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Application of Robotics for Advancement in Agriculture using IoT

K. S. Megha[1], Meghashree[2], S. Roja[3], P. Shilpa[4], H. R. Seema[5]
[1,2,3,4]*Student, Dept. of Information Science Engg., Vidya Vikas Inst. of Engineering & Technology, Mysuru, India*
[5]*Assistant Professor, Dept. of Information Science Engg., Vidya Vikas Inst. of Engg. & Tech., Mysuru, India*

***Abstract*: The paper aims on the design, development and the manufacture of the robot which can put the seeds, burrow the soil, plough the land and cutting the waste plants. These entire systems of robot works with battery. In India almost about 70% of humans are relying on agriculture. So the agronomics procedure in India ought to be progressed to reduce the efforts of farmers. Various operations are performed in the agronomics acreage like seeding, weeding, waste plant cutting, ploughing, etc. Exceptionally primary operations are seeding, ploughing and plant cutting. But the present techniques of seeding, ploughing & plant cutting are problematic. The equipments acclimated for seed dispersing are actually difficult and inappropriate to handle. So there is a need of advance techniques and equipments which will reduce the man power. The mechanism can be progressed for sowing seeds in farm with specific separation between seed is balanced. In this paper robot administration is provided by utilizing Software programming. By utilizing that proper administration is specified to the robot. The acreage is not the undeviating line and smooth. If any obstacle is occurred like stone, electric light pole, trees, etc. the robot automatically get stop.**

***Keywords*: Agricultural Robots, Agricultural Machinery, Bluetooth, Robotic Technology.**

1. Introduction

Food is the man's most basic requirement. Man has become the center part in food production, where this has become the limiting factor. All through the ages men have struggled to produce more and superior food for increasing population. The use of technology advancement is to increase the productivity and the safety of an operator. Automation technology has been used in every domain like construction, manufacturing and etc. But now it has been incorporated in the field of agriculture [9].

The term agriculture is coined from two Latin words ager means field and culturia means cultivation. In agriculture most of the energy consuming work is done by the farmers. For example, in the vegetable field, the farmers should lift the heavy bags of vegetables at the time of harvest and during fertilizing time they carry the bags of fertilizers. These operations are repetitive, energy consuming work for farmers [11]. After the manual operators, then comes the tractor-based operator such as the power units that are exposed to high noise and vibration, which is very hazardous to health of the farmers [10].

The development of Agricultural Robots was started from the past 1980s and these agrobots are mainly used for seeding, spraying and weeding process. The AGROBOT is built by using sensors and some of the enabling technologies like wireless communication and GPS. Kawamura and co-workers developed the apple-harvesting robot for harvesting apples. Many of the robots are still in the stage of research and development. An efficient robot is one which must have a high performance with the low cost price [11]. Over the past, agriculture has advanced from a labouring occupation to a highly technical business, using a wide variety of tools and machines, but now the researchers are looking for robots to do the agricultural activities.

2. Research background

The initial stage of evolution, automatic vehicle guidance, has been studied for a great number of years, with a number of revolutions investigated as early as the 1920s. The idea of completely autonomous agricultural vehicles is far from newly discovered. Examples of initial driverless tractor prototypes using leader cable guidance procedure date back to the 1950s and 1960s.In 1980s, the possibility for integrating computers with image sensors contributed opportunities for machine vision based guidance systems. In mid-1980s researcher's at Michigan state university and Texas A&M university were exploring machine vision guidance. Further, throughout that decade, a program for robotic harvesting of oranges was successfully performed at the University of Florida.

In India during the decades of 1970s and 1980s there was a dramatic increase in productivity which is credited to a sequence of steps that led to the accessibility of farm technologies frequently described as green revolution. The vital sources of agricultural extension during this span were the spread of modern crop varieties, intensification of input use and investments leading to expansion in the irrigated area. In regions where green revolution technologies had major influence, growth has now reduced. New methodologies are now essential to push out yield frontiers, utilize inputs more productively and transform to more maintainable and higher value cropping patterns [11]. In 1997, agricultural automation had become a vital subject along with the advocacy of precision agriculture. Many of the Indian researchers also designed many of the AgriRobot some of them are given below:

- Mahesh R. Pundkar et. al. studied the performance of

seeding, plowing and plant cutting devices by using image processing algorithm using flash magic. They also studied the effect of seed depth, seed spacing, miss seeding ratio and performance seed sowing device on germination of seed and efficiency of yield crop [2].

- Aditya kawadaskar et. al. redesigned and tested the seed sowing machine using CAD package like PROE. They concluded that multipurpose seed sowing machine maintain row spacing, controlling seed and fertilizer rate, controlling the seed and fertilizer depth [3].
- Ajith Abraham, He Guo, and Hongbo Liu., This is highly adaptable and self-organized system of robots is a new approach to co-ordination of multi robot systems [4].
- B. Mursec et. al. presented two sowing machines pneumatic vacuum sowing machine OLT and pneumatic pressure sowing machine Aeromat-Becker for interval sowing, differing in the mode of operation for cultivation of sugar beet. They concluded that on the pneumatic vacuum sowing machine OLT the optimum distance between seeds in the sowing row is reached with 4.5 - 8 km/h speed and on the pneumatic pressure sowing machine Aeromat - Becker with 4.5 - 10 km/h [5].
- Joginder Singh studied the effect of farm mechanization on Indian economy. He concluded that Production and productivity cannot be enhanced with primitive and traditional methods. Thus, selective mechanization is the need of the future [6].
- Mahesh K. Ashatankar studied that the machine can be advanced for sowing seeds in farm with particular distance between seed is adjusted. It can automatically sow seed in land. It can also be used as fertilizer sowing instead of seed. The basic requirements of this machine for small scale cropping, they should be suitable for small farms, simple in design and technology and versatile for use in different farm operations. An automatically operated template row planting is well designed and developed to improve planting efficiency and reduce drudgery involved in manual planting method. Seed planting is also possible for different size of seeds at variable depth and space between two seeds. Also it results in increased seed planting, seed or fertilizer placement accuracies and it is made of durable and low cost material affordable for the small scale peasant farmers [7].
- Simon Blackmore Developed agricultural needs to find new ways to improve efficiency. One approach is to utilize available information technologies in the form of more intelligent machines to reduce and target energy inputs in more effective ways than in the past. Precision Farming has shown benefits of this approach but we can now move towards a new generation of equipment. The advent of autonomous system architectures gives us the opportunity to develop a complete new range of agricultural equipment based on small smart machines that can do the right thing, in the right place, at the right time in the right way [8].

The automatic agricultural vehicles are categorized into four categories

1. *Guidance:* To know how the vehicle navigates.
2. *Detection:* How the vehicle extracts the features of environmental field.
3. *Action:* How well the vehicle executes its task. Example radicchio harvesting.
4. *Mapping:* The construction of the map of agricultural field with its relevant features [9].

The main motivation for developing agricultural automation technology is reduced labour force, a phenomenon common in the developed world. Other causes are the requirement for upgraded food quality, security in terms of inspection of contaminants in food grains and saving the wastage of resources and to save time from manual work and to improve efficiency of the agricultural products and also to increase the productivity, accuracy and enhanced operation safety.

3. System architecture

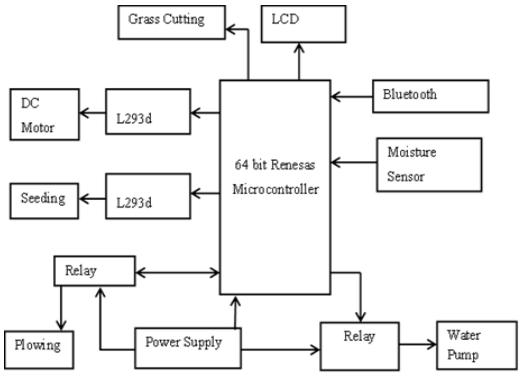

Fig. 1. System architecture

The above figure represents the architecture diagram of AGROBOT. Renesas Microcontroller is interacting between all modules. Bluetooth (HC-05) will be given to communicate with the robot and plants cut automatically. The complete project will be displayed on LCD screen. 12v Power supply is provided to drive Motor and Microcontroller; drivers are used to control the speed movement of the robot. Bluetooth module HC-05 Bluetooth is a serial port convention module. It is a simple to utilize "Bluetooth" and intended for straightforward remote serial association setup. HC-05 Bluetooth module was associated with the same microcontroller to set up a duplex correspondence channel amongst itself and the android advanced Mobile Phones.

Bluetooth is utilized to communicate with robot through android and send the changes to the Microcontroller. As per the guidelines given by the client the robot moves in forward, turn around, left and right bearing to drop the seeds at a specific position. Four wheels are associated at the base for the adaptable development of robot. Two DC engines are utilized to drive the wheels associated with the robot. L293D is utilized to drive the DC engines. Hindrance locator sensor is utilized to identify diverse obstruction in the way of the robot. In the event

that any obstruction is distinguished in the way of the robot the data of the snag is sent to the client through remote association. In Seeding engines are utilized to drop a seed one by one. Plant cutting is finished by engines. Transfer is an exchanging operation and Furrowing is performed. Fig. 2. Represents the representation of the system which gives the clear picture of the system.

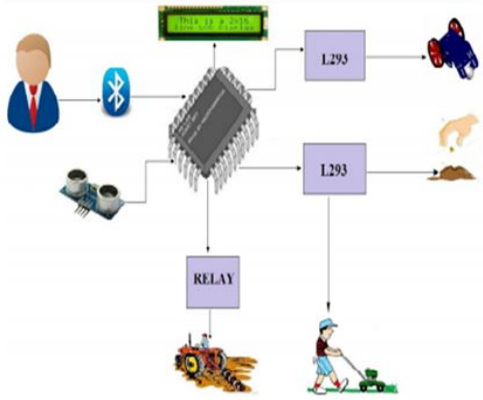

Fig. 2. Diagrammatic representation of AGROBOT

4. Flow chart of system

A flowchart is a type of diagram that represents an algorithm, workflow or process. The flowchart shows the steps as boxes of various kinds, and their order by connecting the boxes with arrows. This diagrammatic representation illustrates a solution model to a given problem. Flowcharts are used in analyzing, designing, documenting or managing a process or program in various fields. Flowcharts are used in designing and documenting simple processes or programs. Like other types of diagrams, they help visualize what is going on and thereby help understand a process, and perhaps also find less-obvious features within the process, like flaws and bottlenecks. There are different types of flowcharts each type has its own set of boxes and notations.

The two most common types of boxes in a flowchart are:

- A processing step, usually called activity, and denoted as a rectangular box.
- A decision, usually denoted as a diamond.

A flowchart is described as "cross-functional" when the chart is divided into different vertical or horizontal parts, to describe the control of different organizational units. A symbol appearing in a particular part is within the control of that organizational unit. A cross-functional flowchart allows the author to correctly locate the responsibility for performing an action or making a decision, and to show the responsibility of each organizational unit for different parts of a single process.

The Fig. 3, explains the flowchart of ploughing, seeding and Grass cutting. The first step here is initialization of microcontroller. After initializing the microcontroller, initialize the LCD and UART protocol. Then check for commands from user continuously through HC-05 Bluetooth. The user selects the operations like Ploughing, Seeding and Grass cutting, then HC-05 Bluetooth receives command from master then command is sent to HC-05 Bluetooth, which processes the input and performs the operation until the next command is selected.

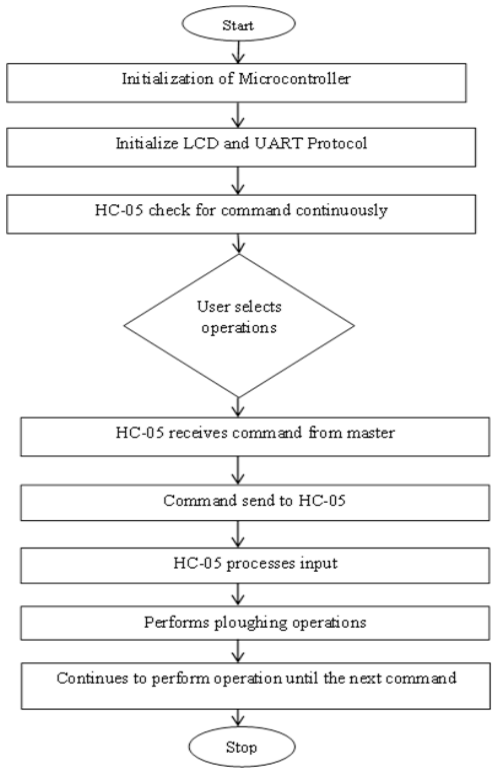

Fig. 3. Flowchart of system

5. Results

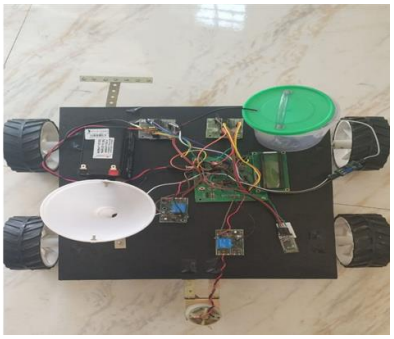

Fig. 4. Snapshot of robot system

In this work a robot, farm robot, has been designed, built and demonstrated to carry out ploughing, seeding, grass cutting in an agriculture field. It is expected that robot will assist the farmers in improving the efficiency of operations in their farms. It is aimed at increasing the productivity and reducing the labour involved, this robot is designed to execute the basic functions required to be carried out in farms. The robot performs the tasks like digging the ground, sowing the seeds and backfilling the soil automatically in a sequence without human intervention.

Thus an effort is made so that the robot becomes an aid to the farmers. The design is accepted and unique compared to the existing robots. The Fig. 4, explains the snapshot of the entire robot system.

6. Conclusion and future enhancement

This automated robotic machine which is named as "AGROBOT" is specially designed to facilitate the farmers so that the demand of food can be met easily. Agriculture robot serves better result than manual system. It is an automated robot which works on the basis of size of field, size of seed and in which mode it is meant to be operated. This robot can be controlled by using algorithm for the comfort of farmers and interfaced with RENESAS microcontroller. It is expected that this robot will change the trend of farming in the upcoming days from manual to automation. The implementation of AGROBOT has significant saving in the term of time, efficiency, man power, wastage of resources and also it works at much cheaper price. This also makes farming easy to learn and implement. By the help of this robot we can create interest among youths in farming which is very important for our development. These robots can be created in different sizes as per the requirement of farm which will make it more affordable. Robots can come over the difficulties in farming and also it leaves scope of further advancement in it. The solar energy can be generated and used as a source of power for the functioning of the robot by attaching the solar panel to the device. It reduces the human efforts and performs the activities automatically and accurately.

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