

AUTOMATIC WALL PAINTING ROBOT

1.chavan shubham balasaheb ,mechanical engineering,shreeyash college of engineering and technology Aurangabad ,maharastra,india

ABSTRACT

The primary aim of the project is to design, develop and implement Automatic Wall Painting Robot which helps to achieve low cost painting equipment. Despite the advances in robotics and its wide spreading applications, interior wall painting has shared little in research activities. The painting chemicals can cause hazards to the human painters such as eye and respiratory system problems. Also the nature of painting procedure that requires repeated work and hand rising makes it boring, time and effort consuming. When construction workers and robots are properly integrated in building tasks, the whole construction process can be better managed and savings in human labour and timing are obtained as a consequence. In addition, it would offer the opportunity to reduce or eliminate human exposure to difficult and hazardous environments, which would solve most of the problems connected with safety when many activities occur at the same time.

Keyword:-automatic wall painting robot ,construction field

1. INTRODUCTION

Building and construction is one of the major industries around the world. In this fast moving life construction industry is also growing rapidly. But the labors in the construction industry are not sufficient. This insufficient labor in the construction industry is because of the difficulty in the work. In construction industry, during the work in tall buildings or in the sites where there is more risky situation like interior area in the city. There are some other reasons for the insufficient labour which may be because of the improvement of the education level which cause the people to think that these types of work is not as prestigious as the other jobs.

The construction industry is labour intensive and conducted in dangerous situations; therefore the importance of construction robotics has been realized and is grown rapidly. Applications and activities of robotics and automation in this construction industry started in the early 90's aiming to optimize equipment operations, improve safety, enhance perception of workspace and furthermore, ensure quality environment for building occupant. After this, the advances in the robotics and automation in the construction industry has grown rapidly. The development of service robots became popular recently due to the fact that the society needs robots to relax humans from tedious and dangerous jobs. In Egypt, as well as other developing countries, the increasing population stimulates the construction-related activities such as interior finishing and painting. Painting is classically done by humans and generally requires exhaustive physical efforts and involves exposure

to dangerous chemicals. Chemicals can seriously impair the vision, respiratory system and general health of the human painter. These factors make painting an ideal candidate process for automation.

More than 100,000 apartments are built annually in Egypt, with an average painting area of 40 million square meters (based on an average 100 m² apartment area with 400 m² painting area). The surface area of painting is more due to the renovation work and expected population increase in the future. This demand imposes challenges that will hardly be met using human painters only in the next decade. Therefore, development of a Painting machine that can perform the painting task with minimum human intervention is needed and will improve the quality of painting. The need for an autonomous painting robot is both clear and strong.

Automated painting had been realized successfully in the automotive industry to paint millions of cars in the assembly lines. This industry uses spray painting and the robotic system is fixed in the assembly line. The domestic painting robots should be different in the sense that robots should have mobility so that it can move to paint the fixed walls. Also, the domestic painter robots should use roller instead of spray which is the common practice in the market to attain customer satisfaction.

1.1 project background

The primary aim of the project is to design, develop and implement semi automatic Wall Painting Machine which helps to achieve low cost painting equipment and safety.

The painting chemicals can cause hazards to the human painters such as eye and respiratory system problems. Also the nature of painting procedure that requires repeated work and hand rising makes it boring, time and effort consuming. When construction workers and machine are properly integrated in building tasks, the whole construction process can be better managed and savings in human labor and timing are obtained as a consequence.

In addition, it would offer the opportunity to reduce or eliminate human exposure to difficult and hazardous environments, which would solve most of the problems connected with safety when many activities occur at the same time. These factors motivate the development of an automated painting system.

1.2 Objective of project

The actual targets for development of the wall painting machine, in order to solve the aforementioned situation, were set as follows:

- 1) To make machine structure simple to enable easy mounting as well as for safety.
- 2) To perform only painting in a single color.
- 3) To be usable only on external walls of structures but also in various other places such as on walls of civil structure.
- 4) To Avoid Hazard Effect Of Paint On Human Body.
- 5) The Automated Painting Robot Was To Be Designed With The Vision To Facilitate Easy.
- 6) Being A Prototype Design, The Painting Section Is Limited In Height.
- 7) Accurate And Smooth Painting .

2. CONSRTUCTION AND WORKING OF PROJECT

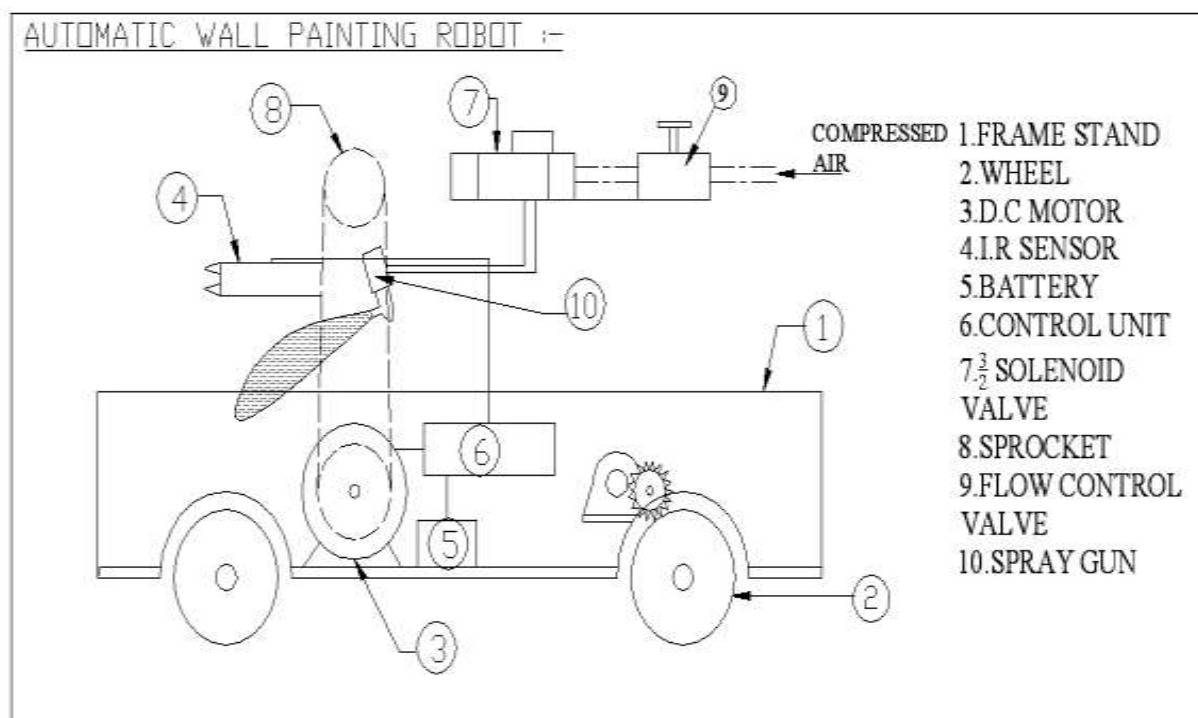


Fig 2.1 Construction wall painting robot.

2.1 working principle



Fig 2.2 Actual wall painting robot

The construction of Paint Spraying equipment consists of a frame which is used for mounting the components such as D.C motor, Battery, electronic timer unit, solenoid valves, flow control valve and spur gear arrangement. The stand (or) base is to carry the whole machine. The whole experimental setup is shown in. The two conveyor roller is fixed to the two ends of the frame stand with the help of end bearing with bearing cap. The conveyor roller shaft is coupled to the D.C. permanent magnet motor with the help of spur gear mechanism. This total arrangement is used to transfer the material from one place to another place with the help of conveyor.

IR Sensor Setup the IR transmitter and IR receiver circuit is used to sense the material. It is fixed to the frame stand with a suitable arrangement. The spray gun is fixed to the frame stand to spray painting in the material. The spray gun painting operation is controlled by the flow control valve, single acting solenoid valve and Microcontroller unit. This high pass filter is used to eliminate the high frequency signal due to external unwanted signal. In our circuit simple R-C high pass filter circuit is used. **Spray gun setup** The experimental setup of spray gun in which the silver colored box is the spray gun. The board covered with the plastic box is the IR sensor circuit since it is covered with plastic box in order to avoid unnecessary detection of walls on the sides.

Microcontroller Setup The 12V signal from the battery is given to the power supply unit where it gets regulated to 5V. The 5V signal is given to the microcontroller unit. Once the supply is ON, LCD gets initialized. The microcontroller sets to setting mode and the moving and painting distance is given as input to microcontroller. The microcontroller (by using microcontroller program) and “ON” relay-2 & 3 for given seconds and once again “OFF” the relay-1 and operation continues. Reset switch is connected to the pin number 32 of the microcontroller unit. When the IR receiver receives the signal, the conveyor belt moves and spray gun goes to ON condition.

The experimental setup of mobile platform. The steels welded together to carry the entire robot is considered to be the platform which is fitted with four wheels for the movement of robot such that making it to be mobile platform.

3. COMPONENTS

Table 3.1 Component Specification

Sr.no	Name of component	Quantity
01	DC motor	03
02	Air compressor	01
03	Transformer	01
04	Nozzle	01
05	Frame	01
06	Microcontroller	01
07	IR sensor	02
08	Resistor	03
09	Touch sensor	02
10	Capacitor	01
11	Wheels	04
12	Spray gun	01

3.1. Programe

```

/*----- Program for Line Follower Robot using Arduino----- */
/*-----definning Inputs-----*/
#define US 3 // left sensor
#define DS 4 // right sensor

/*-----definning Outputs-----*/
#define UR A2 // left motor
#define DR A3 // left motor
#define FR A5 // right motor
#define RM2 A4 // right motor

void setup()
{
  pinMode(US, INPUT);
  pinMode(DS, INPUT);
  pinMode(UR, OUTPUT);
  pinMode(DR, OUTPUT);

  pinMode(FR, OUTPUT);

  pinMode(RM2, OUTPUT);
}

void loop()
{
  if(digitalRead(DS) ) // Move UPWARD

```

```

{
digitalWrite(UR, HIGH);
digitalWrite(DR, LOW);
digitalWrite(FR, LOW);
digitalWrite(RM2, LOW);
}

if(digitalRead(US)) // Turn right
{
digitalWrite(UR, LOW);
digitalWrite(DR, LOW);
digitalWrite(FR, HIGH);
digitalWrite(RM2, LOW);

delay(3000);
digitalWrite(DR, HIGH);
digitalWrite(UR, LOW);
digitalWrite(FR, LOW);
digitalWrite(RM2, LOW);
delay(3000);
}

```

4. CONCLUSION

Automatically paint the wall of given dimension has been designed and implemented. The approach uses IR transmitter and IR receiver to detect the presence of wall. The microcontroller unit to control the movement of the DC motor. The robot eliminates the hazards caused due to the painting chemicals to the human painters such as eye and respiratory system problems and also the nature of painting procedure that requires repeated work and hand rising makes it boring, time and effort consuming.

The robot is cost effective, reduces work force for human workers, reduce time consumption. The pitfall of the project is that the robot continues painting even after the end of the wall hence it can be overcome by adding some indicating objects such as buzzers. In the future the painting robot can be enhanced by using image processing in order to scan the objects and obstacles that are present in the wall so that those objects can be automatically omitted while painting.

The painter robotic system has achieved optimum benefits with regard to reliability, safety appearance, and ease of use. All the objectives set up for this system have been achieved successfully. In terms of mechanical design, the X-axis, the Y-axis, the Z-axis module and the end-effectors module were designed and fabricated properly. All motor mountings and couplings were properly adjusted. All the prismatic joints were developed successfully. In terms of electrical and electronic systems, the power distribution module, the sensor module, the electro-pneumatic system, the AC induction motor driving system and the control panel were developed successfully. In terms of software development, the author had written a control program for the painter robot. This was indicated by the performance of the painter robot. Each movement of the painter robot was successfully controlled by the control program. It can be reprogrammed easily to cope with any changes in the process. A conclusion can be made that the painter robotic system had been successfully.

5. REFERENCES

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