Multifunctional Robotic Vehicle for Agriculture Application

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Abstract *–This is the paper which proposes Multifunctional mechanical vehicle for agriculture application. In the past agriculture was accepted out using furnish seized tools and as the civilization progressed people started using animal driven tools. After that self-governing age robots for agriculture. In the developed countries the automatic agriculture has reached to a complete state but in the increasing countries like India is still developing. The mechanized agriculture autonomous agrirobots for improving agriculture efficiency must increases to meet the expectations demand of the ever grooving human being population to rise above it we was developed robotic vehicle .Agriculture robotic are machines programmed to do agricultural task and form assignments. Such as harvesting or picking, weeding, spraying, cutting. The challenge is designing and developing robots to work in synchronization with the nature [1].*

Keywords- *weeding, spraying, cutting, rotted left, rotted right.*

Objectives:- The aim of this project is to present the status of the existing trends and achievement of agricultural and horticultural robotic vehicles and self-governing systems and outline the potential for future application. Dissimilar applications of autonomous vehicles in agriculture have been examined and compared with conventional systems, where three main groups of field operations have been identified to be the first potential practical applications crop establishment, plant care and selective harvesting. Moreover we will give examples of the economic potential of applying autonomous robotic vehicles compared to conventional systems in two different applications: robotic weeding in high value crops, particularly sugar beet, and crop scouting in cereals. The comparison was based on a systems analysis and an individual economic feasibility study for each of the applications. Focus will be put on potential labor cost savings, farm structure implications and sizes for operation, daily working hours, potential environmental impact, energy costs and safety issues.

I. INTRODUCTION

Now a day's world is moving towards automation and sophistication. It is equally important to have development and automation in agricultural equipments. Earlier, farmers were mostly depending on traditional farming equipments, which were depending on bullock, camels etc. Animal for their uses on field.

Fig.1.Multifuctional robotic vehicle

We are interested to have some innovative development in agriculture to move India to sit in the row of developed countries. We have chosen the process of seed sowing in farming for our project.

So why, we are wishing to have automation, sophistication in agriculture with seed sowing issue? This project is basically having microcontroller as a main device it is easily available device for controller and driving of various devices like DC Motors etc. This robot will definitely help in development of agriculture in India. This is fort and time saving and energy saving project. This may require much more cost at two primary basic but, if we have mass production in future it will definitely got in smaller prize. There will not more job remain rather than only filling the seed container, giving distance sets and publishing start button of robot. It will work automatically till end of seed chamber only regular attention should have to user on seed chamber.

II. METHODOLOGY

Block Diagram:-

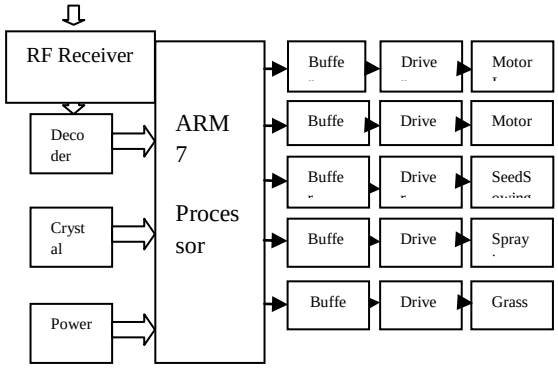

Fig.2. Block diagram multifunctional robotic vehicle system.

1) RF Receiver

In the transmitter section (remote), we have the following components:

- Eight switches
- RF encoder
- RF transmitter (STT-433MHz)

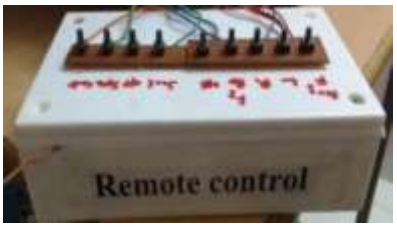

Fig.3. Shows Remote Control

Fig.4. Shows Remote Control inner Ckt.

This stage has a class 'C' type of amplifier which is perfectly matched with the antenna impedance to have faithful power transfer & no power is wasted.

There are eight switches for the movement of the robot in various directions like forward, backward, left and right etc. These eight switches are connected to the RF encoder. The RF encoder is then connected to RF transmitter, which is thereby connected to the antenna for the transmission of the radio waves.

2) RF Decoder:- The RF decoder is mainly used to decode the RF signal into its binary equivalent. But at starting due to interference of line and wrong selection of resistor and capacitor (which will decide the RC time constant which must be 30 ms or more). So by solving above problems the RF signal can be received. This stage decodes the coded signal & gets

the signal in the readable form to the microcontroller. That is in the digital form. Depending on the switch that is been pressed (left, right, forward, and backward), the digital data from the switches is transferred to the RF encoder, which encodes this digital data into RF signals and transmits to the RF transmitter. This transmitter transmits the RF waves to the receiver (robot) through the antenna. Receiver section received data and performs action as same data is transfer from the trance miter. The receiver section consists of the following components:

Fig.5. RF receiver ckt.

- RF receiver (STR-433MHz)
- RF decoder (HT12D)

Fig.6. ARM 7 controllers Board ckt.

3) ARM 7 controllers Board :- ARM architecture has become the most pervasive 32-bitarchitecture in the world, with wide range of ICs available from various IC manufacturers. ARM processors are embedded in products ranging from cell/mobile phones to automotive braking systems. A worldwide community of ARM partners and third-party vendors has developed among semiconductor and product design companies, including hardware engineers, system designers, and software developers.

3.1 ARM7 controller: - The ARM7controller is mainly used for controlling and performing the action of relay driver. But due to wrong selection of crystal oscillator and decoupling. The controller time cycle is disturbed. So by using capacitor to decouple these problems are solved.

3.2 Microcontroller - Microcontroller IC89c51 is heart of our project. We select this Microcontroller IC for our project for following no. of advantages such as Internal 1k bytes 14words of electrically erasable programmable read only memory with internal EPROM, 13 I/O pins with 25mA source capability, Internal 64 byte RAM to store temporally storage of data.

4) Motor Driver: - A gear reducer, also called a speed reducer or gear box, consists of a set of gears, shafts and bearings that are factory-mounted in an enclosed, lubricated housing. Gear reducers are available in a broad range of sizes, capacities and speed ratios. Their job is to convert the input provided by a “prime mover” into output of lower RPM and correspondingly higher torque. In industry, the prime mover is most often an electric motor, though internal combustion engines or hydraulic motors may also be used There are many types of gear reducers using various gear types to meet application requirements as diverse as low first cost, extended life, limited envelope size, quietness, maximum operating efficiency, and a host of other factors. The discussion that follows is intended only as a brief outline of the most common industrial gear reducer types, their characteristics and uses.

Fig.7. D.C.Motor

5) Power Supply-For our all IC we require 5V D.C. supply which can be generated by step down transformer, full wave bridge rectifier, filter condenser & voltage regulator IC7805. The power supply is mainly used to give the regulated 5V output to all the components. But due to interference between ground and output there is glitch in the output. So we have used capacitor to decouple them and hence the power supply gives the 5V regulated output.1) Current and battery discharge time with and no load. Table 1 shows Current consumed by DC motor and ARM7 controller, servo motor and Relay from that we can calculate the discharging time for battery with load and without load. Formula to calculate to time for no load is , Discharge Time = mAH current of battery / Total current consumed by circuit in mA.

Table 1: shows current and battery discharge time with load and no load

No.Of Battery (12V)	Current (mA) No load	Current (mA) With load	Microcontroller current(mA)	Battery discharge time with no load (Hr)	Battery discharge Time with load (Hr)
1	920	1200	100	1.25	0.95
2	920	1200	100	2.50	1.90
3	920	1200	100	3.80	2.84
4	920	1200	100	5.10	3.82

6) Modulator- This stage modulates the input signal. Here frequency modulator is used because of its feature of less noise.

7) Motor L: - This is the left tuning motor which use to turn vehicle at left side.

8) Motor R: - This is the right tuning motor which use to turn vehicle at right side

9) Seed Sowing /weeding Motor: - This motor is use as a time interruption purpose because one by one side wills down to earth side and vehicle move forward direction at same time. 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. [2]

10) Spraying Motor: - This motor is used for pesticide spraying on much vegetation.

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. [2]

11) Grass Cutting motor: - This motor is use for cutting unwanted grass or plants (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

"Labour necessities to grow and harvest the crops must be compact through computerization". The most important area of relevance of robots in agriculture is at the harvesting arena. Demeter is a robot that can cut crops like wheat. Although, it may look like a 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.

III. CONTROL STICK

This block contains the control keys, which control the specific operation of the robot, here every key press, the controller circuit generates a specified coded signal & each signal is different from the other one.

IV. PLANNING IN PHASES

Before commencement of the project it was decided to plan the project in phases so the following are the phases in which the project will be done: The very first phase was planning the project and getting the concepts right about the project. This involved lot of reading and understanding about the core concepts and the applications of our project. Getting to know about the features of various components present in the circuitry. Learning about various software like keil , Eagle 4.11 etc that will be used in our project. Procuring the various components required for the project. Creating the PCB (printed circuit board) for our project. Interfacing the monitoring system with PC. Implementing the entire project. Testing the working of the final monitoring system.

1) Farmer robot

normal harvester, Demeter can drive by itself lacking any human regulation. Unfortunately, people get weary and bored rigid, and their efficiency goes down. With a mechanical harvester, however, it never gets weary and can work 24 hours a day.

ADVANTAGES:

- The machine does not get unwell or tired and does not need point off.
- It can function with quicker tolerances (so every round is at full ground capacity), Fewer errors and at superior speeds
- Because machinery can be made lighter and cheaper if the driver's seat, controls and cab can be eliminated.
- It can be used in various fields like agriculture, medicine, taking out, and space study.
- It can be sent to another planet to study their environmental situation.
- The machines could easily work around trees, rocks, ponds and other obstacles.
- Small suburban fields could be worked almost as efficiently as large tracts of land.

FUTURE IMPLEMENTATION

The system can be advanced for checking the moisture of farming land by moisture sensor and adjust the particular amount of water in soil (i.e. moisture of soil) according to seed and its requirement. It can automatically increase the moisture of soil in land, when providing water supply to this system.

2) Justification for differences-

In tradition method, there is a use of animals for seed sowing like bullock, camel etc. There is also manual seed sowing. This method also required the highly skilled labour and charges are also high. This machine does not require much skilled operator and it also have good speed with accuracy. In traditional system accuracy is poor which causes reduction in production. If we consider, in traditional method 2 inches reduction in seed sowing area in each row, for huge field it will lead to reduction in production up to one row. Now a day's tractors are employed for seed sowing, but it also requires skilled operator and large energy source like diesel or petrol. This increases the production cost of crop. Our machine works only on batteries and the batteries can be easily charged.

CONCLUSION

1. As explained earlier India is a developed country. Many people still depends on farming. Also all the raw material required for many industries are get from farming. This type of innovative and developing ideas plays an important role in development in agricultural fields and also does the things easier and less time consuming. Our ideas definitely will become advantageous when it will be implemented on practical and real time basis. Primarily on demo basis it looks somewhat costly, but in future it may become more usable when produced on large scale. It will also minimize the energy requirement, if we make use of convention energy sources like solar energy sources like solar energy, which looks costly today.

2. This type of machine reduces the highly skilled labour requirement. It also increases the accuracy and linearity in seed sowing.

3. Traditional methods are much time consuming, this type of new inventions defiantly reduces time requirement and increases the speed of operation.

4. Operation procedure is also very easy and it is not necessary for the operation to move with machine.
5. The system can further be modified to measuring various parameter in farming like crop growth, weed prevalence, its type etc. Also, one or many system can be monitored through GSM system.
6. The project has consists of three different mechanism. The first mechanism contains making an assembly of vehicle and its motion, where as second mechanism is cutting the weed in between to crop lines. And third one is to spraying pesticide on different vegetation rows, the microcontroller is used to control and monitoring the process of system motion of vehicle. It is controlled with help of 12 volt DC motor, servo motor and RF Based Wireless Remote using RX-TX MODULES (434MHz.) etc.

FUTURE SCOPE

1. As India is still in development phase, it is necessary to have the development in all fields including agriculture. This type of new defiantly help in development of agriculture in future.
2. This machine is now working on batteries for the demo purpose. This type of machine can be development to work on hydraulic power like power like tractors. This will increase the speed of operation and accuracy in seed sowing.
3. This vehicle is now capable for the working only rectangular fields, but if we develop this system by using GPS systems, image scanning systems, etc. It will be available to use for any shape of fields.
4. By using solar panels we can make use of conventional solar energy is a vast source of energy.
5. This type of automatic system can develop in future for other processes in farming.
6. Limitations in this system can be overcome in future using some advancement for positioning of vehicle on field.

RESULT

Upon initial inspection of the circuit operation, multiple problems were noted. The input signal is transmitted from the pc but it is not detected by the receiver. Troubleshooting of the circuit was undertaken to isolate causes of circuit failure. The original and expected results of various components of the circuit are as follows

1) Power Supply: - The power supply is mainly used to give the regulated 5V output to all the components. But due to interference between ground and output there is glitch in the output. So we have used capacitor to decouple them and hence the power supply gives the 5V regulated output.

2) RF Decoder: - The RF decoder is mainly used to decode the rf signal into its binary equivalent. But at starting due to interference of line and wrong selection of resistor and capacitor (which will decide the RC time constant which must be 30 ms or more). So by solving above problems the RF signal can be received.

3) Microcontroller:- The microcontroller is mainly used for controlling and performing

the action of relay driver. But due to wrong selection of crystal oscillator and decoupling. The controller time cycle is disturbed. So by using capacitor to decouple these problems are solved.

4) Motor Driver: - The motor driver is mainly used for the controlling of the supply to transformer. The motor driver requires signal from microcontroller to operate. the relay takes 12v and 20ma. So we have connected it directly to relay driver ckt cannot connect directly to microcontroller. So that it will satisfy the surge current requirement of the motor.

5) Result of Debugging: - After debugging the circuit's individual modules, it was found that each of them functions as were expected, and with some modifications the output of each component is right and consistent.

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