Automatic Wall Painting Robot

Sagar Raut, Gaurav Ujawane, shilpa thakur

***Abstract*— The primary aim of this project is to develop an wall painting robot for the purpose of automation in painting on wall. The Robot is mounted on frame which permits it to move up and down, left and right within the frame body. It is computer controlled and is activated simply by the operator pressing a switch on the control panel.**

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 Automated Wall Painting Robot.

I. INTRODUCTION

Despite the advance in robotics and its wide spreading applications, painting is also considered to be the difficult process . To make this work easier and safer and also to reduce the number of labors automation in painting is introduce.

This project aims to develop the wall painting machine which is used for advertisement purpose. This machine is not designed using complicated components .This machine is simple and portable. The automated wall painting robot is designed using aluminum frame, DC motors , painting point and a controller unit to control entire operation of the machine It also have a very small weight to power output ratio and predictable performance , losses are minimum due to less number of moving parts. It has longer life, flexibility and it is efficient and dependable , and its installation is easy .

II. WORKING

This automatic wall painting robot is not designed using complicated components. This robot is simple and portable. The robot is designed using aluminum frame structure ,painting point and a controller unit to control entire mechanisms. The horizontal and vertical traveler is also made from aluminum which is used to up, down and lateral moment of painting point which is mounted on it. The dc motor is mounted on sides of traveler . The vertical traveler consists of painting point which is used to draw words or basic shapes. Controlling unit consist of ATmega 16 microcontroller which control the total mechanism as per the program save to it. This wall painting robot paints characters or basics shapes according to the input given to it through keyboard which is predefined in the program built in the microcontroller , the program consists of predefined logic of all the characters presents on the keyboard along with some basics shapes so when giving input from the keyboard the microcontroller checks the input with predefined logic present in program and works according to that.

Manuscript received March 17, 2015

Sagar Raut, Department of Electronics, Datta Meghe Institute of Engineering Technology And Research sawangi (Meghe)Wardha, India

Gaurav Ujawane, Department of Electronics , Datta Meghe Institute of Engineering technology And Research sawangi (Meghe) Wardha ,India

shilpa thakur, Department of Electronics, Datta Meghe Institute of Engineering technology And Research sawangi (Meghe) Wardha, India

III. HARDWARE

Hardware used to design the whole setup are as follow :
Microcontroller ATmega 16, Rack and Pineon mechanism , Gear, Painting Point, Keyboard ,DC Motor ,
Motor Driver IC (L293), Aluminum Frame, Connecting Wires, Switches.

A. Frame Structure

The frame body is made up of aluminum. The horizontal and vertical traveler is also made up of aluminum which is mounted on the frame body used for up down and lateral movement of painting point. For movement of Traveler along x-axis and y-axis Rack and Pineon mechanism is used . One DC motor is mounted on each sides of vertical Traveler .and one Dc motor is mounted on horizontal traveler along with painting point.The overall Frame structure is shown in Fig. Frame Structure below.

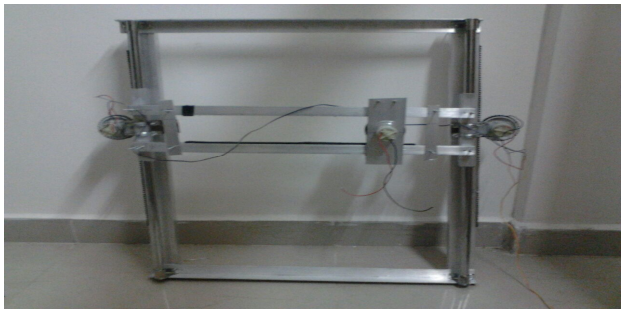

Fig1. Frame Structure

B. DC motor

DC motor 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 motor is same as electric motors in grneral .DC motor are widely used in speed and direction control .these motor can't be connected to controller as mostly it runs on voltage higher than +5V.

Fig 2.DC Motor

C. Motor Driver IC

L293D is a typical Motor Driver Iv which allows DC motror to drive on either directions .L293D is a 16-pin Ic which can control a set of two Motor simultaneously in any direction. It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either directions. As voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction,hence H-bridge IC are ideal for driving a DC motor.

In a single L293D chip there are two H-bridge circuits whics can rotate two DC motor independently. There are two enable pins on L293D. pin 1 and 9, for being able to drive the motor these pins need to be high . For driving the Motor with left H-bridge pin 1 need to be high ,and for driving th motor with right H-bridge pin 9 need to be high .if any one of either pin 1 or pin 9 goes low the corresponding motor stops working. Pin diagram of L293D IC is given in fig 3.L293D Motor Driver IC below.

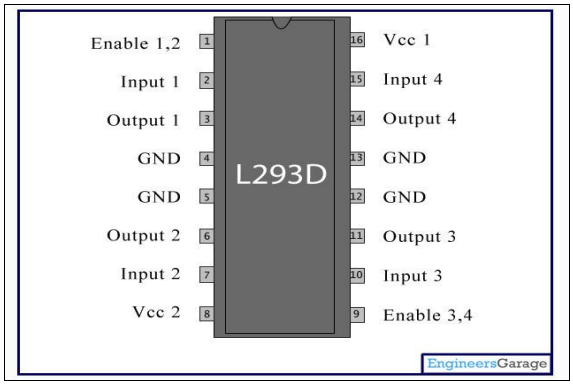

Fig 3.L293D Motor Driver IC

D. ATmega 16 microcontroller

To use microntroller pins effectively ,best controller must be chosen. The whole operation of machine is controlled by ATmega 16 microcontroller. It is high-performance low power AtmelAVR8-bit Microcontroller. Pin diagram of ATmega16 is given in Fig 4.pin diagram of ATmega 16 below.

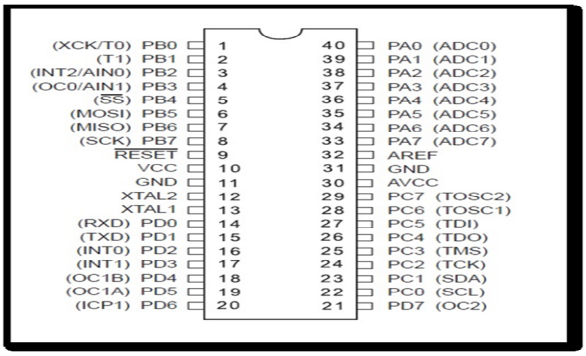

Fig 4.pin diagram of ATmega 16

VCC - digital supply voltag
GND - Ground
Port A (PA7-PA0)- Port A serves as the analog inputs to the A/D Converter . Poart A also serves as an 8-bit bi directional I/O port .Port pins can provide internal pull-up resistor (selected for each bit). The Port A output Buffers have symmetrical drive characteristics with both sink and source capability.

Port B (PB7...PB0) - Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port C (PC7...PC0) - Port C is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port C output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running. If the JTAG interface is enabled, the pull-up resistors on pinsPC5 (TDI), PC3 (TMS) and PC2 (TCK) will be activated even if a reset occurs.

Port D (PD7...PD0):- Port D is an 8-bit bi-directional I/O port with internal pull- up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port are tri-stated when a reset condition becomes active, even if the clock is not running.

Reset - Reset Input. A low level on this pin for longer than the minimum pulse length will generate a reset, even if the clock is not running. Shorter pulses are not guaranteed to generate a reset.

XTAL1- Input to the inverting Oscillator amplifier and input to the internal clock operating circuit.

XTAL2 -Output from the inverting Oscillator amplifier.

AVCC - AVCC is the supply voltage pin for Port A and the A/D Converter. It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter.

AREF- AREF is the analog reference pin for the A/D Converter.

E. Rack and pinion Mechanisms

For the movement of traveler i.e. for up –down and lateral moment along x-axis and y-axis on main frame body the idea of rack and pinion mechanisms is implemented.

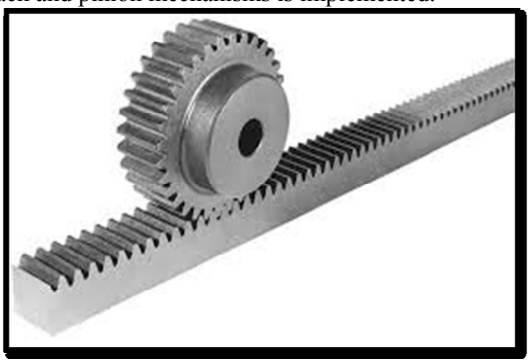

Fig 5. Rack and Pinion Mechanisms

IV. ADVANTAGES AND DISADVANTAGES

Advantages

Reduce man power -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 .Hence this project aims to reduce man power.

Less wastage of paint-As all the character are programmed and saved in microcontroller .this machine use paint which is required and is sufficient for painting.

Less consumption of time-As the complete setup is automatic and programmed hence time required for operation is less.

Threat to human life reduce- 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. For this purpose our project provides efficient system.

Disadvantages

One potential disadvantage is an increases job shortages as automation may replace staff members who do tasks easily replicated by a robot. Some systems require the use of programming languages such as C++ or Visual Basic to run more complicated tasks.

CONCLUSION

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

APPENDIX

```
/* This code is  for keyboard character  viz. A,B and C and
some basic shapes like rectangle ,square ,triangle.
 */
#include <avr/io.h>
#include <mega16.h>

ISR(USART_RXC_vect);
char z;
#define Hori_Forword sbi(PORTC,0);cbi(PORTC,1);
#define Vert  Forword sbi(PORTC,3);cbi(PORTC,2);
#define Hori_Back cbi(PORTC,0);sbi(PORTC,1);
#define Vert_Back cbi(PORTC,3);sbi(PORTC,2);
#define Hori_stop cbi(PORTC,0);cbi(PORTC,1);
#define Vert_stop cbi(PORTC,3);cbi(PORTC,2);
#define Pick_Up sbi(PORTC,4);cbi(PORTC,5);
#define Pick Down cbi(PORTC,4);sbi(PORTC,5);
#define Pick_Stop cbi(PORTC,4);cbi(PORTC,5);
int main(void)
{
   DDRC=0xFF;
   init_usart(51);
   sei();
   while(1)
   {
      if (z == 'A')
      {
   Pick_Down;_delay_ms(130);Pick_Stop;Vert_Forword;_delay_ms(3000);Hori_Forword;_delay_ms(700);Vert_Back;_delay_ms(700);Hori_stop;Vert_Back;_delay_ms(1000);

   Vert_stop;Hori_Back;_delay_ms(2000);Hori_Forword;_delay_ms(2000);Hori_stop;Vert_Back;_delay_ms(2000);Hori_stop;Vert_stop;Pick_Up;_delay_ms(130);Pick_Stop;
         Hori_Forword;_delay_ms(800);Hori_stop;
         z='S';
      }
      else if (z == 'B')
      {

   Pick_Down;_delay_ms(130);Pick_Stop;Vert_Forword;_delay_ms(3000);Vert_stop;Hori_Forword;_delay_ms(1200);Vert_Back;_delay_ms(350);Hori_stop;_delay_ms(1000);

   Hori_Back;_delay_ms(350);Vert_stop;_delay_ms(1300);Hori_Forword;_delay_ms(1300);Vert_Back;_delay_ms(350);Hori_stop;

   _delay_ms(1000);Hori_Back;_delay_ms(350);Vert_stop;_delay_ms(1200);Hori_stop;Pick_Up;_delay_ms(130);Pick_Stop;
         Hori_Forword;_delay_ms(2000);Hori_stop;
         z='S';
      }
      if (z == 'C')
      {

   Vert_Forword;_delay_ms(3000);Vert_stop;Hori_Forword;_delay_ms(1500);Pick_Down;_delay_ms(130);Pick_Stop;_delay_ms(100);Hori_Back;

   _delay_ms(1500);Hori_stop;Vert_Back;_delay_ms(3000);Vert_stop;Hori_Forword;_delay_ms(1500);Hori_stop;Pick_Up;_delay_ms(130);Pick_Stop;
         Hori_Forword(500);Hori_stop;z='S';
      }
      else if (z == 't')
      {

   Hori_Forword;_delay_ms(3500);Hori_stop;Pick_Down;_delay_ms(130);Pick_Stop;Hori_Back;Vert_Forword;_delay_ms(2000);Vert_Back;_delay_ms(2000);Vert_stop;Hori_Forword;

   _delay_ms(3500);Pick_Up;_delay_ms(130);Pick_Stop;
         z='S';
      }
      else if (z == 'r')
      {
         Pick_Down;_delay_ms(130);Pick_Stop;
   ;Vert_Forword;_delay_ms(2000);Vert_stop;Hori_Forword;_delay_ms(4000);Hori_stop;Vert_Back;_delay_ms(2000);

   Vert_stop;Hori_Back;_delay_ms(4000);Pick_Up;_delay_ms(130);Pick_Stop;
         z='S';
      }
      else if (z == 'f')
```

```
    {

  Vert_Forword;_delay_ms(1000);Hori_stop;Vert_stop;
      z='S';
    }
    else if (z == 'b')
    {
      Vert_Back;_delay_ms(1000);Hori_stop;Vert_stop;
      z='S';
    }
    else if (z == 'l')
    {

  Hori_Forword;_delay_ms(1000);Hori_stop;Vert_stop;
      z='S';
    }
    else if (z == 'h')
    {
      Hori_Back;_delay_ms(1000);Hori_stop;Vert_stop;
      z='S';
    }
    else if (z == 'p')
    {
      Pick_Up;_delay_ms(130);Pick_Stop;
      z='S';
    }
    else if (z == 'u')
    {
      Pick_Down;_delay_ms(130);Pick_Stop;
      z='S';
    }
    else if (z == 'S')
    {
      Hori_stop;Vert_stop;
      _delay_ms(300);
    }
  }
}
ISR(USART_RXC_vect)
{
  z = receive_data();
}
```

REFERENCES

[1] Microcontroller Based X-Y Plotter Published by - Mrs. R.Dayana,Gunaseelan P Assistant Professor, Dept. of ECE, SRM University, Kattankulathur, Tamilnadu, IndiaEmbedded System Technology, SRM UniversityKattankulathur, Tamilnadu, India

[2] Automatic wall painting robot Published by - Internationals Journal of Innovative Research in science, Engineering and Technology

[3] Design of An Autonomous Wall Painting Robot Published by -Mohamed Abdullatif Mechatronics and Robotics Dept. Egypt-Japan University of Science and Technology, Alexandria, Egypt.

[4] An economical intelligent plotter Published by - Dalzell D.T Institution of Electronic and Radio Engineer Vol 48 No.11. pp. 573-579 November 1978

[5] Atmel® Studio 6 - Atmel Corporation www.**atmel**.com/microsite/**atmel_studio6**

[6] Set Up of an Automated Multi-Colour System for Interior Wall Painting Published by - Berardo Naticchia, Alberto Giretti and Alessandro Carbonari Department of Architecture Construction and Structures (DACS), Engineering Faculty Polytechnic University of Marche, via Brecce Bianche, 60131 Ancona,ItalyCorresponding author: alessandro.carbonari@univpm it (AlessandroCarbonari)

[7] Design and fabrication of automatic wall plastering machine Published by- Mahesha P.K1, Sree Rajendra2 1M-Tech IAR, Mechanical Engg. MCE, Hassan, India2Associate Professor, Mechanical Engg. MCE, Hassan, India

[8] WEBSITES:Engineersgarage.com www.electronics-lab.com