pay the cost once the system is activated. The scope of the system, especially in metro cities, is located in places where people are unaware of farming. Agriculture is more valuable compared to others fields for occupation. The utility of technology with agriculture consider for automation. The Farming System is a suitable system which aids to sure that it has wide scope for improvement, which in turn eases the agricultural system for the farmers and ultimately helps in effective crop productivity.

X. FUTURE WORK

In the future, we plan to use solar panels along with Rechargeable batteries instead of 9V batteries in order to make our system efficient, reliable and self-sustainable in terms of energy consumption. This will be done by allowing to access and control the system with the use of web-services. Plant detection can be done by using a wireless Web Camera instead of RFID tag. This will reduce the cost of the system considerably. Moreover, the same can be used for path planning and obstacle avoidance for the mobile robot. Furthermore, the plant water requirements can also be analyzed by extracting the present day temperature and other required values by remote sensing of satellite data.

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