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Semi-Automaized Sugarcane Planting Technology

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Abstract*: *The main epigram of this paper is to overcome the labour shortage and to reduce time and money. Mainly cultivation of sugarcane involves three process - cutting of sugarcane into reliably smaller pieces, ploughing the field for sowing the sugarcane and sowing them in the sand. This paper proposes a piece of equipment which can perform the above mentioned three works simultaneously. In this paper, we come up with the use of pneumatic pistons for cutting the sugarcane, which is also attached to the equipment/planter. The planter consists of a plough setup and addition plough control at the back to cover the cane with sand after it is sowed in the sand.

Keywords: Ploughing, Sowing, Cutting.

I. INTRODUCTION

The backbone of the Indian economy is Agriculture, in which sugarcane is one of the leading contributors to the Indian economy, and it also contributes measurable sources of income in the agriculture field. The oldest crop known to humankind is sugarcane, from long ago, and it is a significant crop of tropical and subtropical regions worldwide. Since sugarcane plays a substantial role in the farmer's economy, thus it is necessary to grow more sugarcane with high yielding, which will significantly help in the economic prosperity of the farmers and other stakeholders associated with sugarcane production. In India, many Sugar-Agro industrial Complexes are established by transforming the sugar units, producing utility products and a variety of chemicals from sugarcane. The highly desirable trait in sugarcane is the sucrose content, as the demand for cost-effective biofuels is increasing worldwide. Sugarcane as got high efficiency in fixing CO2 into carbohydrates for conversion into biofuel. This made awakened in the world as more interest in the crop. The Indian sugar industry is the second largest industry in the world. From the traditional method, it can be observed that farmer's used to do sugarcane cultivation with labours in an uneconomic manner. To overcome the problems dealt by farmers in cultivation of sugarcane, we give forth a piece of equipment that can perform some of the cultivation processes involved in sugarcane plantation simultaneously.Sugarcane's global production was 1.84 billion tonnes in 2017, 41% of the world total was produced by Brazil, 17% of the world total was contributed by India, and about 12% was added by China and Thailand equally. The average yield of sugarcane crops worldwide was 70.6 tonnes per hectare in 2016, led with 112 tonnes per hectare by Peru and 103 by

Zambia. The possible theoretical yield is about 280 tonnes per hectare per year for sugar cane, and in Brazil, small experimental plots have demonstrated yields of 236–280 tonnes of sugarcane per hectare.

II. EXISTING METHOD

The existing method of planting sugarcane is by manual plantation method. In this method, the sugarcane is already cut into pieces, and then it is spread throughout the field, and the labour sows the sugarcane into the field manually by picking one by one in hand.

III. PROPOSED METHOD

The main block diagram of this project is shown in figure 1. The block diagram consists of Microcontroller (PIC16F877A), 555 timer, Relay, Solenoid valve and Pneumatic piston.

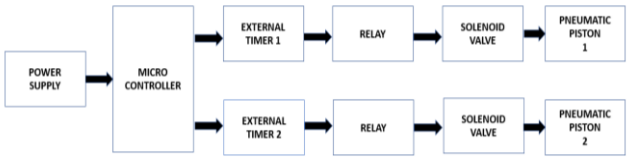

Fig 1. Block diagram of proposed project

IV. COMPONENTS USED

The components used in this project are

A. Microcontroller (PIC16F877A)

A microcontroller is an integrated chip which consists of ROM, RAM, Timers, CPU, Counter, etc., PIC is a microcontroller which also includes ROM, RAM, Timers, CPU, Counter, DAC (digital to analog converter), ADC (analog to digital converters). PIC also supports protocols like UART, SPI, CAN for interfacing with other peripherals. In this project PIC16F877A, shown in Fig 2, is used for the operation of solenoid valve at regular interval of time.

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Fig 2. PIC16F877A microcontroller

B. External Timer (555 timer)

The external timer used is 555 timer. The 555 timer IC (Integrated Circuit) is used in a variety of timer, oscillator and pulse generation applications. The 555 timer, shown in Fig 3, is used to provide time delays for pneumatic through the solenoid valve for cutting the sugarcane.

Fig 3. 555 Timer

C. Relay

Relays are simple switches that are operated both mechanically and electrically. Relays consist of an electromagnet and a set of contacts. The electromagnet here is used for the switching mechanism. Most of the devices have the use of relays. The schematic of relay is shown in Fig 4.

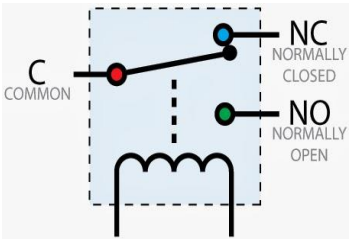

Fig 4. Relay

D. Solenoid valve

A solenoid valve is a control unit which, when energized or de-energized electrically, either allow fluid or airflow (or) shut off. The actuator takes the form of an electromagnet. A magnetic field is developed when energized, which pulls a pivoted armature against the action of a spring. The solenoid valve, shown in Fig 5, is used for the transportation of the compressed air or fluid for operating the pneumatic piston.

Fig 5. Solenoid valve

E. Pneumatic piston

Pneumatic cylinders are mechanical devices in which the power of compressed gas is used to produce a force in a reciprocating linear motion. The piston is a cylinder or disc, and the piston rod transfers the force it develops to the object to be moved. The piston of the pneumatic, shown in Fig 6, is attached with blades for cutting the sugarcane. The piston moves front and back for the process of cutting the sugarcane.

Fig 6. Pneumatic piston

Table 1. Specification of components

S.No	Name of component	Quantity	Specififcation
1	Microcontroller	1	PIC16F877A
2	External timer	2	CM555
3	Relay	2	-
4	Solenoid valve	2	12V DC
5	Pneumatic piston	2	-

V. HARDWARE SETUP

The proposed project's hardware setup is shown in the Fig 7. Control circuit is also contained in the hardware setup as shown in Fig 8.

Fig 7. Hardware implementation of the proposed project

The Control circuit consists of two units controlled by a microcontroller (PIC16F877A). Each unit is connected to a solenoid valve which is further connected to a pneumatic piston. Both the units produce same amount of delay but the PIC16F877A decides which unit should operate at a time.

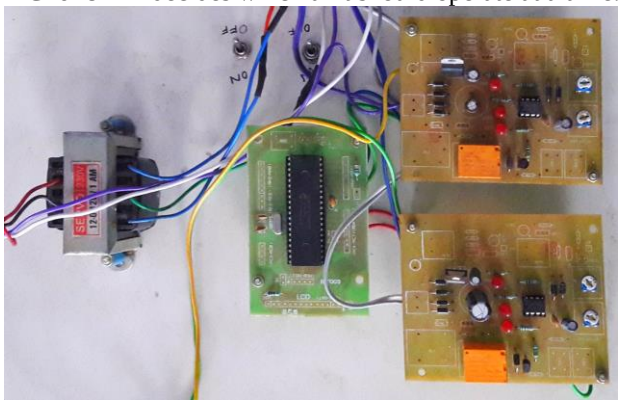

Fig 8. Control circuit

VI. WORKING

The equipment contains some of the essential parts such as ploughing blades, soil closing blades, container and seat. The whole planter is connected to a tractor to carry out work in an efficient way. The planting process starts with ploughing the field as per the farmer's requirement, i.e., the farmer decides the required distance between two rows of seeds needed for planting.

The labour sitting on the seat attached to the planter drops the sugarcane stored in the container to land through pipes continuously. The pneumatic piston cuts the sugarcane passing through the pipe, following which the closing blades cover the soil over the cane which has fallen to the ground and make it fully sown.

VII. RESULT

Our equipment was tested in the field and it was able to plough the land ready for sowing followed by sowing the cane and closing the sowed cane with sand simultaneously along its way in an effective manner. The labour required for this process was only three which reduced the labour cost as in the conventional way of sugarcane plantation more amount of labour is required for the process.

VIII. CONCLUSION

The whole process of cultivating is semi-automated. The distance required between two rows of cane planted can be maintained according to the farmer's requirement. By the traditional method, it can be estimated that eight labours are required to work continuously for 8 hours to cultivate one acre of land, i.e., the labour cost for cultivating one-acre land is around 2400 by assuming Rs.300 for each labour. And before the cultivation process, a row has to be made ready for seeds that costs around Rs.3600 but, our planter can do the cultivation process with three labours along with tractor within 2 hours. By using our equipment/planter, the price is reduced, as ploughing the land and cutting the cane is semi-automated, so it reduces the cost by a maximum of Rs.2000 in the process of ploughing and sowing the cane for an acre of land.

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