

# Automatic Wall Painting Robot

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## Abstract

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 labour 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. The construction industry is labor-intensive and conducted in dangerous situations; therefore the importance of construction robotics has been realized and is grown rapidly.

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 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. This project aims to develop the interior wall painting robot. 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 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 less 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. Some of the conditions that have to be considered while using this robot is that the system is operates in pneumatics, so it needs air tank or compressor and the electric shock is always there, which makes the machines ugly and dust and dirt are adhering to them. The life of the parts like seals, packing and gaskets etc., are very short but, they are essential to prevent leakage so that the system becomes costlier.

**Index Terms**— Wall Painting, Crack Detection, plastering,

## 1 INTRODUCTION

Today's developing world is always in the need for new developing ideas to help make work easy and fast. This paper proposal is related to the construction field which relates to our project. Construction of buildings both residential and workplaces are also requiring new ideas to boost their work by using automated and semi-automated ideas which help do manual work in a faster and efficient way. So to prove helpful to the construction industry we have made a workable semi-automated wall-care (putty) machine which helps apply the wall-care in an efficient and faster way as compared to the existing manual method. This project prototype includes- Design, development, fabrication, testing and analysis as well as experimental work. This will improve the quality and the kind of conventional machinery and procedures used to plaster walls. The machine is semi-automated and makes use of day to day practices about plastering and wall surfaces modify the header or footer on subsequent pages.

## 2 CIRCUIT DIAGRAM EXPLANATION

### 2.1 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 are 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 are controlled automatically the movement of the other one will be controlled. Therefore, in this robot the movement of the back wheels are controlled using the DC motor such that the movement of entire robot is controlled.

### 2.2 Dc motor

DC motors are part of the electric motors using DC power as energy source. These devices transform electrical energy into mechanical energy. 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 are 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, message display on LCD, precise control and also protection for motors.

### Controlling of DC motor using Microcontroller

1. Microcontroller provides us only digital logic (1 or 0)
  2. The polarity can't be provided from microcontroller
  3. The motors can't be connected to Controller as mostly motors runs on voltage higher than +5V, and motors demands high current (depends), this can be removed by use of a "H Bridge" here four transistors are used to change polarity
- 1) Specification of DC motor: The specification the DC motor used in this project is mentioned as follows:

- Voltage -12V
- No load speed -810 rpm
- Load speed -120rpm
- No load current -75mA
- Load current -1400mA
- Power -17W

### 2.3 Control unit

The microcontroller used in the controller unit is AT89c52. The microcontroller unit is used to control the DC motors and the movement of spray gun fitted on the conveyor belt. Microcontroller unit is provided with the 5V signal and as soon as the supply is ON, LCD gets initialized. The controller sets to setting mode and the moving and painting distance are given as input to the microcontroller. The microcontroller controls the rotation of DC motor based on the distances given in order to control the wheel and conveyor belt movement. When IR receiver receives the signal, the conveyor belt moves and the spray gun goes to ON condition and if the conveyor belt stops, the spray gun goes to OFF condition. It contains relays for the control of forward and backward movement of the DC motors. IC AT89s52 is a low-power, high performance, 8-bit microcontroller with 8kB of Flash programmable and erasable read-only memory (EPROM), 256 bytes of RAM, 32 input/output (I/O) lines, three 16-bit timers/counters, a six-vector two-level interrupt architecture, a full-duplex serial port, on-chip oscillator and clock circuitry. AT89s52 is designed with static logic for operation down to zero frequency and supports two software selectable power-saving modes. The idle mode stops the CPU while allowing the RAM, timers/counters, serial port and interrupt system to continue functioning. The power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next hardware reset is activated. When the microcontroller receives the signals from IR sensor, it will be taking a

decision to operate the machine. This pulse signal received from IR sensor circuit when there is any object. At starting time RL1 is in "OFF" position which is given to the conveyor motor (conveyor Movement).

Programming in AT89c52: The Keil Cx51 ANSI C Compiler supports all classic and extended 8051 device variants. Compiler extensions provide full access to all CPU resources and support up to 16MB memory. The Keil Cx51 generates code with the efficiency and speed of hand-optimized assembly. New compiler and linker optimizations shrink programs into the smallest single-chip devices. The Keil µVision4 IDE fully integrates Cx51 Version 9 and provides control of the Compiler, Assembler, Real-Time OS, Project Manager and Debugger in a single, intelligent environment. With support for all 8051 devices and full compatibility with emulators and third-party tools, Keil Cx51 is clearly the best choice for your 8051 project.

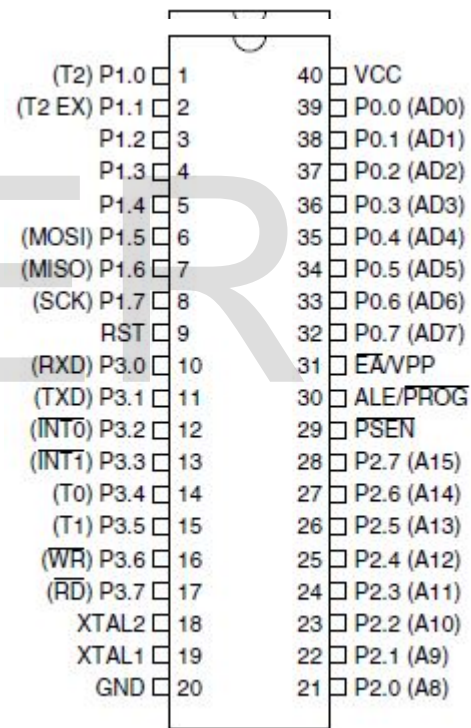


FIGURE 4.2: PINOUT OF AT89s52

### 2.4 Microcontroller Unit

The microcontroller unit is connected to the 12V battery but it requires 5V supply, hence voltage regulator is used to convert 12V to 5V. When supply is given the LCD gets initialized and it displays as „AUTOMATIC WALL PAINTING ROBOT“ . The Fig.19 shows the output of LCD initialization. After LCD initialization „MOVING DISTANCE“ is displayed

in the LCD display followed by „PAINTING DISTANCE“ and the distance is given as input by using increment and decrement button

## 2.5 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 diodes 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. The filtered waveform is essentially a DC voltage with negligible ripples, which is ultimately fed to the load.

## 2.6 Liquid Crystal Display

A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals (LCs). LCs do not emit light directly. They are used in a wide range of applications, including computer monitors, television, instrument panels, aircraft cockpit displays, signage, etc. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones. LCDs have replaced cathode ray tube (CRT) displays in most applications. They are available in a wider range of screen sizes than CRT and plasma displays, and since they do not use phosphors, they cannot suffer image burn-in. LCDs are, however, susceptible to persistence. A 16x2 LCD is connected to the microcontroller.

## 2.7 IR Sensor

- A thermal infrared sensor detects the change of heat from its nearby objects
- The photo IR sensor uses a photo diode to sense IR radiations. In this article as an infrared sensor a photo IR sensor is used to build the circuit.

The applications of the infrared sensors involve from domestic devices to industrial devices. These sensors are used in object sensing, motion detectors, obstacle avoidance robot, gas leakage detection, smoke detection, and measurement of distance, robotics and many more.

## 2.8 Infrared Sensor Circuit with Working

The IR sensor circuit diagram is shown below. In the circuit below, the main parts of this sensor are photo diode and the

IR receiver LED. Photo diode emits IR radiations when it strikes to any object, then turn back with some angle. The IR receiver detects reflected radiations. Because in this circuit, we are using a photo diode, so this type of sensor is called a photo infrared sensor

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