**Microcontroller based solar powered seed sowing machine**

**INTRODUCTION**

India is the country of agriculture. Agriculture is the main profession of India. The economic condition of India depends strongly on agriculture. Therefore, it is necessary to adopt newer techniques and skills to improve the yield of agriculture. At the same time, the population of India is growing day by day. Hence it becomes necessary to improve the profession of agriculture in order to full fill the demand. There are various activities one need to carry out for effective farming. One among is seed sowing process. It is one of the tedious, time consuming and laborious work. There are various traditional methods of seed sowing. They are discussed in brief here.

* 1. **Traditional Sowing Methods**

Sowing of Seed is the processes of putting the seed in the soil at a particular depth for good germination. The conventional methods include manually broadcasting, opening furrows by a country plough and dropping the seeds by hand and dropping seeds in the furrow by a bamboo/metal funnel attached to a country plough. For sowing in small areas dibbling i.e., making holes or slits by a stick or tool and dropping seeds by hand, is practiced.

**1.1.1: Animal drawn multi-crop planter**

In earlier days animals were used to sow the seed. One such method is shown in Fig.1.1.



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 Fig.1.1 (a) Fig.1.1 (b) Fig.1.2

**Fig 1.1 (a) and (b) Animal drawn multi-crop planter Fig 1.2The tractor operated seed sowing**

Fig 1.1 (a) shows common method of seed sowing. In this method seed sowing is carried out using two oxen. Two persons are involved. One is for preparing the furrows and another for sowing the seed. Fig 1.1 (b) shows animal drawn 3-row planter is a multi-crop planter for planting of bold and small seeds. The planter is also suitable for sowing of inter-crops as different seeds can be filled in different boxes. These traditional methods are time consuming. Hence to save the time, machine operated seed sowing technique has come up.

**1.1.2Tractor operated seed sowing**

For planting of bold and small seeds tractor operated 6-row inclined plate planter which is a multi-crop planter is used. It is having a frame with tool bar, modular seed boxes, openers for furrow and a system for ground drive wheel. It will have six modular design seed boxes with inclined plate type seed metering mechanism which acts independently. Different types of Seed plates for sowing different seeds can be selected and changed as desired. The plate thickness, number and size of cells on seed plate vary according to seed size and desired plant-to-plant spacing. For operation, the seed is filled in the hopper, seeds are picked up by the cells of inclined plate and delivered in the opening connected to furrow opener through seed tubes. Shoe type furrow openers ensure deep seed placement in moist zone for sowing under dry land condition. Modular seed box-furrow opener units are adjustable for sowing seeds at different row-to-row spacing. By changing the transmission ratio the plant to plant spacing can be changed.

**1.1.3 Limitations of Traditional Sowing Methods of Seed**

1. In manual method of sowing the seeds, it is difficult to attain uniformity in

 spacing or distributing the seeds.

1. Farmer may sow at the required rate but inter- row and intra – row spacing

 Of seeds is likely to be uneven which results in bunching and gaps in field. The

 control over depth of seed placement may not be good.

1. Because two persons are required for dropping seedand Fertilizer labor

 requirement is high.

1. The effect of inaccuracies in seed placement on plant stand is greater in case of

 crops sown under dry farming conditions.

1. Use of tractor works out to be costlier and is not environment friendly.

To overcome the above said drawbacks, it is required to design a low cast, automatic and environment friendly sowing machine for seeds.

**METHODOLOGY**

The method used for the implementation of the work is described with the help of block diagram and is shown in Fig 1.1.

**POWER**

**MANAGEMENT**

**CIRCUIT**

**PV CELL**

**OR**

**SOLAR PANEL**

**BATTERY PACK**

**POWER SUPPLY CIRCUIT**

**IC REGULATOR (+5V SUPPLY)**

 **MOTOR 3**

**GEAR MOTOR**

**MEGA AT 2560**

**CONTROLLER**

**MOTOR 1**

**JOHNSON MOTOR**

**DRIVER CIRCUIT**

**DRIVER AND POSITION CONTROL**

**SEED NOZZEL AND ARMS**

**MOTOR 2**

**JOHNSON MOTOR**

 **LCD DISPLAY**

**SEED CONTAINER**

**IR SENSOR**

**BLUETOOTH MODULE**

**BUZZER**

**Fig. 1.3Block Diagram of sowing machine for seeds**

In the diagram, motor 1 and motor 2 are used for driving the sowing machine of seeds. The third motor is used for controlling the opening as well as closing of the nozzle of the seed container. These motors are powered from the energy generated by the solar PV cell. The controlling operation of the machine is carried out using microcontroller. Blue tooth module is used for giving controlled signal for the to and fro movement of the machine. The sensors are used to check the status of the container to indicate whether it is empty or not. The buzzer is used to indicate the empty status of the seed container.

The logic used in the work is given in the Fig.1.2

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**Fig 1.2 Flow chart**

On receiving the signal from blue tooth module and IR sensor, microcontroller generates signal to drive the motors and display the information on the LCD. Buzzer indicates the empty condition of the seed container.

**3.0 HARDWARE COMPONENTS**

The hardware components used for fabrication and operation of the sowing machine of seeds are.

* 1. **Mechanical components**

The mechanical hardware components used for the fabrication of the machine are frame, Hopper, Disc Shaft and Plough

* 1. **Electrical components**

The electrical hardware components used for the operation of the seed sowing machine are: Solar panel, Johnson motor, AT MEGA 2560 Microcontroller,7805 voltage regulators, LCD display, Driver circuit, Gear Motor, Blue tooth module, IR sensor,Photo diode and relay

The interfacing of all these electrical components for their controlled operation is shown in Fig.1.3

**V 1KΩ GND**

 **PHOTO DIODE**

**ZCD**

**D7 D6 D5 D4 RS E VCC GND**

**A1 VCC**

**A0 2**

**3**

 **4**

 **5**

 **6**

**MICRO - CONTROLLER**

**MEGA-AT 2560**

**9**

**10**

**11 8**

**12**

 **RX**

**12**

**BUZZER**

 **+5V**

 **+12V**

 **+5V**

 IN1

 IN2

 IN3

 IN4

 OUT1

**L293 DRIVER CIRCUIT**

 OUT2

OUT4 OUT3

 **+VCC**

M331

 **BLUETOOTH**

**TX**

**VCC**

**M2**

 **+ 5V**

M1

**Fig 3.15 Interfacing all the components with microcontroller**

**4.0 Results and discussions**

The complete assembly of the machine is shown in Fig 1.4.



**Fig 1.4 Model of Seed sowing machine**

The speed of the Johnson DC motor and gear motor is controlled by varying the delay. As the delay increases, the voltage applied decreases, hence the speed of the DC motor and gear motor decreases. This results in increase in distance between the seeds. The results are shown in the Table 1.1 and Table 1.2 and in Fig 1.5

**Table 1.1 Speed of the motors and time delay**

|  |  |  |
| --- | --- | --- |
| **Time Delay** | **Johnson motor speed** | **Gear motor speed** |
| 1 sec | 2.5 R.P.S | 0.25 R.P.S |
| 1.5 sec | 1.6 R.P.S  | 0.1 R.P.S |

From this table it is clear that the speed of the motor is controlled by controlling the delay in the program.

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**Table 1.2 Seed to seed distance and Time delay**

|  |  |
| --- | --- |
| **Time Delay****(seconds)** | **Seed to seed distance****(mm)** |
| 1 sec | 190 |
| 1.5 sec | 280 |
| 2 sec |  350 |
| 2.5 sec  | 400 |

**Fig.1.5 Relation between seed to seed distance and time delay**

From the tables 1.1 and 1.2 it is clear that as the delay increases the distance between seeds will also increase.

The condition of the seed container whether it is full or empty is also checked and results are presented in the Fig 1.6

 **(a)**



**(b)**

**Fig.1.6 Seed Container condition (a) seed container is full (b) Seed container is empty**

The Fig 1.6 (a) shows that, when seed sowing machine’s container is full the IR Sensor does not send a signal to the buzzer through Arduino so it does not make sound. The LCD displays that “seeds box is full”.

The Fig 1.6 (b) shows that, when seed sowing machine container is empty, IR Sensor sends a signal to the buzzer through the Arduino so it makes sound then the LCD displays that “seeds box is empty.

From the results, it is seen that the operation of the machine is easy. The distance between the seeds can be controlled very easily simply by changing the delay in the programme.

The condition of the seed container is monitored and displays the status. Hence, it is possible to carry out effective sowing, which intern results in increased yield and reduces labour cost and time. The machine works out to be cheaper as it is fed by solar.

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