



# Intelligent Motorized Wall Painting Crane

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## ABSTRACT

*This project deals with the fabrication of Motorized wall Painting crane. The aim of this project work is to acquire practical knowledge in the field of complicated wall painting with the helped of motor. The project work is concerned with the fabrication of the portable motorized crane. 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 consuming workers and robots are properly integrated in buildings tasks, the whole construction process can be managed and savings in human labor and timing is 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 intelligent automated motorized wall painting crane or robotic painting system.*

## 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 labors 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 riskier situation like interior area in the city. There are some other reasons for the insufficient labor which may be because of the improvement the education level which cause the people to think that these types of work are not as prestigious as the other jobs. The construction industry is labor-intensive and conducted in dangerous situations; therefore, the importance of construction robotics has been realized and is grown rapidly

## 2. SCOPE OF THE PROJECT

This project aims to develop the interior wall painting robot. This automatic wall painting robot is not designed using complicated components. This robot is simple and portable. The robot is designed using few steels, conveyor shaft, spray gun and a controller unit to control the entire operation of the robot. This robot is compact because of high speed 2 and pressure capabilities they have. They also have a very small weight to power output ratio and predictable performance i.e., losses are minimum due to a smaller number of moving parts and so gives expected performance. Due to elegant and simple control systems it can control noise vibration and does silent operation and no vibration is produced. It has longer life, flexibility

and it is efficient and dependable, and the installation is simple and the maintenance is also easy.

### 3. EXISTING SYSTEM

Paint robots are designed to help standardize the distance and path the automatic sprayer takes. Eliminating the risk of human error caused by manual spraying. Paint robots are often paired with other automatic painting equipment to maximize the efficiency and consistency of the paint finish. Rotational Bell atomizers, other automatic electrostatic or automatic conventional sprayers are mounted on the robot to provide the highest quality finish. Automatic mixing equipment will usually supply the sprayers with paint. This equipment is designed to regulate pressure and flow, which are extremely important in providing consistent paint finish. Varying levels of automatic mixing equipment can also provide features that cut down on paint waste, and energy costs.

### 4. PROPOSED SYSTEM

The construction of the automatic wall painting robot consists of two main parts. They are:

#### 1. Mobile platform:

- ⊙ Frame stand
- ⊙ Wheel
- ⊙ DC motor
- ⊙ Battery
- ⊙ Control unit

#### 2. Spray gun mount:

- ⊙ IR sensor
- ⊙ Solenoid valve
- ⊙ Flow control valve
- ⊙ Sprocket
- ⊙ Spray gun

### 5. DESIGN METHODOLOGY

Despite the advances in the robotics and its wide spreading applications, painting is also considered to be the difficult process as it also has to paint the whole building. To make this work easier and safer and also to reduce the number of labors automation in painting was introduced. The automation for painting the exterior wall in buildings has been introduced. Above all these the interior wall painting has shared little in research activities. The painting chemicals can cause hazards to the 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. These factors motivated the development of an automated robotic painting system.

### 6. COMPONENTS USED

#### a) FRAME STAND AND WHEEL

The frame stand is the steel welded in such a way that it can carry the whole equipment. The steels are welded strongly in welding laboratory with an idea to carry the entire robot with the control unit, battery and DC motor in the mobile platform and the IR sensor, solenoid valve and spray gun in the roller shaft. Four wheels are attached to the frame stand in order to move the robot in the direction specified. The movement of these wheels is controlled by the DC motor rotation which is controlled by the microcontroller. Since, it is obvious that if either the movement of front or back wheels is controlled the movement of the other one will be controlled. Therefore in this robot the movement of the back wheels is controlled using the DC motor such that the movement of entire robot is controlled.

#### b) DC MOTOR

DC motors are part of the electric motors using DC power as energy source. The basic principle of DC motors is same as electric motors in general, the magnetic interaction between the rotor and the stator that will generate spin. DC motors are widely used in speed and direction control because control of these motors is easier than other motors. The motion of a DC motor is controlled using a DC drive. DC drive changes the speed and direction of motion of the motor. Some of the DC drives are just a rectifier with a series resistor that converts standard AC supply into DC and gives it to the motor through a switch and a series resistor to change the speed and direction of rotation of the motor. But many of the DC drives have an inbuilt microcontroller that provides programmable facilities, precise control and also protection for motors.

#### c) BATTERY

In order to provide supply to the controller unit battery is used. Lead acid battery is used in this project. The lead-acid battery is a rechargeable battery. Despite having a very low energy-to-weight ratio and a low energy-to-volume ratio, their ability to supply high surge currents means that the cells maintain a relatively large

power- to-weight ratio. These features, along with their low cost, make them attractive for use in motor vehicles to provide the high current required by automobile starter motors. Here we use 12V and 5V Battery.

#### d) ARDUINO

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

#### e) POWER SUPPLY UNIT

The DC level obtained from a sinusoidal input can be improved 100% using a process called full-wave rectification. It used 2 diode in this configuration. From the basic configuration we see that one diode is conducting while the other one diode is in OFF state during the period  $t=0$  to  $T/2$  accordingly for the negative of the input the conducting diodes. Thus, the polarity across the load is the same. The filter circuit used here is the capacitor filter circuit where a capacitor is connected at the rectifier output and a DC is obtained across it. It filtered waveform is essentially a DC voltage with negligible ripples, which is ultimately fed to the load.

#### f) RELAYS

Relays are used throughout the automobile. Relays which come in assorted sizes, ratings and applications are used as remote control switches. A typical vehicle can have 20 relays or more.

#### g) BEARINGS

A bearing is a machine element that constrains relative motion between moving parts to only the desired motion. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Bearing are classified broadly according to the type of operation, the motions allowed,

or to the directions of the loads(forces)applied to the parts.

#### h) GEAR WHEEL MECHANISM

The spur gears, which are designed to transmit motion and power between parallel shafts, are the most economical gears in the power transmission industry. The spur gear arrangement is used to move the conveyer in forward direction.

#### i) IR SENSOR

IR sensor is used for this project. IR is the typical light source being used in the sensor for robot to detect opaque object. In this project, no programming, microcontroller and soldering are required. IR sensor the basic principle of IR sensor is based on an IR emitter and an IR receiver. IR emitter will emit infrared continuously when power is supplied to it. On the other hand, the IR receiver will be connected and perform the task of a voltage divider. IR receiver can be imagined as a transistor with its base current determined by the intensity of IR light received.

#### j) SINGLE ACTING 3/2 SOLENOID VALVE

A solenoid is an electrical device that converts electrical energy into straight line motion and force. These are used to operate a mechanical operation which in turn operates the valve mechanism. Solenoids may be push type or pull type. The push type solenoid is one in which the plunger is pushed when the solenoid is energized electrically. The pull type solenoid is one in which the plunger is pulled when the solenoid is energized. The solenoid control valve is used to control the flow direction is called cut off valve or solenoid valve. This solenoid cut off valve is controlled by the electronic control unit. This solenoid valve is used to painting operation into the materials.

## 7. SOFTWARE USED

### ARDUINO IDE

The Arduino Integrated Development Environment (IDE) is a cross platform application , that is written in functions from c and c++. The source code of IDE is released under GNU, General Public License. Here we written the code using IDE software and burn into the chip. The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This

software can be used with any Arduino board. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. By default, avrdude is used as the uploading tool to flash the user code onto official Arduino boards. Arduino IDE is a derivative of the Processing IDE, however as of version 2.0, the Processing IDE will be replaced with the Visual Studio Code-based Eclipse Theia IDE framework. With the rising popularity of Arduino as a software platform, other vendors started to implement custom open source compilers and tools (cores) that can build and upload sketches to other microcontrollers that are not supported by Arduino's official line of microcontrollers

## 8. ADVANTAGES

- ⊙ Compact : Because of high speed and pressure capabilities they have a very small weight to power output ratio.
- ⊙ Predictable performance : Losses are minimum due to less number of moving parts and so gives expected performance.
- ⊙ Noise vibration control : Due to elegant and simple control systems , it does silent operation and no vibration is produced.
- ⊙ Longer life
- ⊙ Flexibility 24
- ⊙ Efficient and dependable
- ⊙ Simple installation
- ⊙ Easy maintenance
- ⊙ Cost effective
- ⊙ Reduces work force for human workers.
- ⊙ Reduces time consumption

## 9. APPLICATIONS

- Up and down painting system
- Domestic purpose

## 10. RESULTS AND DISCUSSION

We have designed and fabricated the prototype model for testing purpose which is limited to a certain height .The system is tested part by part and after successful testing we came to the discussion that the system is functioning properly as per the objectives of the project. The painting procedure specifies how to apply spray gun motions to the surfaces in order to achieve a satisfactory process quality. The procedure library is established through experimental work. The basic idea is to enable planning of paint strokes that continue throughout the parts even though different geometric primitives must be covered along the surface and even though continuous robot motions cannot follow the surface. The system will attempt to approximate the triangular patches of the surface model by larger plane regions(virtual surfaces), which are oriented in a few main directions.

## 11. CONCLUSION

We have designed and fabricated the prototype model for testing purpose which is limited to a certain height, but it can be developed and the limit can be increased. Also, our model requires an external compressor for the compressed air this can be eliminated by using an in-built compressor. It automatically paints the wall of given dimension. 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. The robot is cost effective, reduces work force for human workers, reduces time consumption. The pitfall of the project is that the robot continues painting even after the end of the wall hence we can overcome this 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.

### Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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