Automatic Wall Painting Robot

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Abstract - **Nowadays robots are widely used in many applications such as military, medical application, factories, entertainment, automobile industries etc. However, the application of robots is still not widely implemented in the construction industry. In the construction industry, robots are designed to increase speed and improve the accuracy of construction field operations. It can also be used to do hazardous and dangerous jobs in construction. For example, currently house painting is done manually. This process can be simplified using a special dedicated robot. It is very difficult and troublesome for human being to work in an upright position, especially for painting, cleaning and screwing in the ceiling for a long time. Painting in an upright position is also very dangerous for the eyes. To overcome this difficulty, a wireless wall painting robot system is proposed, designed and developed by using Mobile Application. In which we are going to operate the robot by mobile app through Bluetooth will give commands to robot.**

Keywords: Mobile Application, Bluetooth, Robot, Wireless.

I. INTRODUCTION

Building and Construction is one of the major industries around the world. In fast moving life construction industry is also growing rapidly. But the labors in the construction industry are facing difficulty in work and it is more risky situation. 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. So, we have come with the idea to develop an Automatic wall painting robot. The development of service robot became popular recently due to fact that society needs robots to relax humans from tedious and dangerous task. . In Egypt, as well as other developing countries, the increasing population stimulates the construction-related activities such as interior finishing and painting.

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. 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. Generally in India we use conventional method of painting is by applying paint on wall manually with the help of workers. The major problem is that, Painting is classically done by humans and generally requires exhaustive physical efforts and exposure to dangerous chemical. 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 make painting an ideal candidate process for automation.

II. PROBLEMS WITH EXISTING SYSTEM

There are few problems with the existing system which we observed during research of past few papers.

- All systems were wired so it may cause problem if power cut off.
- Excessive automation was used which make system expensive like Raspberry pi, Image processing.
- System design was bulky.
- Use of cylinder pressure regulator in a system i.e. need have pressured air all time.

III. LITERATURE SURVEY

Automatic Wall Painting is the process in which Spray Painting is done by Robots or Robotic Arm to reduce the human effort and to increase accuracy is done by mobile application through Bluetooth.

Rajesh Kannan Megalingam, Vineeth Prithvi Darla and Chaitanya Sai Kumar Nimmala have developed an Autonomous Wall Painting Robot in the year 2020. The system was implemented by Use of Raspberry pi, ultrasonic sensor and mechanical lift to paint wall automatically inside the house. Easy operation and ultrasonic sensor gives wall distance maintained Low computational complexity and small memory footprint. But they face challenges like High cost electronics, Bulky design.

Bhuvaneswari S, Madhavan K and Ipsita Thandapani T. describes Automated Exterior Wall Painting Robot Using Raspberry Pi a system in the year 2020. The proposed system will build a robot that you can program to move around using simple Python commands. Advantages: Simple operation on python commands uses line follower robot that guide the wall robot Challenges: Cannot provide accuracy using IR sensors.

Kundan Jawale, Ramesh Kumar and Vishal Kale have developed a Design and Development of a Wall Painting Robot for the Houses Wall in the year 2015. The proposed system has Pneumatic cylinder pressure regulator and air filter in combination with electronics system.

P. Keerthanaa1, K. Jeevitha2, V. Navina3, G. Indira4 and S. Jayamani describes Automatic Wall Painting Robot. The robot is designed using few steels, conveyor shaft, spray gun and a controller unit to control the entire operation of the robot. Advantages: Battery operated. Challenges: Needs air tank or compressor and the electric shock is always there, which makes the machines ugly and dust and dirt are adhering.

IV. PROPOSED SYSTEM

It consist of ultrasonic sensor, linear actuator, power supply, Arduino, Bluetooth module, motor driver, stepper motor, mobile application etc. The system sending command or input from mobile phone to the robot using Arduino. So through mobile application we can give the command to the robot. Motor driver is used to drive dc motor in any direction. One dc motor used for the movement of robot i.e. robot wheel motor and other dc motor is used for linear actuator i.e. movement of spray bottle in up down direction. Through spray bottle paint is applied to the wall and painting operation is done and the robot will work.

V. SOFTWARE REQUIREMENTS

Language	Embedded C
Firmware Environment	Arduino IDE
Hardware PCB design	Dip Trace
Schematic design	Proteus

a) Arduino IDE 1.8.9

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, MacOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. 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.

b) Dip Trace

Dip Trace is an EDA/CAD software application for creating schematic diagrams and printed circuit boards. The developers provide a multi-lingual interface and tutorials (currently available in English and 21 other languages). Dip Trace has 4 modules: schematic capture editor, PCB layout editor with built-in shape-based auto router and 3D- preview & export, component editor, and pattern editor.

c) Proteus 8

It is a software suite containing schematic, simulation as well as PCB designing. ISIS is the software used to draw schematics and simulate the circuits in real time. The simulation allows human access during run time, thus providing real time simulation. ARES is used for PCB designing. It has the feature of viewing output in 3D view of the designed PCB along with components. The designer can also develop 2D drawings for the product.

d) Mobile Application "Bluetooth Electronics"

Control your electronic project with an Android device. This app communicates using Bluetooth to an HC-06 or HC-05 Bluetooth module in your project. Since version 1.2 of the app, it will now also communicate to Bluetooth low energy modules such as the HC-08 and via USB-serial connection. This app comes with a library containing 11 Bluetooth examples for Arduino. Ideal for rapid prototyping a new idea. Ideal for exhibiting your project. Some electronics skills required. Requires an Android device with Bluetooth capability enabled. Large selection of controls available including buttons, switches, sliders, pads, lights, gauges, terminals, accelerometers and graphs, Drag and drop them onto the panel grid. Then edit their properties. 20 customizable

panels available. Import/Export panels to share them. Discover, Pair and connect to Bluetooth devices. Then click Run to use the panel.

VI. HARDWARE REQUIREMENTS

a) ATmega328P Microcontroller

Microcontroller used in the proposed system is Arduino UNO. It is the main component of the system which assigns and handles all the works performed by the different modules. Microcontroller is a controlling device for monitoring the project. This Microcontroller collects the data, reads and sends the data through the Wi-Fi network to the cloud computing web page. ATmega328 is an 8-bit and 28 Pins AVR Microcontroller, manufactured by Microchip, follows RISC Architecture and has a flash type program memory of 32KB. It has an EEPROM memory of 1KB and its SRAM memory is of 2KB. It has 8 Pin for ADC operations, which all combines to form Port A (PA0 - PA7).

b) Bluetooth HC-05

The Bluetooth module HC-05 is a MASTER/SLAVE module. By default the factory setting is SLAVE. The Role of the module (Master or Slave) can be configured only by AT COMMANDS. The slave modules cannot initiate a connection to another Bluetooth device, but can accept connections. Master module can initiate a connection to other devices. The user can use it simply for a serial port replacement to establish connection between MCU and GPS, PC to your embedded project. *Features:* Typical -80dBm sensitivity, Up to +4dBm RF transmits power, 3.3 to 5 V I/O, PIO (Programmable Input/output) control, UART interface with programmable baud rate.

c) DC Motor

In DC motor the current is passed through, it spins continuously in one direction until the current stops. It's absolutely marked as + or – pins as shown in the figure 6. To reverse the direction of the motor it can change the two wires. PWM is known to managing the endurance of an electronic pulse. Here the motors should be classified the brush as a water wheel and electrons as the flowing droplets of water. Voltage fluctuation damages the motors frequently. If it is controlled through PWM the motors will last much longer and be more dependable.

d) Motor Driver L293D

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control

two DC motor with a single L293D IC. Dual H-bridge Motor Driver integrated circuit (IC).

e) Ultrasonic sensor Hcsr04

The HC-SR04 Ultrasonic Distance Sensor is a sensor used for detecting the distance to an object using sonar. The HC-SR04 uses non-contact ultrasound sonar to measure the distance to an object, and consists of two ultrasonic transmitters (basically speakers), a receiver, and a control circuit. The transmitters emit a high frequency ultrasonic sound, which bounce off any nearby solid objects, and the receiver listens for any return echo. That echo is then processed by the control circuit to calculate the time difference between the signal being transmitted and received. This time can subsequently be used, along with some clever math, to calculate the distance between the sensor and the reflecting object.

f) Lead Screw

A leadscrew (or lead screw), also known as a power screw or translation screw, is a screw used as a linkage in a machine, to translate turning motion into linear motion. Because of the large area of sliding contact between their male and female members, screw threads have larger frictional energy losses compared to other linkages. They are not typically used to carry high power, but more for intermittent use in low power actuator and positioner mechanisms. It has good wear resistance and strength, high accuracy, hard to rust and has good performances due to low friction coefficients and long usage spans. This Trapezoidal Lead Screw with Copper Nut is a new type of screw which is mainly used in stepper motor, machine tool rails and other types of equipment.

g) MG996R Servo Motor

This Tower Pro MG996R Digital Metal Gear High Torque Servo Motor (180 Degree Rotation) features metal gearing resulting in extra high 10kg stalling torque in a tiny package. The MG996R is essentially an upgraded version of the famous MG995 servo, and features upgraded shock- roofing and a redesigned PCB and IC control system that make it much more accurate than its predecessor.

h) Load cell

It is transducer used to convert force into electrical signal. The output of load cell is plugged into algorithm to calculate the load cell. Here it is used as automatic weighting machine on selecting the product and dispatch the required product. The HX711 ADC is 24 bits analog to digital convertor design for weight scale. The output of load cell is converted into digital form and then it passes to Arduino.
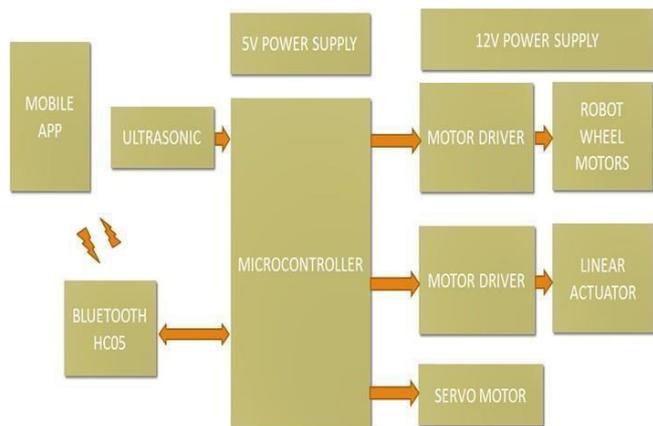
VII. BLOCK DIAGRAM

Figure 1: Block Diagram of system

VIII. ALGORITHM

- Initialize motor header
- Setup forward motor speed for all dc motors
- Setup forward motor speed for all dc motors
- Define motor driver pins
- Initialize Bluetooth
- Setup wall paint time and length
- Arrange the motor working manner
- Read the value from User
- Initialize all motor position to zero
- Turn on required motors for first iteration
- Read all the user value
- Print remaining value on Bluetooth app
- Turning on uplift dc motor (for one step)
- Turning on spray motor
- Repeat step from Read all the user value till turning on spray motor.

IX. OUTPUT OF THE SYSTEM

Figure 2: Output of the system

X. APPLICATIONS

- Use in all types of painting wall / car.
- In industries purpose.
- Can be used in engineering workshop.
- This system is reliable & flexible.

XI. CONCLUSION

Developed an exterior building wall painting robot to paint the wall efficiently. It can be used to cover the wall uniformly and reduce the painting cost of wall. It takes only the initial cost to manufacturing. This type of robot used to save the human life for the injuries to paint the higher position in apartments and buildings. The paint having some poisonous some metal it lead some disorder like the respiratory problem and some skin problems. In our robot to paint the square fit in 2 minutes the sprayer mechanism to paint the wall to reduce the time and paint the wall efficiently and precisely.

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