Disinfectants Spraying BOT in Silkworm Rearing House

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Abstract- **The distribution of silkworm industry is widespread with great utilization of silkworms. The rearing process of such global industry should be effective and efficient to bring better growth of silkworms. The silkworms undergoing development are prone to diseases caused by micro organisms. In order to protect the silkworms from diseases, disinfectants are sprayed manually in the initial condition. The exposure of disinfectants such as formalin and bleaching powder may cause health problems like breathing suffocation and eye irritation to farmers. In severe condition, it leads to blindness. To protect the farmers from the contact of disinfectants, a bot is developed to spray the disinfectants to the rearing house of silkworm. The silkworms are kept in beds of shelves. As the shelves are linearly arranged, remote controlled bot is established to cover every shelves. A wireless camera is kept in the bot to move in the proper directions. Also, rack and pinion arrangement is fixed with sprayer nozzle vertically to spray disinfectants to each shelves. The bot movements and sprayer nozzle movements are controlled by Arduino Uno. This proposed work yields a solution to health issues caused by disinfectants to farmers.**

Index Terms- Disinfectant spraying Bot, Radio Frequency, Silk worm, Wireless Camera.

I. INTRODUCTION

The female silk moth lays hundreds of eggs in the beginning. These eggs are then purchased by the silkworm farmers. The farmers then keep the eggs under the proper temperature and humidity at a clean place. Silkworm takes 30-40 days to form cocoons. After taking cocoons out from rearing house, there are certain types of bacteria present inside the house, for that, farmers are using disinfectants to vanish the bacteria before placing the eggs in the rearing house for next batch. Generally, farmers spray the disinfectants manually. Disinfectants solutions cause health problems like skin disease, lung disease, eye sight problems. So, there is a necessity to introduce an effective method for cleaning procedure. This is a step to provide an effective and comfortable method for farmers to clean the infections in rearing house. This is achieved by building a bot spraying disinfectants which is controlled from the remote area.

II. LIFE CYCLE OF SILKWORM

The silkworm is that the young insect stage of the silk moth's life cycle. Moths lay eggs and develop into the silkworm larvae or caterpillar (commonly called silkworms). Silkworms eat for 20-30 days, consuming large amounts of mulberry leaves and molt through four stages namely egg or ova, larvae, pupa and imago. Egg is the first stage of a silkworm's life cycle. The female moth lays an egg about the size of an ink dot during summer or the early fall. The egg remains in dormant stage til spring arrives. The stimulation of the egg to hatch during warmth of the spring. The egg of the silkworm is a very small and hard structure. The larva is the vegetative stage where growth starts. The larva commonly called a silkworm which is host specific to mulberry. During growth, the larva molts 4 times. The period between successive molts is called an Instar. The occurrence of the silk worm while hatching is about 1/8th of an inch and extremely hairy. Life cycle of silkworm is shown in fig. 1. As the silkworm prepares to acquire, it spins a protective cocoon. About the dimension and color of a plant disease, the cocoon is constructed from one continuous strand of silk, perhaps 1.5 km long nearly a mile. The silk cocoon is protection for the insect Cocoons are shades of white, cream and yellow depending on silkworm genetics. In the cocoon after a final molt, the larva develops into the brown, chitin covered structure called the pupa.
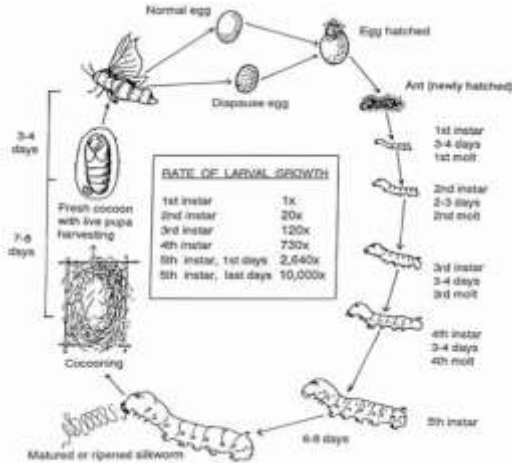
Fig.1: Life cycle of silkworm

Cocoon is that stage during which the larva spins silk threads around it, to protect itself from its predators. The larva traps itself within the cocoon in order to pupate. The color of the cocoon differs, depending upon food the silkworm eats. It can range from white to golden yellow.

III. REARING PROCESS OF SILKWORM

Disinfection is the most important process that to be carried out prior to the commencement of rearing. Disinfection of everything including rearing places is carried out by physical, chemical or radiation methods. Physical methods are cheap, convenient and easy to operate, e.g. sunlight, steam, hot air. The most commonly used disinfection method is chemical method. Chemicals have broad spectrum activity, stable and readily mixable with water and fair in cost. These chemicals are non-toxic to man and animals. Chlorine as chloramine, iodine as iodophores, phenol as cresol, hexachlorophene, formaldehyde as formalin (2%), bleaching powder, etc are most regularly used chemicals. A newly hatched larva is separated from their egg shells and transferring them to rearing trays from the egg cards is called brushing. The newly hatched larvae are black and bristly.

Cocoons quality and size are mainly determined by the quality of mulberry leaves fed by larvae during rearing. After a slight practice, the amount of leaves is given per feeding after a slight practice to fulfill the desire of the worms, is adjusted. The amount of food given also depends on races and number of generations of the moths per year. Some unutilized leaves after each feeding was accumulated by the rearing tray of silkworms, exuviae after moulting, excreta, dead or diseased larvae, etc. All these if not cleaned, combine to form a thick and damp litter which promotes the growth of different micro-organisms, generation of heat and injurious gases and depletion of oxygen. Mounting is the process of transferring the ripe worms to the mountages. On the mountage, the ripe worms exude silk, spin the cocoon around itself and transformed into the pupa inside it. The metamorphosing into adult moth of pupa comes out by piercing open the cocoon.

IV. EXISTING METHODS

CSRTI, Mysore developed a low cost electric sprayer for disinfection operations in sericulture. It is fitted with ½ hp electric pump set or a twin piston HTP pump. The disinfection is quiet effective with both sprayers. ½ hp electric pump set sprayer is suitable for small rearing house say up to 300-400 dfls capacity whereas twin piston pump sprayer is suitable for rearing house on 400 dfls and above capacity.

Fire is the best disinfectant. It is not only cheap but also eco-friendly. A flame Gun using LPG as fuel is an effective and efficient tool for disinfection of silkworm rearing houses, rearing equipments, mountages, etc. The flame gun can also be used for floss removal from bamboo, plastic & rotary mountages. It is also useful for disinfection of plastic trays used in egg production and chawki rearing centers. The main lagging part in the existing methods is the possibility of contact of disinfectants with the farmers.

V. PROPOSED METHOD

To bring a better solution to the disinfection process, a bot is developed to spray the disinfectants to the rearing house which is controlled from remote. The proposed model consists of bot and control part. The control part consists of radio transmitter which sends the signals to control the bot movement and the nozzle adjustment to the receiver. The disinfectants used in sericulture causes health disorders. This can be solved by using a bot to spray the disinfectants. The bot is controlled manually using radio transmitter and receiver. The nozzle is adjusted manually with

the help of RC control to spray the disinfectants in the desired direction.

The block diagram consists of radio control, DC motors, motor drivers, webcam and camera display. Camera sends the video signals to the remote display with the help of radio transmitter and receiver. Motion of the bot is controlled by motor driver which functions according to the radio signals received from user radio transmitter. The nozzle movement is adjusted vertically using a DC motor controlled by a motor driver. Fig. 2 shows the block diagram of the proposed method.
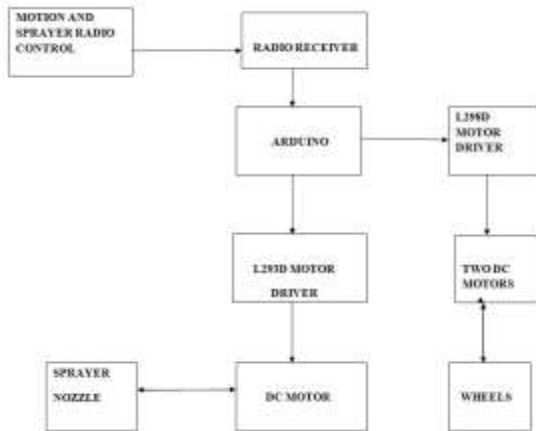

Fig.2: Block Diagram of the Proposed Method

Camera present in the bot provides continuous video streaming with the help of webcam to the remote display. With the video streaming, radio transmitter is operated which sends the control signals to the receiver connected to radio receiver in the bot which enables the L298D motor driver. The L298D motor driver controls two DC motors based upon the control signal .Depending on the control signal,bot moves. Another motor driver controls the vertical adjustment of nozzle rod with the help of DC motor.

VI. HARDWARE DESCRIPTION

Motor A inputs and Motor B inputs are connected to the microcontroller. The motor terminals are connected to ports 1, 2, 3, 4 where Motor A is connected to terminals 1 and 2 while Motor B is connected to terminals 3 and 4. Based upon the control signals from the L298D motor driver, the motors move accordingly. The connection between L298D motor driver and DC motors are shown in Fig. 3. signals to L298D motor driver is shown in fig. 4.
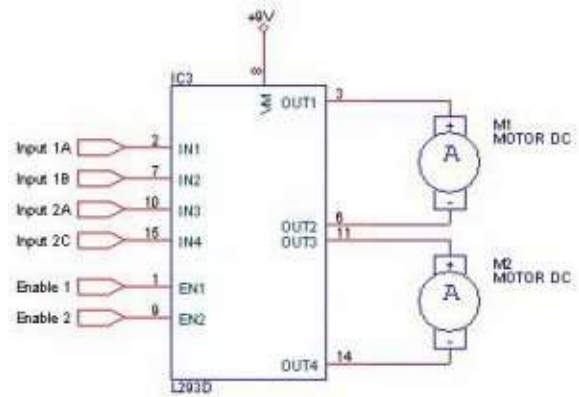

Fig.3: L298D Motor Driver and Motors Connection

IN1	IN2	IN3	IN4	Direction
0	0	0	0	Stop
1	0	1	0	Forward
0	1	0	1	Reverse
1	0	0	1	Left

Fig.4: Control Signals to L298D motor driver

High quality wireless video transmission is provided by the kit which consists of Color Wireless Micro Camera and matching receiver. It is an enhanced model with audio capability. It is used by private investigators and law enforcement agencies for surveillance and video monitoring. Important characteristics of wireless camera include wireless transmission and reception, long reception range, small compact size and minimal weight, low power consumption, high sensitivity, low maintenance, easy installation and operation, and easy concealment. Webcam sends the video signals to the display through TV. Many devices were available for transmission and reception of RF band. Here, low frequency RF module with the range of 434MHz is used. Peer to peer communication is allowed with multi channel facility. Five switches are used in transmitter side to control the movement on the receiver side is connected with the transmitter control IC. The output state of the switch in TX-2B IC is encoded into data logic of unique value for each switches. These data logic bits are given to the data pin of the transmitter, which transform it to an analog signal. The connection of wired antenna with the transmitter helps to transmit these signals. The Fig.5 shows basic 434MHz Radio frequency transmitter.

Fig. 5: Radio frequency Transmitter

The receiver side with the identical frequency of 434MHz is used. The analog signals into digital bits are converted in the receiver side. These bits are given to the Receiver controller IC which decodes the received signal into the corresponding data logic bits. For the input of the Arduino processor this information are given. The Arduino processor is preprogrammed to analyze the received bits from Receiver and transmit control parameters to motors which rotate the corresponding propellers. The 434 radio frequency receiver is shown Fig. 6
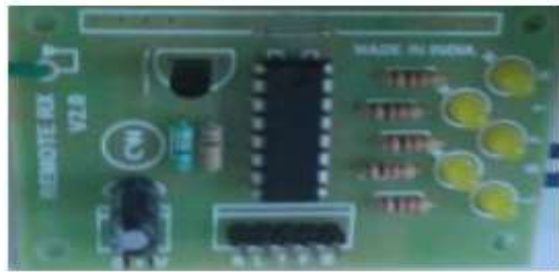

Fig. 6: radio frequency receiver

L293D motor driver acts as H-bridge circuit which is shown in Fig4. L293D is an integrated circuit of dual H-bridge motor driver. The function of motor drivers is a current amplifier since they acquire a low-current control signal and give a higher-current signal. To drive the motors these higher current signals are required. Four switches like S1, S2, S3 and S4 are fabricated in H-bridge. When the S1 and S4 switches are closed, then positive voltage will be applied across the motor. The switches S1 and S4 are opened and the switches S2 and S3 are closed will form the voltage to be inverted and allowing invert operation of the motor. The H- bridge circuit shown in Fig. 7.
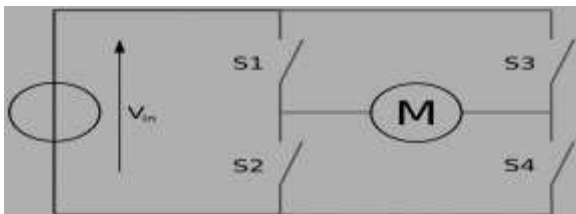

Fig.7: H-Bridge Circuit

The upward and downward movement of rack is produced by rotating directions of DC motors. DC motor is made to rotate in either clockwise or anti-clockwise directions with the help of L293D motor driver. The operation of L293D motor driver is shown in table1.The control signals is given to the motor driver according to the truth table to produce the desired movement of rack.

Table 1 Operation of H –bridge

S1	S2	S3	S4	Operation
1	0	0	1	Motor moves right
0	1	1	0	Motor moves left
0	0	0	0	Motor free runs
0	1	0	1	Motor brakes
1	0	1	0	Motor brakes
1	1	0	0	Short Power Supply
0	0	1	1	Short Power Supply
1	1	1	1	Short Power Supply

A pump motor is a device of DC motor which moves the fluids. It is used to pump the disinfectants from tank to nozzle. An electrical power into mechanical power is converted in DC motor. The working principle of DC motor is when a current carrying conductor is placed in a magnetic field it experiences a torque and has a tendency to move. This is known as motoring action. From the many energy sources, pumps can operate which includes manual operation, electricity, engines, or wind power, come in many sizes, from microscopic for use in medical applications to large industrial pumps.

VII. RESULTS AND DISCUSSION

Thus a bot was developed to spray the harmful disinfectants to the rearing house of silkworm. The spraying solutions are 5% bleaching powder, 2.5% sanitech, formalin. These solutions can cause severe side effects like burning sensation in eyes, irritation in lungs and skin problems. Due to establishment of a bot contact of disinfectant with farmers are avoided. . With the video streaming, radio transmitter is operated which sends the control signals to the receiver connected to radio receiver in the bot which enables the L298D motor driver. The L298D motor driver controls two DC motors based upon the control signal. Depending on the control signal,bot moves. L293D motor driver controls the vertical adjustment of sprayer nozzle with the help of DC

motor. The two motor drivers L298D and L293D are connected to Arduino ports. Based upon the control signals from programmed Arduino, two motor drivers help in desired bot and sprayer nozzle movements. Results of the proposed method are shown in table 2. Hardware setup of disinfectant spraying bot is shown in fig. 8. An internal connection of disinfectant spraying bot is shown in fig. 9.

Table 2 Results of the proposed method

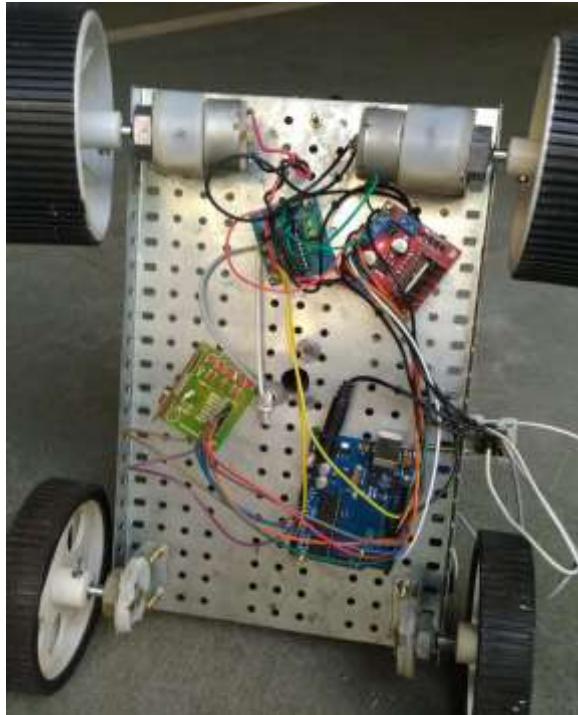| Sl.No.	Parameters	Magnitude
1.	Spraying distance	60 cm
2.	Upward and Downward Movement	0.75 cm/sec

Fig.8: Hardware setup of disinfectant spraying bot

Fig.9: Internal connections of disinfectant spraying bot

VIII. CONCLUSION

The contact of concentrated disinfectants is prevented from farmers while using a bot. The disinfectants used in sericulture causes health disorders which can be solved by using a bot to spray the disinfectants. As the rearing shelves of silkworms are arranged orderly, it is more efficient to use remote control. Camera was established for the automating the disinfection process. The bot is controlled manually using radio transmitter and receiver. The nozzle is adjusted manually with the help of RC control to spray the disinfectants in the desired direction. Hence, Health hazard caused by harmful disinfectants are avoided.

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