ITSP 2015

PROJECT DESCRIPTION

The aim of our ITSP project is to create a robot that would paint a wall given a soft copy of the image to be painted. The robot will process the image and break it down to a predefined pixel size(squares of small size). The squares will be such that each one will have only one colour in it. The colour of each square will be analysed from the given input image and this information will be sent to that part of the machine involved in painting the wall. We will convert a coloured image into black, white and grey colour. Once the information has been transferred (as electrical signals to the motors attached) , the correct spray can will paint the colour on a corresponding small square on the wall . The spray cans will move in a systematic manner around the wall to cover the whole picture.

PROJECT TIMELINE

- Not in town till 27th may.
- 27th may-28th may : Finalising mechanism after talking to mentor
- 29th may-30th may: Acquiring materials
- 30th may-3rd june: Completing code
- 4th june-6th june: testing paint spray and deciding spray time, template size etc.
- 7rd june-15th june : Making and assembling mechanical parts
- 16th june-18th june: testing and fine tuning
- 18th june onwards: Making any adjustments and/or improvements.

MOTIVATION

The motivation behind our Autonomous Wall Painting bot is reducing the human effort in painting of walls using black , white and grey colours.These walls do not require special skills of painting ,it is just about maintaining the uniformity of the paint which can be done in a better way by using a robot as machines have more accuracy than humans. The overall aim is to remove the human element in painting of walls with simple colouration so that it can also be applied in painting large number of walls just as to make them look fresh.This can be particularly implemented in hostels as there are plenty of walls to be painted and it requires simple painting which can even be done using a robot instead of manpower.We have added some features like painting a given image in black, white and grey instead of single coloured painting.

LEARNING OBJECTIVE

Open cv coding

Image processing

Working of different motors

Optimization of the mechanical components

Handling electrical circuits

Converting coding to electrical signals

Implementation

First the required image to be painted is to be input, along with the size of painting required.

The image is then to be converted to a pixelated, scaled image. The pixelated image consists of 1cm by 1cm paint squares of white, grey or black.

Once this conversion is done, the device is to be set up such that the whole painting can fit on the wall.
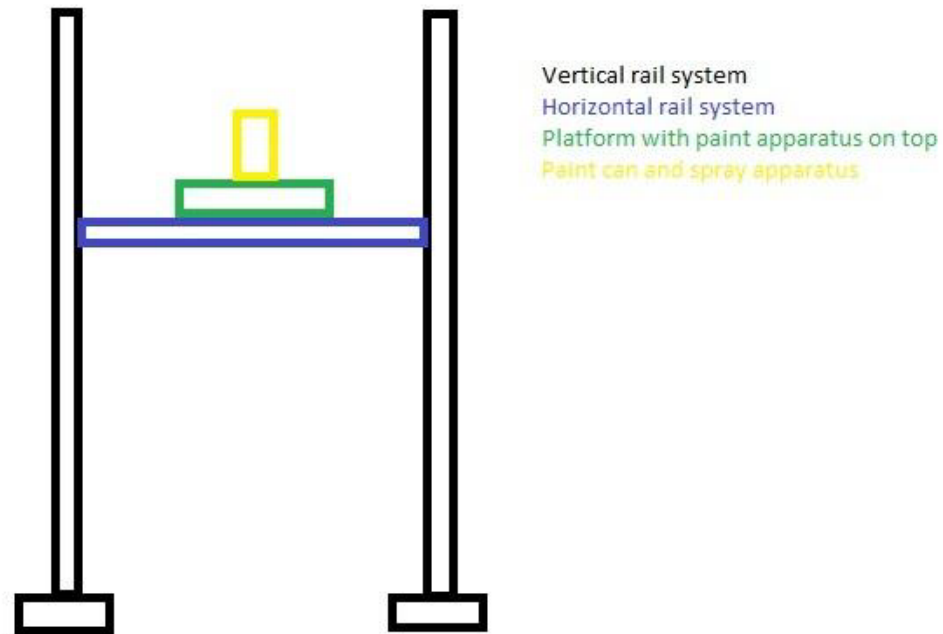
All components will be controlled by a ready-made circuit kit that we will program.

The starting position is with the painting apparatus at the top left corner of the painting space. The device then moves systematically by 1cm left, stopping to apply the appropriate square of paint. (how a square is painted is described later) It continues to paint this way till it reaches the end. After this the apparatus moves 1 cm down and then proceeds to move to the right by 1cm, painting the squares appropriately. This process continues till the whole image is painted.

The mechanism for horizontal and vertical motion of the platform is as follows:
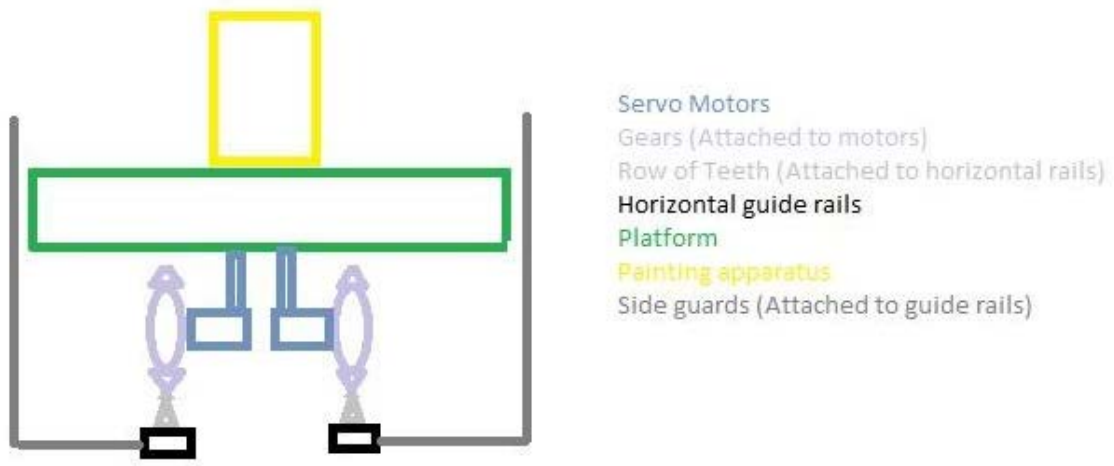
There are two vertical guide rails with gear and teeth system to allow vertical motion. The gear is attached to a horizontal system that allows a platform to move in the horizontal direction; the platform contains the painting apparatus.

Vertical rail system
Horizontal rail system
Platform with paint apparatus on top
Paint can and spray apparatus

The system for horizontal motion is as follows:

First possibility:

Servo Motors
Gears (Attached to motors)
Row of Teeth (Attached to horizontal rails)
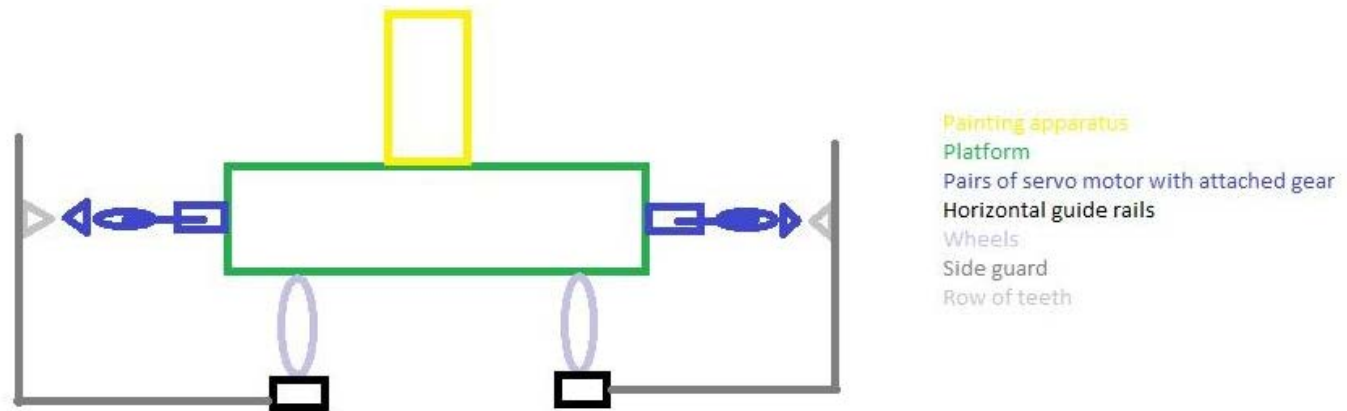**Horizontal guide rails**
Platform
Painting apparatus
Side guards (Attached to guide rails)

(SIDE VIEW)

In this system the platform on which is the painting apparatus is attached has pairs of servo motors attached to it underneath, which are connected to gears that rotate on teeth rows on the horizontal guide rails, thus allowing for motion of the platform. Here the weight of the platform is supported by the motors + gears.

The side guards are to prevent accidental motion of platform in direction perpendicular to required direction.

Second Possibility:

Painting apparatus
Platform
Pairs of servo motor with attached gear
Horizontal guide rails
Wheels
Side guard
Row of teeth

In this design, the weight of platform and pint apparatus is supported by pairs of wheels that move on the horizontal guide rails.

The platform moves due to the pairs of servo motors on the sides that are attached to gears. The side guards contain teeth rows that convert the rotational motion of the gears into translational motion.

Painting Apparatus:

The painting apparatus consists of a circular rotating table with slots for 3 paint spray cans. Each of the cans has a mechanism for releasing the paint for a decided short period of time. (mechanism for release as yet undecided).
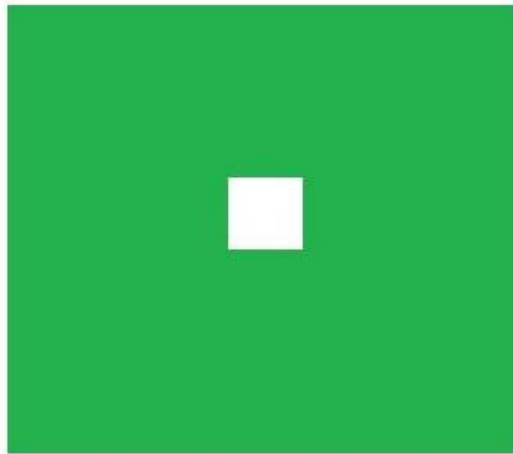
A square template ensures the paint that comes out is in a square form.
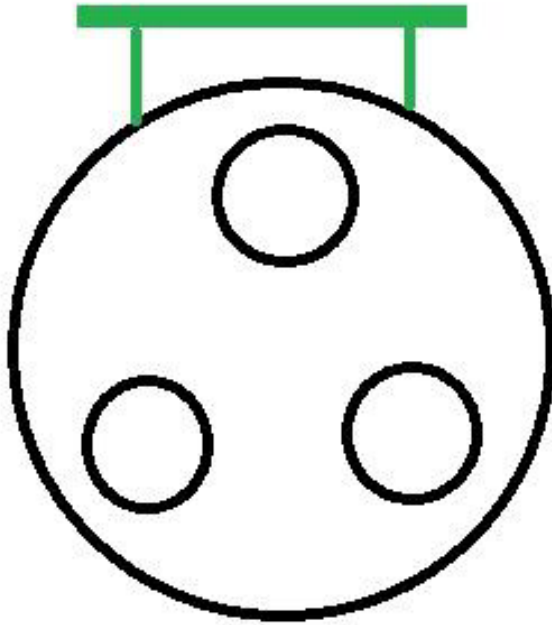
Template (does not rotate with table)

Rotating table with slots for paint cans

The template is a square sheet with a 1 cm X 1 cm hole in the center. It is placed t such a distance that the paint from the cans sprays out ONLY over the template. Due to the hole in the center, a square shaped paint image is formed over the wall. NOTE: the template is very close to the wall so that there is no spread of paint after passing through the hole.

The mechanism for the vertical motion has not been decided upon yet. We had two ideas which are mentioned below.
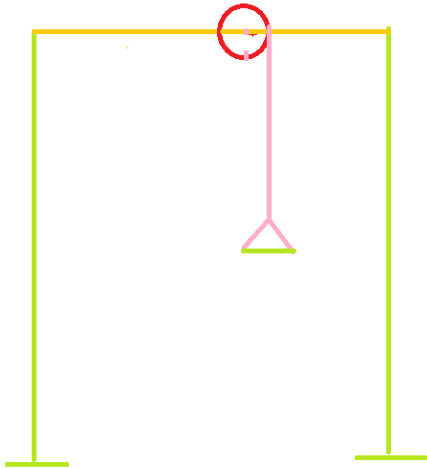
VERTICAL MOTION 1
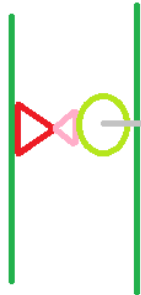
(SIDE VIEW) : two vertical bars with teeth on one bar and a gear with a motor on the other. Though there might be an issue in the weight balancing when the gear has to stationary.

The axis which holds the spray paint is exactly perpendicular to the page through the gear.

VERTICAL MOTION 2

(FRONT VIEW)

The yellow line is a stationary bar along which the horizontal motion occurs. On that a pulley is attached which supports a strong thread on which the painting mechanism rests. The paint cans can be thus moved vertically by desirable amount through appropriate motors attached.

But instability might be an issue ie , the cans may shake horizontally will moving down.

We are yet to decide between these two mechanisms .

COMPONENTS(Quantity) AND COST

Servo motors(8)-Rs.4000

Spray paint(6)-Rs.2100

Manufacturing and structure-Rs.2000

Arduino or atmega kits-Rs.1500(grossly estimated)

Electrical components for image processing-Rs.1000(self estimated)

Batteries-Rs.500(approx.)

Wires-Rs.300

Total-Rs.10900

PROOF OF CONCEPT:

We were informed by a mentor during one of the brainstorming sessions that a similar 'sketching bot' had been successfully made in one of the past ITSPs.