Solar Powered Variable Pitch Smart Seed Sowing System with Herbicides Sprayer

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Abstract *- According to ISAE, it is found that axes and shovels are the main farm tools used by the farmers for agricultural operation. These tools are conventional and no improvement in agricultural practice is adopted. Hence, it is necessary to develop a system which results in reduction and is user friendly to agricultural community in India. Presently the seed sowing machines need tractors as prime mover and the distance between seed cannot vary (constant pitch) as per requirement. Also tractors are not emission free. Hence, an automated solar powered seed sowing machine with variable pitch was designed and constructed.*
Keywords: - Atmega 2560, Rotary encoders, Solar panel, Servo Hopper, DC motors.

Keywords - Put your keywords here, keywords are separated by comma.

I. INTRODUCTION

Near about 70% people are dependent upon agriculture. Agriculture has been the backbone of the Indian economy and it will continue to remain so for a long time. It has to support almost 17 per cent of world population from 2.3 per cent of world geographical area and 4.2 per cent of world's water resources. Annual growth rate in GDP has accelerated from below 6 percent during the initial years of reforms to more than 8 percent in recent years. This happened mainly due to rapid growth in non-agriculture sector. Sowing means process of planting seeds. An area that has or had seeds planted will be defined as being sowed. Among the major field crops, oats, wheat, are sown, grasses are seeded, and maize and soybeans are planted. In planting, wider rows are used, and the intent is to have precise, even spacing between individual seeds in the row; various mechanisms have been invented to count out individual seeds at exact intervals.

II. EXISTING SYSTEM

The method of seed sowing is with the help of a simple device having bamboo tube with a funnel on it attached to a plough. As the plough moves over the field the tube attached to it leaves the seeds kept in the funnel at proper spacing and depth. The plough makes furrows in the soil in which the seeds are dropped with the help of seed drill. Tractors mounted with multiple seed drills also used some times for dropping the seeds.

III. OBJECTIVE OF THE PROJECT

The principle necessity of Automation is to diminish labour in our nation; the trendy expression in every single modern firm for the most part includes electrical, electronic segment and also mechanical part

1) The main objective of this project is to design and fabricate a smart seed sowing robotic vehicle which can automatically sow seeds in the field based on variable pitch which is given as input by the farmers using the keypad present on the robot.

2) To make this vehicle Solar power so that it can be charged using the solar energy

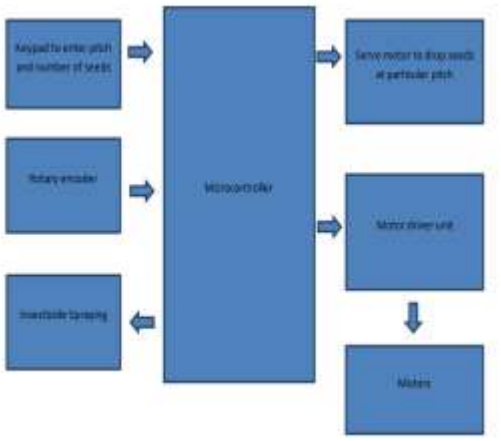
3) To incorporate the Insecticide spraying feature in the robotic vehicle which permits it to be used to spray insecticides.

IV. PROPOSED SYSTEM

The system involves smart seed sowing system with the help of microcontroller, rotary encoder, seed dropping system with servo hopper

Catia Design of Robot

A. ***Block Diagram*** In block diagram we used keypad, rotary encoder, microcontroller board, servo hopper, motor drive train, herbicide spraying



Block Diagram of Smart seed sowing system

The figure above shows the principle of operation of Automated Robotic Vehicle. The farmer initially inputs the pitch using the numerical keypad provided on the robot at which the robot is expected to sow the seed and initiates the seed sowing sequence. The data input of the farmer is provided to the microcontroller mounted in the robot which processes the input data. Depending on the pitch the robot then moves through the distance specified in the pitch. The distance is calculated using rotary encoders. After that, when the robot covers the respective distance the robot stops to sow the seed. When the robot stops the microcontroller signals the seed sowing mechanism to sow the seed at required pitch.

This vehicle has an insecticide spraying mechanism, which can spray the insecticides when required. The insecticide spraying system, when activated, sprays the insecticides from the tank provided on the robot.

B. ***Design calculations:***

Solar panel calculations: (actual design)

24 V geared motor.

Therefore Power=P=VI

Considering the operation of the machine day long is a period of 8 hours = P x 8 = 2000 watt

24 V 100 AH (standard battery)

Using these batteries we get a battery backup of: 2400/250 = 9.6 Hours

Solar panel to be used for charging of batteries

Since the battery is 2400 watt we can use standard 300 watt solar panel for charging the batteries so that the entire battery gets charged in 8 hours

Design of Shaft for actual machine:

Therefore diameter of the sprocket = pcosec (180/T)

Torque transmitted = force x radius

Torque transmitted by the shaft is given by

$T=\pi/16 \times \text{shear stress} \times D^3$

From the above formula calculated D

Taking factor of safety as 1.5

D= 18 mm

Design of Shaft for our prototype:

Power = Voltage x Current

$P_{shaft} = 2 \times \pi \times 35 \times T/60$

Torque transmitted = force x radius

$T= \pi/16 \times \text{shear stress} \times d3$

Taking factor of safety as 1.5

D= 12mm

C. ***Mechanical part:***

1) ***Shaft design***- according to the calculations the diameter of the shaft for the robot comes out to be 12 mm. However to provide the sufficient traction in the fields the robot needs to be made heavy. This would require the addition of additional weights onto the robot to make heavy. Thus instead of adding extra weights we are using the shaft size of 20 mm which adds up the weights.

Chassis (ERW steel Pipes)

2) **Drive system**-The drive system for the robot is powered by using a 17 watt DC geared motor

Drive system

3) **Pump sprayer**-A 12 V dc pump

Pump

D. **Electronic part:**

1) **Solar panel and battery**-This project uses a 10 Watt 12 V solar panel as it is sufficient to charge the battery.

Solar panel

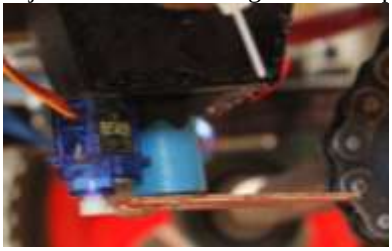
2) Controller board-Technical specs Microcontroller ATmega2560, Operating Voltage 5 , Input Voltage (recommended) 7-12V, Input Voltage (limit) 6-20V, Digital I/O Pins 54 (of which 15 provide PWM output),Analog Input Pin 16,
DC Current per I/O Pin 20 mA, DC Current for 3.3V Pin 50 mA ,Flash Memory 256 KB of which 8 KB used by bootloader ,SRAM 8 KB, EEPROM 4 KB, Clock Speed 16 MHz, Length 101.52 mm, Width 53.3 mm ,Weight 37 g

Test microcontroller module

3) Rotary encoder-The rotary encoder used in this project is 6mm shaft 40 PPR rotary encoder.

Rotary encoder

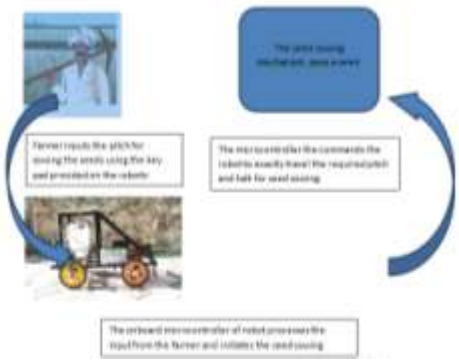
4) Servomotor-The servo motor is used in this project to control the angle of the hopper.



Servo Motor

V. PRINCIPLE OF OPERATION OF AUTOMATED ROBOTIC VEHICLE

Thus by assembling all these components we can make a fully functional smart automated robotic vehicle for Indian farmers. Further the entire system is powered using solar energy which makes Indian farmers to worry less about charging of the robot and completely concentrate on their work.



The Principle of Operation of the Robotic Vehicle

The figure above shows the principle of operation of Automated Robotic Vehicle. The farmer initially inputs the pitch using the numerical keypad provided on the robot at which the robot is expected to sow the seed and initiates the seed sowing sequence. The data input of the farmer is provided to the microcontroller mounted in the robot which processes the input data. Depending on the pitch the robot then moves through the distance specified in the pitch. The distance is calculated using rotary encoders. After that, when the robot covers the respective distance the robot stops to sow the seed. When the robot stops the microcontroller signals the seed sowing mechanism to sow the seed at required pitch.

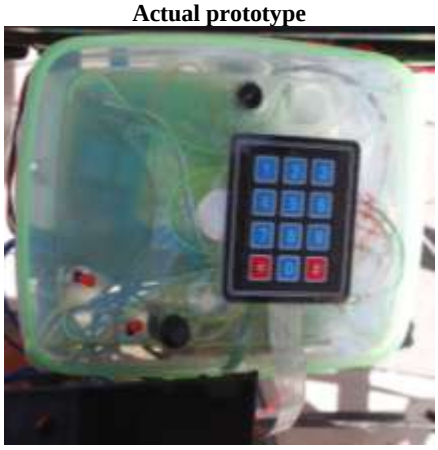
A small plough is attached below which makes the groove for seed then hopper drops the seed in the groove at specified distance and one flap connected at tail of robot covers the seed.

This vehicle has an insecticide spraying mechanism, which can spray the insecticides when required. The insecticide spraying system, when activated, sprays the insecticides from the tank provided on the robot.

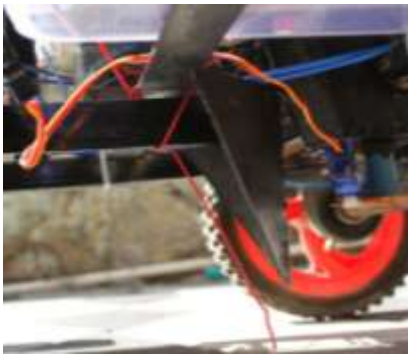
Finally the entire system is solar powered which helps farmers to concentrate on agriculture without the need to remember to charge this robot. The solar panel keeps on charging the battery online whenever the battery charge drops below a particular level.

Thus this vehicle forms a complete automated solution for the problems faced by the Indian farmers today.

Actual prototype



Microcontroller module



Small Plough

A. Advantages:

1) Reduces the effort on farmers by implementing seed sowing automation.

2) Smart pitch is maintained thought the field which can be varied using keypad.

3) Economical

4) User friendly and can be easily operated by Indian farmers

5) Solar powered, hence doesn't require charging

6) Safe

B. Disadvantages:

1) Needs water proofing to operate in rains

2) Some initial investment.

VI. CONCLUSION

The developed robotic vehicle can be a full-fledged example of agricultural automation. However since the field of agriculture is very large, further improvements can be done in this projects to make it smarter and multipurpose. Thus we can conclude that present version of this vehicle as well as the future versions can be effectively used for increasing the efficiency of Indian agriculture as well as reduce the physical burden on the farmers.

After considering different advantages and disadvantages of the existing machine, it is concluded that the automated robotic vehicle for farmers can

- Maintain row spacing
- Proper utilization of seeds can be done with less loss.
- Perform the various simultaneous operations and hence saves labor requirement, labor cost, labor time, total cost of saving and can be affordable for the farmers.
- Achieves automation in agricultural field.

ACKNOWLEDGMENT

This work supported by Research Program supported by the Department of Mechanical Engineering, BVCOEK, Maharashtra, India

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