

# Design and Implementation of Agrobot by Using IoT

Shikha Sharma, Prateek Singh, Vaibhav Singh, Prabhat Kumar Srivastava  
Assistant Professor Dr. Kamal Upreti  
Department of Information Technology  
Inderprastha Engineering College, Ghaziabad U.P,India

**Abstract**—Agrobot 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 Agrobot 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. This approach of developing the robot (the smarter machine) will going to change the old methods of farming and taking this agriculture field into a new world.

*Keywords-* Agrobot; ploughing; sow; water; autonomous; farming machinery; labor; speed; productivity.

## I. INTRODUCTION

In India, approx. 70% people are liable upon agriculture (the major resource to survive).[10] On comparison with other fields, development in agricultural area is less. So,

it is mandatory to do some enhancement in this field. The main objective to developing agricultural technology is to minimize the labor force, a phenomenon which common in the whole world. Another reason is to improve food quality.[10]

Nowadays, agricultural operations like ploughing, harvesting can be done automatically and as there is accessibility of automatic machines like robots. For making of robot, one has to consider two important contemplations which are exact requirement for the field and environmental conditions in which robot have to work for automating the operations of agriculture.

Use of robotics in various operations of agriculture like ploughing, seed dispensing and harvesting, etc. will aid farmers in giving better results of productivity by increasing the productivity rate. Presently, farmers are not getting better results because of non-use of robots in all agriculture operations. Conventional methods depend on manpower manually for dragging, lifting, weed control, fruit picking is being utilized in India.

Farmers are inclined to work in the harmful environment while spraying chemicals and pesticides. While tractors compress the muddy land as they are heavy and large and cannot move in terrain conditions. These techniques neglect to distinguish the harvest and soil in closeness. A robotized and innovative agrarian framework (which utilizes field robot) is exemplified from above issues. Robots can work restlessly in all conditions according to the indicated program to perform required exercises with computerized help. The major advantage of light weight robots is that they do not compress the muddy land.

Following are the modes of operations that will going to be perform by this autonomous farming robot: -

### A. MODE-1

This mode is the seed dispensing mode and, in this mode, the seed get dispensed in the soil along with the obstacle monitoring. An RPM DC motor is connected to the back of

robot where the dispenser is connected. The particular time at which the dispenser will vibrate has been set in the programming of Arduino. This controls the flow of seeds from the seed dispenser in order to prevent the wastage of seeds.

**B. MODE-2**

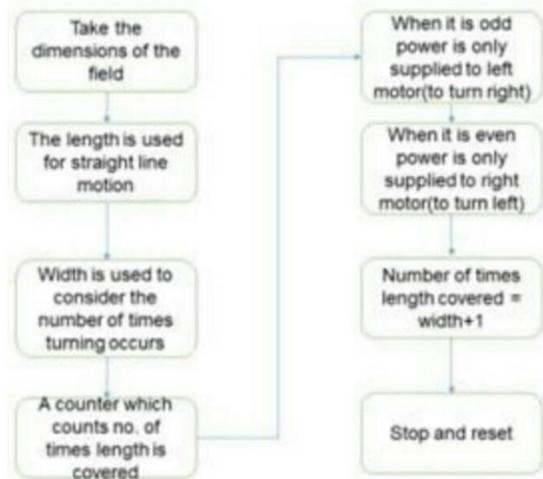
This mode provides the harvesting of the crops. The harvester is made up of cylindrical rods that harvest and collect the crops at the time of harvesting. A RPM DC motor is connected to the side of the harvester in order to provide rotation to the harvester. This mode is connected to the Arduino via motor driver L298D. The rotation speed and the other specifications can be controlled through program code fed in Arduino.

**C. MODE-3**

This mode provides the robot to plough. A plough made up of jagged teeth that is attached at the back of the robot which ploughs the field. It provides a proper stable space for the seeds to settle up in the soil in a proper line.

**II. LITERATURE SURVEY**

Automated Farming Robot is a trial to bring agriculture within the field of robotics and automation through automation, the intention is reducing the hardships of labor encountered on the sphere. An algorithm which might enable the robot to carry out zonal tilting, ploughing, seeding and harvesting are visiting be implemented. The user will only give dimensions (length and width) of the sphere. The micro controller will input these parameters into the algorithm and accordingly the trail is visiting be etched. Zonal tilting could be a farming technique during which a niche is left between two lines of cultivation. this can be done to enable better irrigation yet as maintain the soil nutrients and pH levels. The algorithm of the robot was simulated on various platforms, like Farming Simulator 2017, Java, and implemented on Arduino.[6]



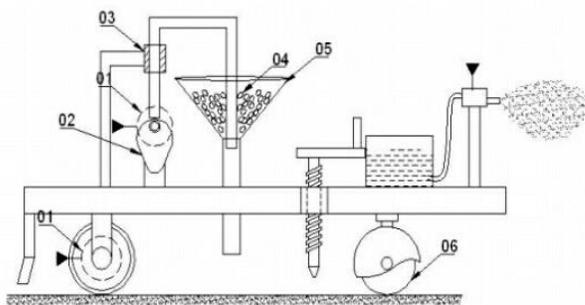
**Fig 1: Flow Chart of Automation algorithm**

The Agrobot paper elaborates the design implementation and experiments of Agrobot. The target of projects to form an agricultural robot which can perform all the essential farming activities like sowing, ploughing, and sprinkling. The implementation of Agrobot saves lots of your time, efficiency, man power, wastage of resources and also it works at less expensive price.[9]

Automatic ploughing and seeding robot paper gives that almost all of those systems which work independently are more pliable than conventional systems. the advantages of reduction parturient costs and restrictions on the amount of daily working hours significantly improved. Thus, the automation of most of the many working routines has been made possible. However, some have failed too because of the necessity of accuracy of specific tasks.[12]

AG-Robot Design and Analysis to Light Weight has body frame of made of glass fiber, whose strength to weight ratio is high compared to the conventional materials like steel or aluminum. Product is familiar with maize crop and it may further upgrade for the other crops. It is capable of doing seeding cutting harvesting and other agricultural tasks.[7]

Sensor Based AGROBOT for Sowing Seeds is a robot Agrobot is designed for agricultural purposes like seeding, cutting, harvesting etc. Main goal of this agrobot is to reduce human labor and increase the speed and accuracy of the work. In this paper we have introduced a product that is result of design and development of a mobile robotic platform for agricultural applications. For proper navigation and to detect the obstacles infrared and ultrasonic sensor is used and moisture sensor is used to measure the humidity in soil. sow seeding is the primary task of this robot.[8]



| S.NO | PART NAME | S.NO | PART NAME       | S.NO | PART NAME       |
|------|-----------|------|-----------------|------|-----------------|
| 01   | dc motors | 04   | seeds           |      |                 |
| 02   | cam       | 05   | hopper          |      |                 |
| 03   | guide     | 06   | rotating wheels | ▶    | TO CONTROL UNIT |

**Fig 2: Fabrication of seed sowing robot.**

In Robotic Farmer, the robot system is made in such a way that it can process the farming land without the use of any physical power. The aim to develop this robot is to lessen the man power, time and increase the productivity rate

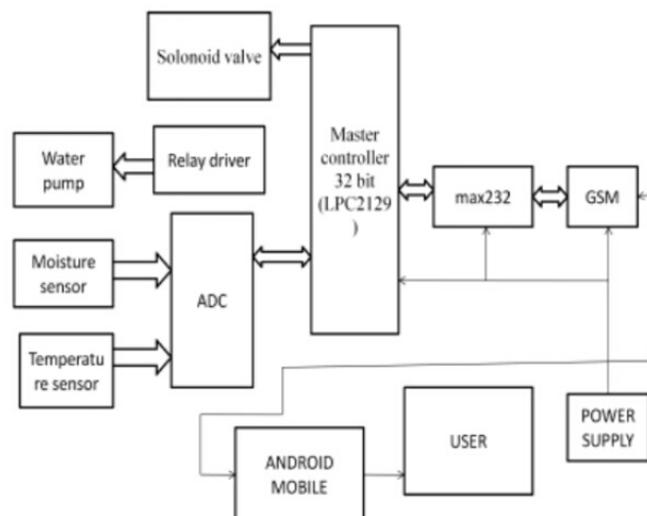
and help the farmers. This autonomous robot is used to plough the land, sowing of the seeds and spraying of fertilizers and harvesting of the crops using microcontroller.[2] Comparison between manual and farming using tractor is as follows:

| S no. | Parameters        | Manual   | Tractor  | Seed Dispensing by robot |
|-------|-------------------|----------|----------|--------------------------|
| 1.    | Man power         | More     | Moderate | No                       |
| 2.    | Time required     | More     | Moderate | Less                     |
| 3.    | Seeding technique | Manually | Manually | Auto-matically           |
| 4.    | Energy required   | More     | High     | Less                     |

In this Agriculture Robotics: Practicality and Feasibility, our main focus is on practical and feasibility study of the agriculture robot. After analyzing, the author conclude that the robot isn't dependent only on advances but on the infrastructure also. All services and technologies are provided by this infrastructure that features wireless connection, human robot interaction (HRI) and software sharing framework. In absence of such infrastructure advanced design can't hold the practicality and feasibility of the agrobot. Many organizations can't allow the technological and monetary cost of building such infrastructure, which leads the robot uneconomical. The conclusion is to search out a practical and feasible robot and also to search out a value effective and reliable approach that leads such infrastructure for agriculture robots.[3]

Agricultural robot -an economic feasibility explains the economic feasibility of applying autonomous robotic vehicles as compared to conventional systems in three different applications is explained through agricultural robot as: robotic weeding in high value crops, crop scouting and grass cutting of cereals and golf courses. The comparison done is with the help of system analysis and feasibility study by individual for these three applications. The results of all the three scenarios showed that the robotic applications are way more economic feasible than the conventional systems. The cost of robotic systems is increased due to small capacity of vehicles and high cost of real time Global Positioning System (RTK-GPS).[11] GSM based Automated Irrigation Control using Rain gun Irrigation System has extensive work on automatic feeding device in rotary cultivator blade shaft welding equipment. It can achieve placement and the feeding of all the blade holders and also assures that the blade holder feeding device and other devices in welding equipment

work will coordinate automatically. Moreover, the huge advantage of it is easy to operate and minimum cost.[15]



**Fig 3: Block diagram for proposed system**

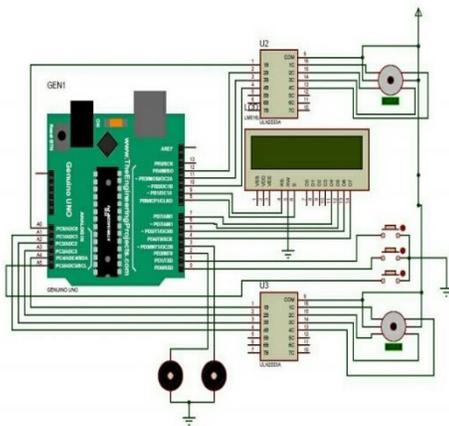
Design of a seeder to achieve highly uniform sowing Patterns, this paper explains the crop establishment for seed mapping. For this an active grid seeder and a punch planter were developed. The measurements for Grid seeding are done in sufficient manner. However, testing all the modes in the field have to be done to examine the effects under extreme conditions. Here, the testing is done with four seed grids connected in front of the tractor and then operated. [14]

### III. METHODOLOGY

The main aim of our project is to build a multitasking agricultural robot, which can be used for agricultural processes like ploughing, seed dispensing, crop cutting(harvesting) and also irrigation system. Keeping in mind low cost and more efficient.

- Front part of the frame is used for harvesting purpose. The cutter is attached to a DC motor which has more rpm (700).[10] The cutter is made up of Iron sheet and sun board.
- Back end of the frame is used for digging process. Iron nail teeth like structure are used for digging. This can be elevated using a robotic arm when not in use or when the robot is performing other process than digging.[10]
- A cylindrical like structure has been used to drop the seeds at their location. This structure is made up of acrylic sheet and is connected to vibrating DC motor and the seeds flow through this cylindrical like shape through the drilled hole on the shaft to the digging soil.

- A circuit has been made on the PCB Board to interface all the components and control the agricultural processes. The main component which executes the processes is a microcontroller Atmega 328p which is commonly known as Arduino. The circuit contains a DC motor driver L293D which can control two DC motors simultaneously, a power supply circuit which consists a voltage regulator to regulate the power from 5V to 12V.
- The circuitry defined above is interfaced and controlled by Arduino uno. Arduino uno is a microcontroller which can be used to operate multiple tasks using logical programming.
- A separate mechatronic sprinkler with water motor is used for irrigation process. It connects with the humidity sensor which sense the moisture of the soil.



**Fig 4: Internal circuit diagram**

#### ***Basic agricultural functions (ploughing, seeding, harvesting)***

Ploughing, seeding and watering are three of the most basic agricultural functions. The basic theory we used is that while the robot is moving, ploughing and seeding would continue. If the robot stops, ploughing seeding would stop.

So, we just merged these functions with our mapping mechanism. Once the robot stops it would start sprinkling water from a nearby tank till the land is full.

The movement of the robot is controlled using four high torque 100 RPM DC motors. The switching is done through Arduino.

The farmer will be giving the dimensions of field area as the input. The three modes will be ploughing, seed dispensing and harvesting. Through the length and width, the total distance to be travelled by the robot will be fixed. It will roughly be the product of length and width. The

algorithm implemented takes length as the distance that the robot covers in one go. Once the length is reached, the robot makes a 180-degree turn. After the turn is made, the robot continues to go in a straight line till the length is covered. Again, the robot takes a 180-degree turn. To help the robot decide which way to turn, the counter is used. This algorithm has been developed for all the modes like ploughing, seed dispensing and harvesting modes.

#### **The steps of implementation are:**

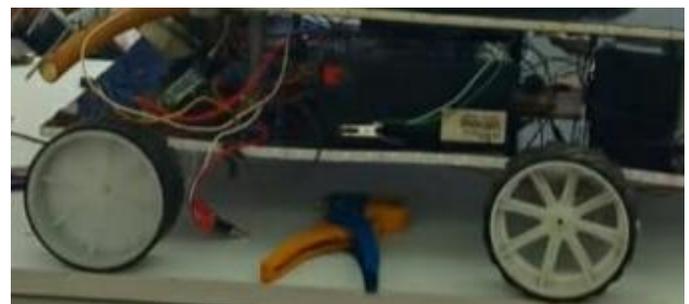
1. Enter the length.
2. Enter the width.
3. Select the mode.
4. Microcontroller inputs the value into the algorithm.
5. The algorithm is executed.
6. Reset once the execution is completed.[6]

The dimensions (length and breadth) of the fields are to be entered directly in Arduino as when it is programmed and after entering the length and breadth of field, mode is to be chosen in which the robot is made to work;

**MODE 1: Seeding-** It adds seeds or fertilizers to the land, a DC motor is connected so that seed disperse properly on the land.

**MODE 2: Harvesting-** In this, the robot has a prototype of harvest machine which is attached at the front end of the robot which activates on mode 2.

**MODE 3: Ploughing-** This prototype does farming implementation with its blades fixed at the back end of the robot.



**Fig 5: Agrobot**

#### **IV. RESULTS**

We tested our project on a small square land. We placed some markers or obstacles manually. The robot worked perfectly by successfully mapping the farmland and performed the three most important functions in the farming strategies (ploughing, sowing and watering). It

also moved and changed its lane according to the desired program.

The processes are as follows:

1. **Ploughing:** This mode is very easily achieved by attaching the metal like structure at the back side of the robot. For this we require a good mechanical strength to the robot, because it is quite heavy and when it is place on soil for ploughing purpose, it required extra force to move forward. This is the initial operation in the farm. This application has no delay time. Once it places on the farm It continuously plough the soil through the ploughing tool which operate on 12V DC.[10]
2. **Seed Distribution:** The dropping of seed is done using the dc motor vibrator mechanism. For that we are using the special mechanical head at the shaft of dc motor.[10] This DC motor is attached with a rectangular shaped funnel at the back side of the robot. The DC motor has large rpm and due to its vibration, seeds are dropping from the funnel like structure and for reducing the wastage a thin AI sheet is fixed below the hole of the funnel.
3. **Harvesting:** For this, a simple motorized harvester (cutter) with single dc motor is used to perform the function of cutting the crop. This mode is placed at the front side of the robot. In this harvester tool, to rotate the roller a DC motor is attached with it that cut the crop very fast. A further modification with advance features can be implemented with hardware changes.
4. **Irrigation:** A separate irrigator in the form of a mechatronic sprinkler was developed to apply variable rates of water when soil is dry. DC motor controls the sector angles and trajectory of the jet. A humidity sensor is attached with this sprinkler which will sense the moisture of the soil and give command to the water pump for supplying the water.[10] We can adjust the range of moisture of soil in humidity sensor according to the weather and the desired pattern with accordance of the circuit.

Hence, all three modes have been checked properly and tested. All the modes work successfully. Mode 1 shows the proper functioning of seed dispenser. The seeds get dispensed in a proper line drawn by the jagged teeth of the plough. Below shows the

image of seed dispensed in the proper line.



**Fig 6: Result of seed dispenser**

#### V. PROBLEMS FACED

Throughout our project we faced many troubleshoots and diagnosed accordingly.

- Dilemma on motor
- Troubleshoot on controlling motor
- Wheels are not big enough to handle the weight[1]

#### VI. BENEFITS

We tried to make the agrobot as feasible as possible for the poor farmers. Below is the list of benefits a farmer can obtain:

- It is cheap and affordable.
- It is portable.
- Farmer is not required to be present on the field.
- Not prone to hazardous chemicals like pesticide.
- Runs on Battery so no harm done to farmland due to oil spill.
- Fully autonomous.[1]

#### VII. FUTURE WORK

In the future, the project can be actualized with tremendous outcomes in huge scale that will profit each farmer. Apart from seed dispensing, ploughing, and harvesting, other cultivating processes like showering pesticides, fruit picking, and so on can be executed in one robot in this manner we are making this robot skilled and multitasking. As we know, Raspberry Pi is one of the mostly used version nowadays so it could be utilized in future rather than using Arduino Uno for greater progression of the robot.[1]ss We have plans to develop this agrobot by adding some more key features as seed dispensing ,harvesting and ploughing like adding camera

to get live updates about the farmland, having crop monitoring system that will tell the farmer if the crops are healthy or not, having a robotic arm to pick and drop fruits and also guide the farmers to farm in efficient manner. We might also add huge cutting mechanisms. The major future plan for this robot would be the weed detection using image processing which will detect the weed between the crops by just detecting it via image processing. We will also try to make it more efficient and less economic so that all kind of farmers can afford this robot to cultivate their land and produce healthy crops. We also have some more plans regarding this robot to make it easily available for large scale cultivation which can be done efficiently and with better reliability reducing the unnecessary load on farmers and making their life easy.

### VIII. CONCLUSION

Our agrobot was made keeping in mind of the poor and uneducated farmers [1] and it is specially designed to ease the work of farmers so that the demand of food can be made easily. Agriculture robot serves better result than manual system. It is an automated farming robot which works as soon as the size of field, size of seed and in which mode it is meant to be operated will be given to it. It is a very simple yet a very effective robot for carrying out farming process in the land. From both the poor farmers and engineering point of view this is a very cost-effective robot that uses readily available and cheap machinery parts. Also, this is more ecofriendly than tractors and pumps which use oil as their primary source of energy. It is anticipated that this robot will change the farming trend in future days from manual farming to automate farming. The application of AgroBot are as it saves time, has more efficiency, reduces man power, no wastage of resources and also it works at much reasonable price. By the help of this robot we can shape the interest of young generation in farming area which is very important for the development of the country. These robots can be created as per the requirement of farmer which will make it to produce in high productivity. Robots can come over with the flaws in farming and can be developed better and better by doing further enhancement in it.

### IX. REFERENCES

[1] MD. DIDARUL ISLAM SUJON, RUMMAN NASIR, MAHBUBE MOZAMMEL IBNE HABIB, MAJEDUL ISLAM NOMAAN, JAYASREE BAIIDYA, MD. REZAUL ISLAM DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING INTERNATIONAL CONFERENCE ON

INTELLIGENT AUTONOMOUS SYSTEMS VOLUME: 06 ISSUE: 03 | MAR 2019

[2] PAYAL SRIVASTAVA, NEDA, MS.KRITI STUDENT, STUDENT, ASSISTANT PROFESSOR ELECTRONICS AND INSTRUMENTATION ENGINEERING GALGOTIAS COLLEGE OF ENGINEERING AND TECHNOLOGY, GR. NOIDA, INDIA IJEDR | VOLUME 5, ISSUE 2 | ISSN: 2321-9939, 2018 INTERNATIONAL CONFERENCE ON INTELLIGENT AUTONOMOUS SYSTEMS

[3] SAMI SALAMA HUSSEN HAJAJ KHAIRUL SALLEH MOHAMED SAHARI CENTRE FOR ADVANCED MECHATRONICS AND ROBOTICS UNIVERSITI TENAGA NASIONAL 43000 KAJANG, SELANGOR, MALAYSIA 2018

[4] M. KAVITHRA, S. SHALINI, A. DHANUSHA, T. VANIKAMATCHI, S. SURESH INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) ISSN: 2278-0181 SPECIAL ISSUE – 2018 ICONNECT - 2k18 CONFERENCE

[5] NEHA D. KHERADE, JYOTI KUTE, POOJA PASHTE PRANITA MARYE, PROF. DR. SAURABH MEHTA 5HEAD OF THE DEPARTMENT, DEPT. OF EXTC, VIDYALANKAR INSTITUTE OF TECHNOLOGY, MUMBAI E-ISSN (O): 2348-4470 P-ISSN (P): 2348-6406 SCIENTIFIC JOURNAL OF IMPACT FACTOR (SJIF): 4.72 VOLUME 4 ISSUE -3 MARCH 2017

[6] RUTVEEZ ROOPAM ROUT, B. SRINATH, VISHAL BISHT, SHUBHANKAR BHARDWAJ, A. MARIA JOSSEY STUDENT ASSISTANT PROFESSOR5 DEPARTMENT OF ELECTRICAL AND COMMUNICATION ENGINEERING SRM UNIVERSITY, CHENNAI, TAMILNADU, VOLUME ISSUE No.4 INDIA ISSN © 2017 IJESC

[7] AG-ROBOT DESIGN AND ANALYSIS TO LIGHT WEIGHT MR. K. RAJESH ASSISTANT PROFESSOR STANLEY COLLEGE OF ENGINEERING AND TECHNOLOGY FOR WOMEN, HYDERABAD, INDIA IJSRD - INTERNATIONAL JOURNAL FOR SCIENTIFIC RESEARCH & DEVELOPMENT| VOL. 5, ISSUE 09, 2017 | ISSN (ONLINE): 2321-0613

[8] S PRASEENA, S SANJENA, S M THEJASWINI , DR M SENTHAMIL SELVI UG STUDENTS, DEPT OF INFORMATION TECHNOLOGY 4HEAD OF DEPARTMENT , DEPT. OF INFORMATION TECHNOLOGY, SRI RAMAKRISHNA ENGINEERING COLLEGE, TAMIL NADU, INDIA INTERNATIONAL RESEARCH JOURNAL OF ENGINEERING AND TECHNOLOGY VOL. 5, ISSUE 09, 2017 P-ISSN: 2395-0072

[9] LAXMI SONIMINDIA, SHRUTI TAWARE, SHREYA SINHA MRS. V. S. KUMBHAR (ELECTRONICS AND TELECOMMUNICATION, PIMPRI CHINCHWAD COLLEGE OF ENGINEERING AND RESEARCH, INDIA) IOSR JOURNAL OF ENGINEERING (IOSR JEN) 2017

[10] SHUBHAM KHANDELWAL NEHA KAUSHIK, SAGAR SHARMA STUDENT, B.TECH ECE, AMITY UNIVERSITY HARYANA, INDIA ISSN No. 0976-5697 VOLUME 8, NUMBER 5 MAY-JUNE 2017

[11] AGRICULTURAL ROBOTS: AN ECONOMIC FEASIBILITY STUDY S.M. PEDERSEN, S. FOUNTAS, H. HAVE AND B.S. BLACKMORE DANISH RESEARCH INSTITUTE OF FOOD ECONOMICS, KVL, ROLIGHEDSVEJ , 1958 FREDERIKSBERG C, DK2 DEPARTMENT OF SOIL SCIENCE, KVL, HOJBAKKEGAARD ALLE 2, 2630 TAASTRUP, [DKMARCUS@FOI.DK](mailto:DKMARCUS@FOI.DK)

[12] J.RAJA, & W.STANLEY KARUNAKARAN (STUDENT, M.A.M COLLEGE OF ENGINEERING, TRICHY, INDIA). (ASP/ECE, M.A.M COLLEGE OF ENGINEERING, TRICHY, INDIA). IOSR JOURNAL OF ELECTRONICS AND COMMUNICATION ENGINEERING (IOSR-JECE) E-ISSN: 2278-2834,P-ISSN: 2278-8735 PP 68-73

[13] MUTHARASU, DIVYA V. VDIVYAE98@GMAIL.COM VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (AUTONOMOUS), TIRUCHENGODE, TAMIL NADU ISSN: 2454-132X IMPACT FACTOR: 4.295 (VOLUME 5, ISSUE 2) MUTHARASU S. ET AL.; INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

[14] H.W.GRIEPENTROG,P.T.SKOU1 J.F.SORIANO,B.S.BLACKMORE THE ROYAL VETERINARY AND AGRICULTURAL UNIVERSITY (KVL), FREDERIKSBERG / COPENHAGEN, DENMARK EMAIL: HWG@KVL.DK POLYTECHNIC UNIVERSITY OF MADRID, MADRID, SPAIN

[15] R.SURESH, S.GOPINATH, K.GOVINDARAJU, T.DEVIKA, N.SUTHANTHIRAVANITHA, "GSM BASED AUTOMATED IRRIGATION CONTROL USING RAINGUN IRRIGATION SYSTEM", INTERNATIONAL JOURNAL OF ADVANCED RESEARCH IN COMPUTER AND COMMUNICATION ENGINEERING VOL. 3, ISSUE 2, FEBRUARY 2014