

Smart Wall Painting System

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Abstract— The objective of this paper is to outline a smart wall painting system for little and medium scale operations. These days robots are broadly utilized as a part of relatively every application like medicinal application, amusement, military, production lines vehicle businesses, and so on. However, the utilization of robot is as yet not generally utilized as a part of constructional work. Robots are fundamentally design to build speed and maximize accuracy of construction field work. The basic point of the paper is to design, develop and actualize Remote Operated Wall Painting Machine which helps for accomplishing painting hardware requiring little to no effort because of which the sketch work can be effectively done proficiently and in particular at extremely ostensible cost. The painting machine keeps away from coordinate contact of chemicals which can be harmful to the human painters, for example, eye, skin and respiratory system issues.. Besides that the idea of painting method that requires rehashed work time and hand rising make it physical torment, and exertion devouring. Moreover, it would offer the chance to decrease or take out human introduction to troublesome and dangerous worked system conditions, which would take care of a large portion of the issues associated with security when numerous activities happen in the meantime. This machine is is easy to operate and no need of labour required to operate effectively. At the point when development specialists and robots are appropriately coordinated in building tasks,the entire development process can be better overseen and savings in human work and timing are acquired as an outcome.Wall painting is a redundant, debilitating and risky process which makes it a perfect case for automation. Painting had been mechanized in car industry however not yet for the development business. There is a strong requirement for a portable robot that can move to paint walls of buildings. In this paper, the conceptual plan of a an autonomous wall painting robot is portrayed comprising of an arm that sweeps the dividers vertically and is fitted on a versatile robot base to give the lateral feed movement to cover the painting area. The design objective is to fulfill the criteria of straight forwardness, low weight, ease and quick painting time. Ultrasonic sensors are fitted on the arm and the portable base to alter as far as possible and move in the room territory. A control system is intended to direct the arm movement and plan the versatile base movement.

Keywords- Robots, smart wall painting system, Ultrasonic sensors, control system, automation

I. INTRODUCTION

Building and construction is one of the significant ventures the world over. In this quick moving life construction industry is likewise growing quickly. Be that as it may, the works in the construction business are not adequate. This lacking work in the construction business is a direct result of the trouble in the work. In construction industry, amid the work in tall structures or in the locales where there is more dangerous circumstance like inside region in the city. There are some different purposes behind the deficient work which might be a direct result of the change in the instruction level which make the general population feel that these sorts of work isn't as lofty as alternate occupations. The construction business is work concentrated and led in risky circumstances; in this manner the significance of construction robotics has been acknowledged and is developed quickly. Applications and acts of robotics and automation in this construction

industry began in the mid 90's intending to advance hardware operations, enhance wellbeing, upgrade impression of workspace and moreover, guarantee quality condition for building tenant. After this, the advances in the robotics and automation in the construction business has developed quickly.

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 proposed. 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 motivate the development of an automated robotic painting system. 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 and pressure capabilities they have. 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.

II. EXPERIMENTAL PROCEDURE

The objective of this paper is designing a “Smart Wall Painting System”. The system consists of microcontroller, DC stepper motor, RGB sensor and power source. Using the RGB sensor, we can detect the intensity of the color sprayed onto the wall. When the rate of spraying is stored on the microcontroller, it can be transferred to the motor spray pump that controls the intensity of spray. All these components are interfaced to the microcontroller Arduino Uno.

BLOCK DIAGRAM

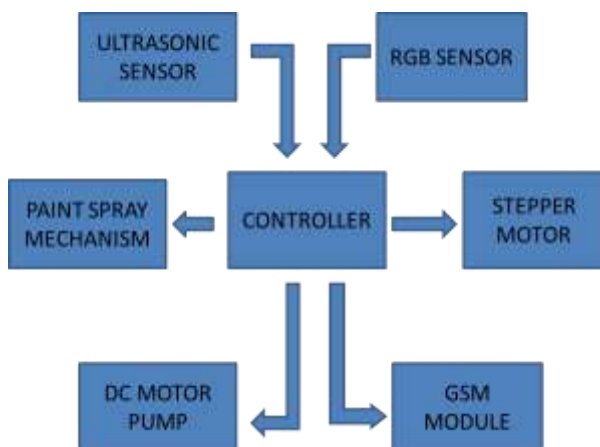


Fig Smart Wall Painting system

Using the above order of the block diagram we were able to design the wall painting system as shown below. The first image shows the insides of the systems railing which holds the nozzle, the motor pump, the sliding mechanism and the arduino connected to the RGB sensor.

The second image shows how this arrangement is hung over a wall. The dc motor on the left is used to maneuver the system up and down over the wall by using a screw thread on the shown spoke.

When the mechanism is initiated at the first position the pump starts spraying the paint and the RGB sensor guides the nozzle such that the paint is even throughout. The Arduino senses this from information from the RGB and rotates the dc motor to move the nozzle on a horizontal plain and the stepper motor connected to the screw thread to move the nozzle and the arrangement up and down depending on where the painting needs to be done.



Fig Prototype Model of Smart Wall Painting System

COMPONENTS

There are various types of components that need to be used in order to make the whole system function, a few of these components include:

- Arduinouno
- Belt driver mechanism
- Stepper motor
- Spray nozzle
- RGB sensor
- li-ion battery

Arduinouno

The Arduino Uno is a microcontroller board based on the Atmel's ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs) and 6 analog inputs

Brand	Arduino
Item Height	25 Millimeters
Item Width	5.5 Centimeters
Item Weight	91 g
Product Dimensions	8 x 5.5 x 2.5 cm
Item model number	A000066
RAM Size	8 KB
Computer Memory Type	SRAM
Voltage	5 Volts
Operating System	None

The Arduino Uno can be powered via USB connection or with an external power supply.

It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable (not included) Arduino IDE supports Windows, Mac OS X or Linux



Fig 2.3 ARDUINO UNO

Belt driven mechanism

The belt drive mechanism is being utilized here because of the fact that it's a fairly basic and less expensive contrasting option to the rack and pinion on some other sliding systems in the present market. We would utilize 2 simple and similar gears on either end on the drive and control the one end fixed to a motor that is guided by an arduino.



Fig. Belt Driven Mechanism

Stepper motor:

Brushed DC motors rotate persistently when DC voltage is connected to their terminals. The stepper motor is known by its property to change over a prepare of input pulses (ordinarily square wave pulses) into an exactly characterized augment in the shaft position. Each pulse moves the shaft through a certain angle.

Product Specification:

Voltage : 1.8 V Current : 0.4 A
Torque : 4 Kg-cm Step Angle: 0.9 deg / step
Motor Dia.: 50 mm Total length: 23 mm
Shaft Diameter: 5mm
Shafts Length: 12mm Weight: 250 grams.

Holes Centre Distance: 31mm x 31mm



Fig DC Motor

Spray paint nozzle:

A nozzle is an instrument intended to control the direction or characteristics of a liquid stream (particularly to build speed) as it exits (or enters) an encased chamber or pipe.

A nozzle is regularly a pipe or container of change in cross sectional zone, and it can be utilized to change the stream of a liquid (fluid or gas). nozzles are as often as possible used to control the rate of stream, speed, course, mass, shape, as well as the weight of the stream that rises up out of them. In a nozzle, the speed of liquid increments to the detriment of its pressure energy..



Fig. Spraying Nozzle

RGB Sensor:

The sensor comprises of a network of color-sensitive filters and a sensor cluster underneath, as appeared on the photo below:

Each filter passes light of just a single colour to the sensor beneath. A solitary pixel is built out of 4 filters: blue, red, and 2*green. There are twice the same number of green filters to mirror the physiology of the human eye which is more delicate to the green light. The signs from the sensors enable us to compute the RGB estimations of every pixel depicting its colour as far as the green, blue and red segments.

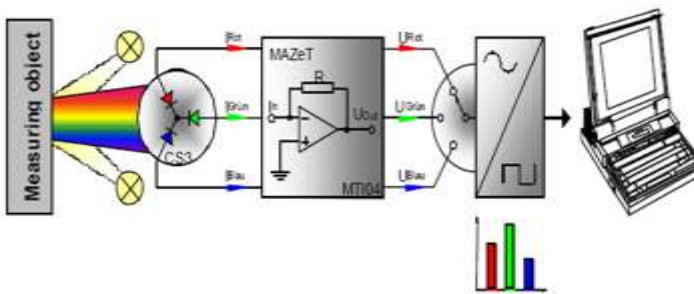


Fig RGB Sensor Principle

R	G	B	Hex Value	Color
0	0	0	000000	Black
255	0	0	FF0000	Red
0	255	0	00FF00	Green
0	0	255	0000FF	Blue
255	255	0	FFFF00	Yellow
255	0	255	FF00FF	Magenta
0	255	255	00FFFF	Cyan
255	128	128	FF8080	Bright Red
128	255	128	80FF80	Bright Green
128	128	255	8080FF	Bright Blue
64	64	64	404040	Dark Grey
128	128	128	808080	Intermediate Grey
192	192	192	C0C0C0	Bright Grey
255	255	255	FFFFFF	White

Fig RGB Sensor Logic

Li-Ion battery:

A lithium-ion battery or Li-ion battery (known as LIB) is a kind of rechargeable battery in which lithium ions move from the negative cathode to the positive anode during discharge and back while charging. Li-ion batteries utilize an intercalated lithium compound as one cathode material, contrasted with the metallic lithium utilized as a part of a non-rechargeable lithium battery. The electrolyte, which considers ionic development, and the two terminals are the constituent components of a lithium-ion battery cell.

Lithium-ion batteries are normal in home gadgets. They are a standout amongst the most mainstream sorts of

rechargeable batteries for compact gadgets, with a high energy thickness, minor memory impact and low self-discharge. Beyond consumer electronics, LIBs are additionally developing in fame for military, battery electric vehicle and aviation applications. For instance, lithium-ion batteries are turning into a typical swap for the lead-corrosive batteries that have been utilized verifiably for golf trucks and utility vehicles. Rather than overwhelming lead plates and corrosive electrolyte, the pattern is to utilize lightweight lithium-particle battery packs that can give an indistinguishable voltage from lead-corrosive batteries, so no adjustment to the vehicle's drive system is required.



Fig Lithium Battery Pack

STEP-BY-STEP PROCEDURE:

1. The project is designed to create a system that can provide hands free wall painting at a cheaper price
2. Initially the systems first check the distance from the wall and the nozzle using the IR sensor.
3. Once the distance is accurate the pump starts sending the paint through the nozzle.
4. As the paint is sprayed onto the wall the RGB sensor senses the thickness and density of the paint that was sprayed.
5. Based on the output of the RGB the dc motor and the stepper motor move the painting platform accordingly on the wall.
6. The upper and lower limits of the wall and sensed by the stepper motor and the signal is sent to the Arduino which stops any further motion of the platform.

By utilizing the above given technique, the system is planned utilizing the parts. Once the system is produced the working begins once the power is provided. At the point when the instrument is started at the principal position the pump begins splashing the paint and the RGB sensor directs the nozzle to such an extent that the paint is even all through. The arduino senses this from data from the RGB and rotates the dc engine to move the nozzle on an even plain and the stepper engine associated with the screw string to move the nozzle and the arrangement up and down relying upon where the sketch

should be finished. Along these lines the divider is painted as equitably as conceivable utilizing the above parts.

SOFTWARE USED:

A program for Arduino might be composed in any programming language for a compiler that produces binary machine code for the objective processor. Atmel gives an improvement situation to their microcontrollers, AVR Studio and the new Atmel Studio.

The Arduino project gives the Arduino coordinated advancement condition (IDE), which is a cross-stage application written in the programming language Java. It started from the IDE for the dialects Processing and Wiring. It incorporates a code supervisor with highlights, for example, content reordering, looking and supplanting content, programmed indenting, prop coordinating, and linguistic structure featuring, and gives simple a single click systems to gather and transfer projects to an Arduino board. It additionally contains a message territory, a content support, a toolbar with buttons for regular capacities and a progressive system of operation menus.

A program having the IDE for Arduino is known as a sketch.[42] Sketches are saved money on the development PC as content documents with the file extension .ino. Arduino Software (IDE) pre-1.0 saved sketches with the extension .pde.

The Arduino IDE supports languages C and C++ utilizing special principles of code organizing. The Arduino IDE supplies a software library from the Wiring project, which gives numerous regular information and output procedures. User-written code just requires two fundamental capacities, for beginning the sketch and the primary program loop, which are compiled and connected with a program stub main() into an executable cyclic executive program with the GNU toolchain, likewise included with the IDE dispersion. The Arduino IDE utilizes the program avrdude to change over the executable code into a text file in hexadecimal encoding that is stacked into the Arduino board by a loader program in the board's firmware.

SOFTWARE CODE:

```
#include <Stepper.h>
int in1Pin = 12;
int in2Pin = 11;
int in3Pin = 10;
int in4Pin = 9;
Stepper motor(512, in1Pin, in2Pin, in3Pin, in4Pin);

void setup()
{
pinMode(in1Pin, OUTPUT);
pinMode(in2Pin, OUTPUT);
```

```
pinMode(in3Pin, OUTPUT);
pinMode(in4Pin, OUTPUT);
while (!Serial);
Serial.begin(9600);
motor.setSpeed(20);
}

void loop()
{
if (Serial.available())
{
int steps = Serial.parseInt();
motor.step(steps);
}
}
```

TESTING:

Software testing is a procedure of executing a program or application with the aim of finding the software bugs. It can likewise be expressed as the way toward approving and checking that a software program or application or item: Meets the business and specialized necessities that guided its plan and improvement. The test was taken upon how equitably the paint was applied on the wall.

III. CONCLUSIONS:

The Spray Painting Machine is the best system to paint the surface. The approach utilizes IR transmitter and IR receiver to recognize the position of wall. The control is use for the movement of the DC motor. Later on the work of painting system can be enhanced by utilizing image processing keeping in mind the end goal to examine the articles and obstacles that exist on the wall so those objects can be naturally vanished while painting.

The approach utilizes IR transmitter and IR recipient to distinguish the nearness of wall. The microcontroller unit to control the movement of the DC motor. The system wipes out the risks caused because of the composition chemicals to the human painters, for example, eye and respiratory organ issues and furthermore the idea of painting method that requires rehashed work and hand rising makes it exhausting, time and exertion devouring. The system is costless, lessens work drive for human beings, and decreases time utilization. The trap of the system is that the robot keeps painting even after the finish of the wall thus it can be overwhelmed by including some demonstrating items, for example, buzzers. Later on the painting robot can be improved by utilizing image processing keeping in mind the end goal to filter the items and obstructions that are available in the wall with the goal that those articles can be consequently precluded while painting.

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