International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-2, December 2019

Automatic Feeder for Sericulture

Mr.R.Ranjith kumar, P.Aravindh ,T.Kavinesh, Y.Sathyanarayanan, P.Sedhumaadhavan

Abstract— Sericulture, or silk farming, is the cultivation of silkworms to produce silk. Sericulture has become an important cottage industry in countries like Brazil, China, France, India, Italy, Japan, Korea, and Russia. Today, China and India are the two main producers with more than 60% of the world's annual production. The major hurdle in this field is shortage of manpower. From the survey it is absorbed that the most time-consuming process in sericulture is feeding of worms with mulberry leaves. As the feeding system for sericulture is concerned, the technologies available in market are of no match to feed the worms efficiently. This project "Automatic -Feeder for Sericulture" aims to provide the solution for the existing problem. The project comprises a movable feeder box mounted over the line following Rover. Four axis movement of Rover and vibrating slider ensures the uniformity in spreading the leaves. This project is designed to feed the leaves automatically. The special design of the rover enables to feed the worms in their growth place (RACKS).

Keywords— Sericulture, Manpower Shortage, Rover, Automatically, Special design

I. INTRODUCTION

sericulture is the process of Rearing the silkworm to produce silk. The most widely used species of silkworm is Bombyx mori. China produced the first silkworm before the Neolithic Period. China, Brazil and India are the countries where sericulture is the important cottage industry. 60% of the world's annual production of silk is produced alone by the countries of China and India. By surrounding itself with a long, continuous filament silkworm caterpillar builds its own silkworm. As said above each cocoon has continuous filament with useful length of 600 to 850 meters and that will be freed by softening the binding sericin and locating the filament end and unwinding or reeling, the filaments from several cocoons at the same time to form a single strand. Workers will twist the several single strand to form a thicker and stronger yarn in the process called throwing. This paper deals with the new technique of feeding the silkworms.

Revised Manuscript Received on December 30, 2019.
***** Correspondence Author
R.Ranjith kumar*, Department of Electrical and Electronics Engineering, Kongu Engineering College, Perundurai, Erode, India,
P.Aravindh, Department of Electrical and Electronics Engineering, Kongu Engineering College, Perundurai, Erode, India,
T.Kavinesh, Department of Electrical and Electronics Engineering, Kongu Engineering College, Perundurai, Erode, India,
Y.Sathyanarayanan, Department of Electrical and Electronics Engineering, Kongu Engineering College, Perundurai, Erode
P.Sedhumaadhavan, Department of Electrical and Electronics Engineering, Kongu Engineering College, Perundurai, Erode, India,

II. EXISTING SYSTEM

Mulberry is a plant that is grown for silkworm rearing. The leaves of the mulberry plants are fed to the silkworms that are placed in the trays. Manual feeding is the existing method of feeding the silkworm, here the mulberry leaves are ploughed from the plants and chopped to the required size then it is fed to the silkworm. One metric ton of mulberry leaves are needed to be fed to silkworms to produce high quality cocoons weighing about 25 to 30 kg. Continuous feeding is the important factor in sericulture.

III. OBJECTIVE

The main objective of the project is to reduce the man power requirement and the labor costs, which is drawback in the existing system. To achieve these, a rover has been designed which feeds the leaves to the silkworms automatically. It is also expected that this project will enhance the involvement of farmers in Sericulture.

IV. PROCESS AND BLOCK DIAGRAM

The silkworms are placed in a tray like stands and a rover contains a small storage tank which is used to store the chopped leaves. The process flow is explained in Fig 1 shown below.

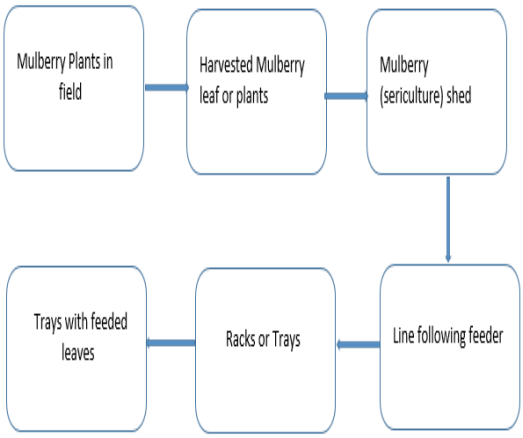

Fig 1: Block Diagram of the Process

The rover follows a mentioned path and feed the leaves to silkworms in trays. Initially when the rover is started it reaches the tray and stopped its movement. Then the slider motor below the hopper storage tank starts to rotate, which makes the leaves from the storage tank to fall on the slider then it slides on to the trays. The hopper mounted on the rover is capable of 4-Axis movement which is driven by two wiper motors.

Initially the slider will be at the end of the tray and it starts to move along the x-axis with the leaves falls on the trays. And once it reaches the other end of the tray the x-axis motor stops. Now the y-axis motor makes the slider moves one step forward and again the x-axis motor starts and it will move in x-axis direction to the end of the tray. Likewise, we can feed the leaves to silkworms. The movement of x-axis and y-axis motors is repeated in forward and reverse to our need as per the size of the trays. These motors are controlled by using Arduino controller. The operating period of the motor is based on the length and breadth of the silkworm trays. The main advantage of using the rover is to reduce the man power required and also saves time. By feeding with this rover the total surface area of the silkworm tray can be filled and no area is left uncovered with the leaves, thus it helps in feeding the leaves uniformly. The structure of the rover is consisting of an under frame with wheels. The hopper is mounted on the frame and thus it will move in x and y-axis with the help of lead screw and wiper motors. Relays are used to switch the supply between the motors used. The operating time of the motors is based on the tray size and so we need to maintain all the trays in a similar size which is an important factor in this automatic feeder.

V. HARDWARE

Fig 2: Hardware Model of the project

In Fig 2, the actual prototype developed for the project is shown, it consists of 3 wiper motors, an agitator and a hopper. The IR-based Line follower is combined along with this rover for the artificial movement among the mulberry shed.

VI. WORKING

The existing method of feeding the silkworms is manual feeding using labors. To avoid this an automatic feeding system is designed using a rover showed in the Fig 3. The feeder consists of the feeding hopper placed on the chassis. The hopper is used as a storage tank for the mulberry leaves. Usually the silkworms are placed in a tray or stand. The feeder will move around the shed based on a line follower. A black line is drawn near to the trays so that the feeder can follow the line. And when the feeder reaches the tray it stops near to it and then the x and y –axis movement of the hopper begins. Initially it starts to move inwards to the tray i.e. x-axis or upper motor is in operation. When the hopper reaches the end of tray x-axis motor stops and y-axis motor starts to operate. It moves the hopper in forward direction for a short period of time and then stops. Now the x-axis motor starts to rotate in counter-clockwise direction so that the hopper comes back to its initial position. By repeating this cycle for a particular time as per the tray size, leaves can be filled in the tray. When a tray is filled the entire feeder moves to the next tray and stops, again the hopper movement takes place. There are 3 wiper motors used in this project. One for the movement of entire feeder and the remaining 2 for x and y-axis movements. The switching of the motors is done by using a 4-channel relay module which is connected to the Arduino controller.

Fig 3: Working Model

The program for the switching sequence of the motors is dumped in the Arduino. A 12v DC battery is used to power the entire process. Apart from the wiper motors, there are 2 other DC motors are used. One is used as a roller in the hopper to move the leaves freely in the slider. Another DC motor is used below the slider as an agitator, which vibrates the slider so that the leaves easily fell from the slider. The time delay for the motors in the program is based on the tray size. It can be varied as per our requirement. Since the tray size plays a major role, all the trays in the shed should be of equal size to avoid feeding problems.

VII. PERFORMANCE OF THE PROJECT IN REAL FIELD

The prototype developed was tested in the field and the observations are showed in the Table 1.

Table 1

Process	Observations
Time taken to feed 1 Square Feet	15 Seconds
Maximum leaf delivering capacity	0.25 Kg per Second (Green mulberry) leaves)
Maximum X-Axis length coverage	3 Feet

Maximum Y-Axis length coverage	5 Feet
Maximum pay load	15 Kg
Operating power consumptions	100 tts (Approx..)

VIII. COMPARISON BETWEEN MANUAL FEEDING AND ROVER FEEDING

8.1 Time Consumption

A survey has been taken among 6 farmers rearing the silkworms and the following consolidated graph has been obtained.

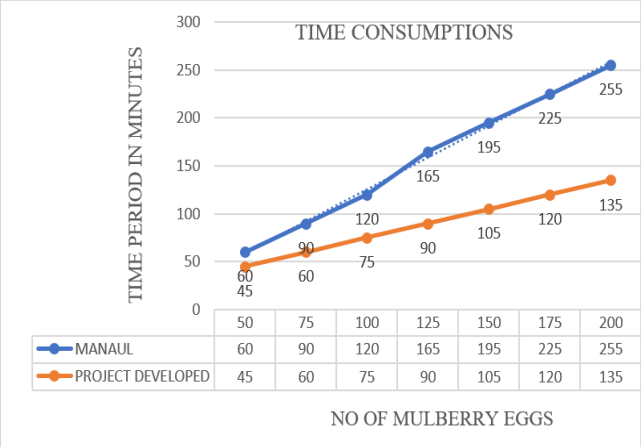

Fig 4: Comparison of Time Consumptions Between Conventional and Project Designed

The above Fig 4, shows the time consumption for the process of feeding the silkworms depending upon the number of eggs being processed. Also, the same has been compared with time consumption, if the project is implemented. From the fig 4, It is observed that the by implementing the project design in the field would bring the solution to reduce the Time consumption problem in sericulture.

8.2 Running Cost

Fig 5: Comparison of Running cost Between Conventional and Project Developed

The Fig 5, gives the comparison of the running cost or Labor cost between the conventional method and the Automatic Feeder developed. It is observed that the rover machine would also help to reduce the cost of rearing the silkworms, thus it indirectly helps to improve the income of the farmers involved in this culture

X. CONCLUSION

This machine helps the farmers to speed the feeding process of worms. Based on the overall performance of the machine it is understood that the project will satisfy the need of small farmer. This project required less man power and less time compared to traditional methods, so if we manufacture it on a large scale its cost gets significantly reduce and hope this will satisfy the people involved in sericulture. So, in this way the labor problem can be solved, which is the need of today's farming in India. The machine can be used to feed as well as to chop the mulberry leaves. The drudgery of field work will be reduced and labor shortage problem will be overcome by the machine.

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AUTHORS PROFILE

R. Ranjith Kumar is the assistant professor of Kongu Engineering College, Perundurai, Erode, India. Completed the Masters in Anna University, Coimbatore. Area of Specialization is Power System Engineering. Published the National Conference Paper Titled with "Solar Powered I Plant" at Industrial Automation in Safety at Sengundar Engineering College, Erode.

P. Aravindh, is the student of Electrical And Electronics Engineering Department at the Kongu Enginering College, Perundurai, Erode. Under gone the Inplant Training at SUNSHIV Electronics Solutions, Coimbatore. An active member in the "Instuite of Engineering and Technology". Area of Interest is DC Machines.

T. Kavinesh, is the student of Electrical and Electronics Engineering Department at the Kongu Enginering College, Perundurai, Erode. Under gone the Interenship at NIT-Trichy, and worked under the topic of "Energy Minimiziation in Three Phase Induction Motor" An active member in the "Instuite of Engineering and Technology",Won the Academic Performance Award (Network Level) in the IET Chennai Local Network Young Professionals Section Award 2019.

Y. Sathyanarayanan, is the student of Electrical And Electronics Engineering Department at the Kongu Enginering College, Perundurai, Erode. Under gone the Inplant Training at "ANARCH ELECTRON PANEL SERVICES". An active member in the "Instuite of Electrical and Electronics Engineering". Placement Co-ordinator of the Department. Area of Interest is Linear Integrated Circuit.

P. Sedhu Maadhavan, is student of Electical And Electronics Engineering Department at Kongu Engineering college, perundurai, Erode. Under gone the Inplant Training at CHENNAI PORT TRUST in Chennai and another Inplant Training at CHEMTECH PROCESS under 800 Kv Power House in Tirupur. Area of Interest is DC Machines.