

## *Short Communication*

# **Wedding of robots with agriculture**

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In the recent days, the trends for green revolution become abridged. At the same time, the industries and IT sectors occupied most of the cultivated land. So this is the main disadvantage for the Green revolution. To overcome this, the idea is to implement the robots that increase the agricultural development. Nowadays, robotics is used in wide applications like industrial purposes and commercial purposes. So this paper deals with the project in Green Revolution using Robotics. In olden technology, it will cultivate the plants without the knowledge of DNA testing and its characteristics. So this proposed system with robots will test their DNA and also their characteristics. The main advantage is that it will cultivate as per human needs like soil nutrients, climatic conditions and seed topology. A micro-controller (Atmel 89c51) checks the DNA status of the plant against the templates. These techniques find better solution to green revolution.

**Key words:** Agri-Robot, Green Revolution.

## **INTRODUCTION**

The agricultural technology need to find new ways to improve efficiency. One approach is to utilise available information technologies in the form of intelligent machines to reduce the human efforts in a 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.

The idea of robotic agriculture (agricultural environments serviced by smart machines) is not a new one. Many engineers have developed driverless tractors in the past but they have not been successful as they did not have the ability to embrace the complexity of the real world. Most of them assumed an industrial style of farming where everything was known before hand and the machines could work entirely in predefined ways – much like a production line. The approach is now to develop smarter machines that are intelligent enough to work in an unmodified or semi natural environment. These machines do not have to be intelligent in the way

we see people as intelligent but must exhibit sensible behaviour in recognised contexts. In this way they should have enough intelligence embedded within them to behave sensibly for long periods of time, unattended, in a semi-natural environment, whilst carrying out a useful task. One way of understanding the complexity has been to identify what people do in certain situations and decompose the actions into machine control. This is called behavioural robotics.

## **Existing process**

There is much advancement in the field of engineering, robotics in particular. Many robotic systems have been developed for various purposes. There are certain systems which are used for automatic motion of vehicles in road and wheel chairs which can help disabled. There are also robotic systems which can be used for agriculture purposes. In addition to these advancements there are also robotic systems which can cultivate the plants. This robot is named "AGRI ROBOTS" and consists of five systems including vision, motion; robot weeding, power estimation and spraying. The vision system is used to carry out seed detection and tracking. The motion system is built for climate condition and used to achieve motion planning in real time.

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Algorithm for the existing process:

Step 1: Seed sowing.

Step 2: Irrigating the land.

Step 3: Monitoring the plant growth.

Step 4: Harvesting the plant.

The robot will place the seeds on the soil without testing soil contents. It doesn't have the prior knowledge about the condition of the soil that which seed will suit for that land to cultivate? After placing the seed, it will cultivate the plant and finally it will harvest it. In the mean while, it won't check the DNA topology before harvesting. This may lead to reduce the efficiency of the growth.

### Proposed process

The new technology has an automatic mode in which it can take its own decision for combating. In addition to this it also includes some of the features like seed detection, DNA mapping, weeding, micro-spraying, irrigation and harvesting.

Algorithm for proposed process:

Step 1: Test and enrich the soil condition.

Step 2: Seed sowing.

Step 3: Monitoring the climatic condition.

Step 4: Checks the DNA structure of the plant with the templates.

Step 5: If the DNA lacks in nutrients, enrich its nutrients.

Step 6: Selectively targets and kills the weeds by microjet spraying.

Step 7: The robot will irrigate each and every plant by analysing their topology.

Step 8: Then the plant is harvested.

In this technology, initially the robot will test the soil of the land of cultivating area. After testing the soil, it will place the seed and monitor the status of the seed. The monitoring status mainly defines the climatic conditions. After the plant grows, it will check the DNA structure of the growing plant with the uploaded structure and enriches its nutrients by mutation. The monitoring of the plant will take place and climatic conditions are also measured. Finally it will cultivate the plant with enriched nutrients.

## RESEARCH METHODOLOGY

### Phytotechnology

The approach of treating crop and soil selectively according to their needs by small autonomous machines is the natural next step in the development of Precision Farming (PF) as it reduces the field scale right down to the individual plant or Phytotechnology. One simple definition of PF is doing the right thing in the right place at the right time with the right amount. This definition not only applies to robotic agriculture (RA) and

Phytotechnology but it also implies a level of automation inherent in the machines. Automatic sensing and control (on-the-go) for each task is also important and many research papers have shown that these systems are feasible but most are too slow, and hence not economically viable, to be operated on a manned tractor. Once these systems are mounted on an autonomous vehicle, they may well suddenly become commercially viable.

### Modern agriculture

Modern agriculture uses a lot of energy. It comes in many forms from fertilisers and chemicals to tractors and fuel. The Phytotechnology approach tries to target the introduced energy to improve efficacy. Chamen (1994) identified that a 70% energy saving can be made in cultivation energy by moving from traditional trafficked systems (255 MJ/ha) to a non-trafficked system (79 MJ/ha). This was for shallow ploughing and did not include any deep loosening. From this we estimate that 80-90% of the energy going into traditional cultivation is there to repair the damage done by large tractors. It would be much better to not cause compaction in the first place which is one of the reasons that leads us to consider using small light machines. If this approach were taken, it would appear that the crop production cycle could be reduced to three stages: Seeding, Plant care and (selective) harvesting.

### Seed bed preparation

Ploughing is one of the most important primary cultivation processes and has been carried out since the start of civilization. It is effectively the inversion or mixing of topsoil to prepare a suitable seed bed. It also has the ability to bury surface crop residues and control weeds. A small robot utilising current technology does not have the energy density to sustain ploughing over a large area due to the high levels of energy needed to cut and invert the dense soil. Secondly, the draft force required to plough also needs relatively high weight to give traction. Perhaps leave it at that, but by considering what the plant, or in this case the seed actually needs, we can approach the problem in a different way. 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.

A solution is twofold. Firstly if we do not compact the soil in the first place there is less need for energy inputs for remedial loosening. Natural soil flora and fauna can be encouraged to manipulate the soil to give a good structure. This is one of the reasons to opt for smaller machines. Secondly, if the majority of the soil rooting

depth is acceptable, then only the local environment of the seed needs to be conditioned before seed placement, which will take a lot less power. Add to this the ability to place nutrients in the correct proximity to the seed we can improve the early phase of establishment. This system has many of the advantages of direct drilling but incorporation of previous crop residues may still cause a problem although removal of crop residues is an option.

### **Seed mapping and placement**

Seed mapping is the concept of passively recording the geospatial position of each seed as it goes into the ground. It is relatively simple in practice as an RTK GPS is fitted to the seeder and infra red sensors mounted below the seed chute. As the seed drops, it cuts the infrared beam and triggers a data logger that records the position and orientation of the seeder. A simple kinematic model can then calculate the actual seed position. The seed coordinates can then be used to target subsequent plant based operations.

Rather than just record the position of each seed it would be better to be able to control the seed position. This would allow not only allow the spatial variance of seed density to be changed but also have the ability to alter the seeding pattern. Most seeds are dropped at high densities within each row, whilst having relatively more space between the rows.

### **Reseeding**

Reseeding is the concept of being able to identify where a seed was not planted, or that a crop plant has not emerged and a machine can automatically place another seed in the same position. This concept could be extended to transplanting a seedling instead of a seed if the surrounding plants are too far advanced. A reseeders would have the ability to insert individual seeds/plants without disturbing the surrounding crop. Conventional seeders could not then be used as they create continuous slots in the soil.

A punch planter could be developed to fulfil this role, or better still adapt a Japanese transplanter to deal with one seedling at a time. Prior local micro-cultivation could be achieved by using a targeted water jet (or gel) to pierce the soil and soften it ready for the seedling roots.. The seeding mat can also include crop nutrients. If this concept became efficient enough, it could also become the main seeders as well.

### **Robotic weeding**

Knowing the position and severity of the weeds there are many methods that can kill, remove or retard these

unwanted plants. Different physical methods can be used that rely on physical interaction with the weeds. A classic example is to break the soil and root interface by tillage and promote wilting of the weed plants. This can be achieved in the inter row area easily by using classical spring or duck foot tines. Intra row weeding is more difficult as it requires the position of the crop plant to be known so that the end effectors can be steered away. Within the close-to-crop area, tillage cannot be used as any disturbance to the soil is likely to damage the interface between the crop and the soil.

### **Micro spraying and irrigation**

Within the close-to-crop area, great care must be taken not to damage the crop nor disturb the soil. One method of killing weeds close to the crop plants is to use a micro spray that delivers very small amounts directly on to the weed leaf. Machine vision can be used to identify the position of an individual weed plant and a set of nozzles mounted close together can squirt a herbicide on to the weed.

Tests have shown that splashing can be reduced when a gel is used as a carrier rather than water. Other trials have shown that when the right amount of herbicide is placed in the right way at the right time, the usage of herbicide can be drastically reduced to about 1 gram per hectare for an infestation of 100 weeds per square meter.

A micro spray system is currently under development at DIAS Bygholm, in Denmark; a robotic irrigator in the form of a mechatronic sprinkler (to simulate a travelling rain gun) was developed to apply variable rates of water and chemigation to predefined areas.

### **Selective harvesting**

Selective harvesting involves the concept of only harvesting those parts of the crop that meet certain quality thresholds. It can be considered to be a type of pre sorting based on sensory perception. Examples are to only harvest barley below a fixed protein content or combine grain that is dry enough (and leave the rest to dry out) or to select and harvest fruits and vegetables that meet a size criteria. As these criteria often attract quality premiums, increased economic returns could justify the additional sensing.

To be able to carry out selective harvesting effectively, two criteria are needed; the ability to sense the quality factor before harvest and the ability to harvest the product of interest without damaging the remaining crop. Most agricultural equipment is getting bigger and hence not suited for this approach. Smaller more versatile selective harvesting equipment is needed. Either the crop can be surveyed before harvest so that the information needed about where the crop of interest is located, or



**Figure 5.1:** simulation results

that the harvester may have sensors mounted that can ascertain the crop condition.

## IMPLEMENTATION RESULTS

The robot also has the inbuilt AI so that it can make decisions on his own. atmel micro controller is used to design the robot for agricultural purposes. to implement this structure we have to switch over the six steps which have already described in the proposed system. The output configuration of the agricultural robot is shown below (Figure 5.1).

### Advantages

It is a fully automated technology.  
No need of large area for cultivation.  
Easy to develop the enriched product.  
Though we are monitoring, data of the plant is stored in the microcontroller which is used for future analysis.

## CONCLUSION

This paper has set out a vision of how aspects of crop production could be automated one. Although existing manned operations can be efficient over large areas there is a potential for reducing the scale of treatments with autonomous machines that may result in even higher efficiencies. The development process may be incremental but the overall concept requires a paradigm shift in the way we think about mechanisation for crop

production that is based more on plant needs and novel ways of meeting them rather than modifying existing techniques.

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