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Design and development of semi-automatic bot for agricultural applications

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ABSTRACT:Agriculture is the backbone of our country, and almost 60% of country's economy depends on agriculture. In today's scenario all fields are injected with automation for the purpose of high productivity and single time investment. The main objective of this work is to automate the drying process of various cereals (PADDY). The manual process of levelling the grains is a time consuming one and it requires a large number of human labours with high wages. The constructed system is a semi-automatic bot with a hopper to load the cereals and a plough tool to level the grains on the surface. The movement of the bot is controlled by a controller as per the instructions loaded By implementing this system large number of human labour is reduced. The maintenance of the system is less and it is an one time investment.

KEYWORDS:drying of cereals, automatic bot, embedded systems, low cost, one time investment.

I. INTRODUCTION

India is the second largest producer of paddy next to china. [2]These paddy after cultivation should be dried to reduce the moisture content in it. At harvest time grain contains a lot of moisture (20-25%). High moisture promotes the development of insects and molds that affects the grains. High moisture rate also reduces the germination of grains. Ineffective and incomplete drying reduces the quality of paddy. The economic benefits from drying of paddy increases the market value of paddy. Increased income from being able to process more grain in a given time. Improper drying leads to fissure development in rice. The two methods of drying paddy are sun drying and mechanical drying. In mechanical drying process it has to be monitored and when it is not dried to the required temperature it causes weight loss and fissure. Sun drying is the traditional method for drying and is still preferred in Asia because of its low cost. The optimum layer thickness for sun drying is about 2-4 cm. The grain needs to be turned or stirred at least once per hour, better every 30 minutes to achieve uniform moisture content. On hot days the grain temperature can rise above 50-60ºC. If that is the case cover the grain at mid-day to prevent over-heating. In sun drying more labour work is involved. In the proposed system the sun drying of paddy is involved but the labour work is greatly reduced. A semi-automatic bot containing a hopper to load the paddy and a plough tool to level the paddy on the surface. In this method a single person is alone required to load the hopper when necessary.

1.1 SYSTEM DESCRIPTION

The experimental work involves the methodology of leveling the paddy on the surface in the surface. Microcontroller forms the heart of the system and carries out the sequence of operation as per the instructions fron programming. [6]The system involves a total of 5 motors and the system is completely electrically actuated. The system carries a hopper that is loaded with paddy. The paddy in the hopper drops on the surface through the tray. A rotating blade is attached in the hopper. The rotating blade is actuated by a motor.[9] Two proximity sensors are placed in the hopper.They are used to sense the presence of paddy in the hopper and sends the signal to the [3]8051 microcontroller and inturn the controller actuates the motors. There were several methods applicable for the leveling of paddy . Some of them are: sun drying of paddy and mechanical driers. To attain good quality of paddy sun drying process is used in the system.

Based on the signal from the proximity sensors, the microcontroller commands the actuation of the motor. [7]The drive for the bot is a gear motor with speed of 60rpm and torque of 110kgcm, which gets actuated by a 12v dc supply. The rotating blade that is used to circulate the grain is powered by a 12v dc motor of 20kgcm torque and speed of 60rpm.

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The cross section of the base is 60*40 cm. The hopper is attached above the base, and a sliding tray is attached below the hopper at an angle of 33. Both the hopper and sliding tray are made up of sheet metal. The plough tool is welded with the base of the bot which is used for the levelling of the grains.

1.2 COMPONENTS

1.2.1 ELECTRICAL COMPONENTS

S. No	Components	Description
1	DC Motor	12V, 110 kg-cm,60 rpm 12V 20 kgf-cm, 60rpm
2	Micro controller	AT89C51
3	Relay	12v relay
4	Proximity sensor	Inductive
5	Transformer	12v 10amps
6	Rectifier	Converts AC to DC
7	Infra red sensor module	For sensing the limit point

1.2.2 MECHANICAL COMPONENTS

S.NO	COMPONENTS	DESCRIPTION
1	Hopper	Sheet metal, 5kg capacity
2	Wheels	110mm diameter
3	Chassis	60 ✖ 40 cm
4	Sliding Tray	540mm , sliding angle 33
5	Plough Tool	Mild Steel
6	Rotating Blade	Mild Steel

1.3 WORKING

The grains which is to be dried is loaded in the hopper. The hopper consists of proximity sensors which senses the presence of the grains and sends a signal to the micro controller.[4] Once micro controller receives the signal, it actuates the relay. The relays are the driver module the are used to actuate the motors. The motor gets actuated based on the signal from the relay and moves over the area that is specified by the labour. The motor that is attached to the rotating blade also gets actuated. The grains comes down from the hopper and reaches the sliding tray by action of rotation of the rotating blade. The grains from the sliding tray falls on the surface and the plough tool that is attached to the chassis of the bot is used to level the grains on the surface.

[5] The entire sequence is controlled by the micro controller. The path by which the bot has to cover the entire surface is programmed in the micro controller. If the grains in the hopper is emptied the sensor sends a signal to the micro controller and bot stops and gives an alarm indicting the labour to load the hopper with the grains. Once it is loaded the sensor senses and the sequence is continued until the entire surface is covered. A single labour is alone required to load the hopper with the grains. Thus the mechanical components are made of metal sheet and hollow frame rods, which result in less weight of the product.

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1.4 DESIGN CALCULATION

1.4.1 TORQUE CALCULATION FOR DC MOTOR:

Load:

Weight = Mass x Gravity
= 20 x 9.81
=196.2 N

Motor Torque:

Torque = Force x Radius
= 196.2 x 0.055
= 10.79 NM

Speed of the Motor:

V = πDn/60
N = 60 rpm

Power of the Motor:

Power = $2 * \boldsymbol{\pi} * \boldsymbol{n} * \frac{t}{60}$
= 2x πx60x3/60
=18.84 Watts

1.5 FABRICATION PROCESS

1.5.1 MECHANICAL SECTION

The primary component of the mechanical section is the frame and the plough tool. The hopper and the Tray are made up of sheet metal.The frame made by arc welding and the hopper is placed above the frame and the tray is placed below the hopper .The clamps are used to hold the motors in the frame of the bot. This completes the fabrication of the mechanical section.

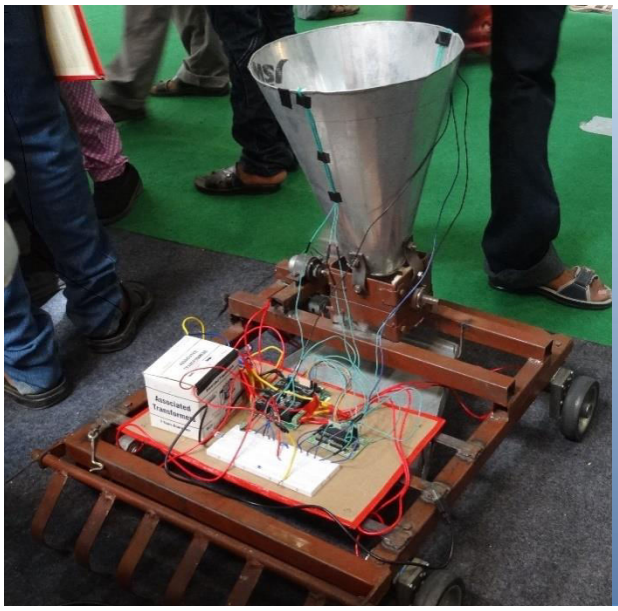

Fig.1. Fabricated Model

Fig.2. Pro-E Model

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1.5.2 ELECTRICAL SECTION

This section involves the fabrication of PCB and rectifier circuit. The first step of PCB design is the fabrication of the motor driver and the main circuit by software simulation using Proteus professional software.

The second step of PCB design is the implementation of the circuit developed in Proteus professional software in the PCB. This is achieved by a series of processes. The impression of circuit is transferred to the copper board by means of iron box. The copper layer in the PCB is removed by etching with ferric chloride solution. The copper board is drilled using a hand drill and the components are fixed and soldered.

[8]The conversion of AC voltage to DC voltage is achieved by a rectifier circuit. The AC voltage is stepped down using a step down transformer and it is fed to the rectifier. The rectifier, thus, converts 230V AC into 12V DC which is given as input to DC motor

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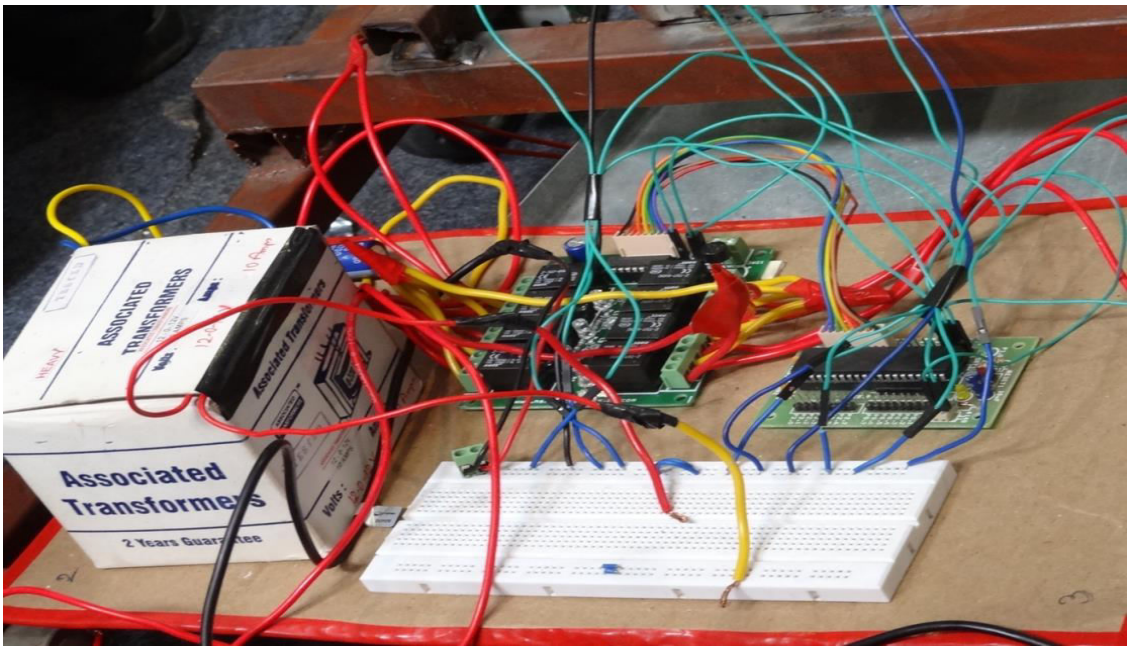

Fig.3. ELECRTICAL SECTION

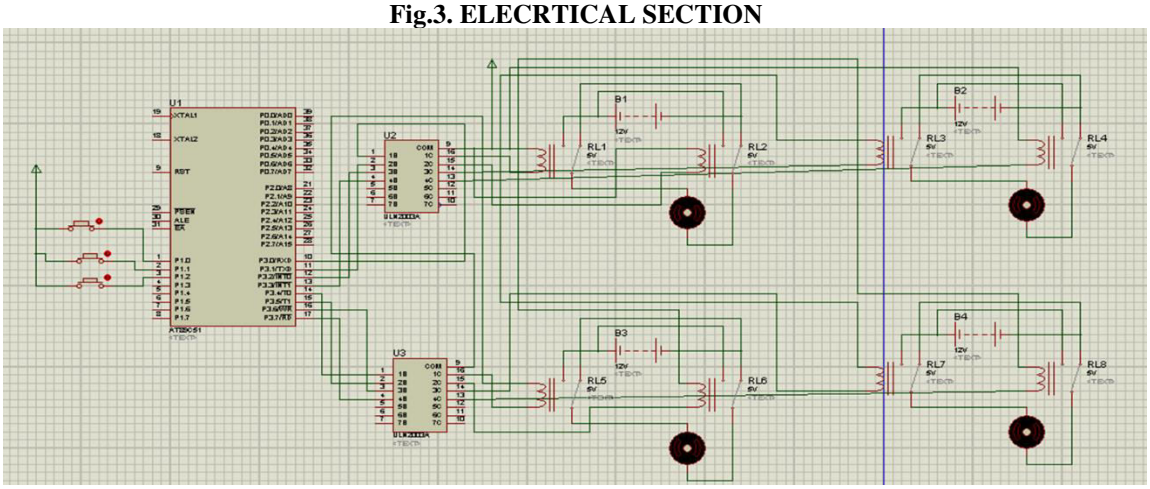

Fig.4. PROTEUS DIAGRAM

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1.6 MACHINE ASSEMBLY

Once the mechanical and electrical sections are fabricated , they are assembled together to achieve the semi-automatic drying process. The infra-red sensors is placed in the hopper and are used to achieve the sensing mechanism. The signal from the sensors are given to the respective ports of the micro controller as created in the program. The connections to the motor are given by wires. The AC supply is given to the rectifier which converts it into DC supply, based on the signal from the controller actuation of the relay takes place, which in turn actuates the motor. All the wires are properly insulated and tagged.

1.7 CONCLUSION

Thus a new system for levelling of grains is developed. The semi- automation of the system is achieved and the system proves to be cost effective as well. Also, the objective of our system is satisfied with the designthat have been developed. This system greatly reduces the work of human labour. Also it increases the efficiency and time consumption.Currently implemented idea involves one human labour to load the paddy in the hopper when the bot stops. In future the system can be made fully automated by implementing large container containing grains which can be loaded to the hopper using a conveyor. This totally eliminates human labour. The idea thathave chosen is a completely new dimension that surely will open up innovative minds to move forward in this direction.

REFERENCES

1. Article titled ”Worlds top 20 rice producing nations” rediff reference site
2. Article titled “drying paddy” by NAIP of IGNOU Uniersity
3.Ayala ,K.J. (1997) “8051 Microcontroller Architecture, Programming and Application”, Penram International Publishing (India) Pvt. Ltd, Second Edition
4.Muhammad Ali Mazidi and Janice GillispieMazidi (2004) “The 8085 Microcontroller and Embedded Systems”, Pearson Education
5.Ajay V Deshmukh(2006) “Microcontrollers(Theory and Applications)”, Tata Mcgraw-Hill publishing company limited, New Delhi.
6.Rajput, R. K., “Electrical Machines”, Third Edition, Laxmi Publications (P) Ltd, New Delhi
7.Mittle, V.N. and Mittle, Aravinth., “Basic Electrical Engineering”, Second Edition, Tata McGraw- Hill,New Delhi, 2007.
8.Floyd, “Electronic Devices”, Sixth Edition, Pearson Education, New Delhi, 2003.
9.Patranabis, D., “Sensors and Transducers”, Second Edition, Prentice Hall of India, New Delhi, 2009.