Automatic Painting Machine

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Abstract
The need of automation in the field of construction is increasing on a daily basis. This makes the automatic process of painting important. This can not only reduce the time lag caused by this strenuous process but also reduce the manual labour required. Also, manual painting of high rise buildings tend to be a threat to both the labourers health and life. The automatic painting machine can paint walls with minimal human intervention. This machine aims to provide horizontal and vertical movement of the sprayer, which is used to paint the wall. For this we make use of motors and control systems. This paper can be used as reference for information of motors used and of control circuits incorporated in this machine.

Keywords: Field of construction, Automation, Painting machine, Sprayer, Motor, Control circuit.

Introduction
In this project we have tried to design and implement an automatic painting machine. In the present world where everything seems to be automated; in the field of construction, painting is still done manually. This is not just risky, when it comes to big buildings, but also time consuming and among the painting workers lung problems are most common.
So, we have come up with a design that can automatically paint walls. The machine we have designed focuses on vertical and horizontal movement of a sprayer unit inside a frame. Thus we have a better alternative for the existing designs.
This project will have a huge impact on the field of construction. It can help complete work meant to be done over a long period of time way faster and with more precision.
During the thought process, the biggest observation was that the need for this machine has been there for a very long time; but due to the many constraints posed by it, the process of painting is being replaced by use of glass or fibrous materials. Conventional methods of painting are mostly manual. As being typical the risks associated with it also increase, like accidents, health problems, etc. The conventional methods are:

- Using paint brush
- Using roller
- Using sprayer

Block Diagram
The figure below is the block diagram of our painting machine:

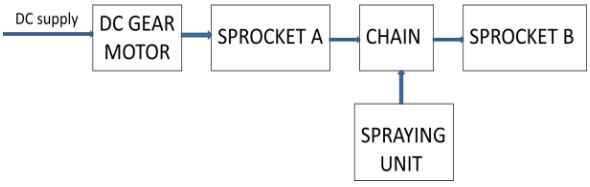

Figure 1: Block diagram

- *DC gear motor:*

Figure 2: DC gear motor

A gear motor may be an AC or DC motor coupled with a gearbox or transmission. A gear motor adds mechanical gears to alter the speed/torque of the motor for an application. Usually such an addition is to reduce speed and increase torque.

- *Sprocket:*

Figure 3: Sprocket

A sprocket or sprocket-wheel is a profiled wheel with teeth, or cogs, that mesh with a chain, track or other perforated or indented material. The name sprocket applies generally to any wheel upon which radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth.

- *Chain:*

Figure 4: Chain

Chain drive is a common way of transmitting mechanical power from one place to another.

- *Spraying unit and compressor:*

Figure 5: Spraying unit and compressor

Spray painting and compressor are painting device which sprays a coating (paint, ink, varnish, etc.) through the air onto a surface. The most common types employ compressed gas usually air to atomize and direct the paint particles. It is typically used for covering large surfaces with an even coating of liquid.

Working:

When a 12V DC supply is given, the shaft of the DC gear motor rotates. This motion is transferred to sprocket A through the shaft. Thus it rotates the chain and hence the sprocket B. As a result the spraying unit moves in one direction. When it reaches the ends of the frame, the stopper switch activates. The stopper switch signals when the poles need to be reversed. The reversal of poles is done using four relays H- bridge. The relays are controlled using an IC which is programmed with the help an arduino. The input is given to the motor using a driver circuit. High velocity air is obtained through the compressor, this aids the spraying of the paint. Four wheels provided at the bottom of the structure helps in the horizontal movement. The wheels are controlled using two motors. The period for which the motor runs is controlled using another IC. In this IC timer control is already programmed

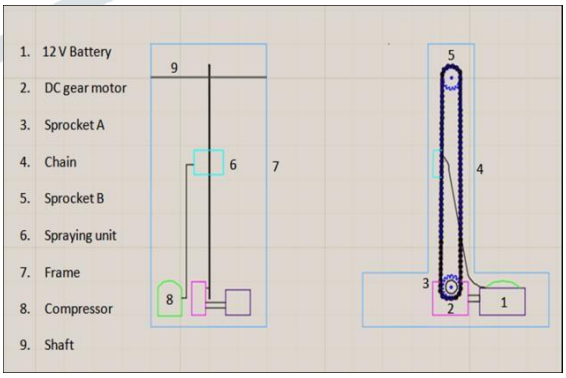

Figure 6: Detailed diagram [5]

Motor Design:

- Motor 1:
  - Radius of sprocket (r) = 8cm
    = 0.08m
  - Weight of spraying unit (w) = 1kg
  - Torque required = w x r [1]
    = 1 x 0.08
    = 0.08Nm

  Hence, the motor selected must have higher torque specification.

  Here, a gear motor of 5 Nm is used.

- Motors 2 & 3:
  - As the weight of the body adds up to 15kg, the motors should have a specification higher than 15kg.cm.
  - Here, two gear motors of 20kg.cm are taken.

Result

Vertical motion of the spraying unit is automated and so is the horizontal motion of the unit.

Discussion

As future scope multi axis movement can be provided to the machine. The nozzle can be mounted on a drone. Compressor and paint can be provided through tubes. Sensors can be used to maintain the required pressure, maintain adequate distance from the surface and to check the surface. CNC machines can be used to control the movement and spraying.

Conclusion

This painting machine can provide automated painting with less human interference.

The present painting method is rather risky as it is harmful to the labourer's health due to the concentration of harmful chemicals in wet paint. Also, another major problem that prevails in the field of construction is that it consumes a lot of time, which can be resolved using automated machines.

Reference

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