

# AUTOMATIC WALL PAINTING ROBOT

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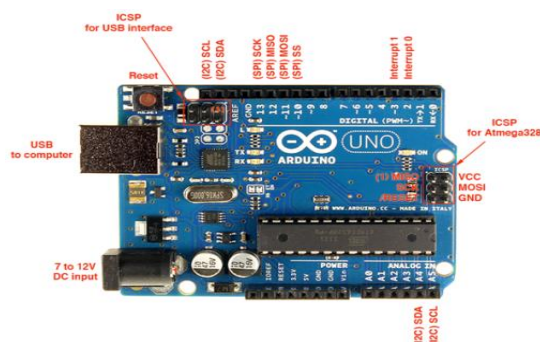
**Abstract:** This paper aims to design and develop an Automated Wall Painting Robot which helps to reduce manual efforts on painting and accomplish cost effective painting accessories. Here we have proposed a robot controlled via Arudino Uno. The autonomous robot can be controlled using simple python program. It is used to eliminate the human exposure in dangerous environments and very effective on time management. Also it completes a painting job without an error. At last, it is expected that the conceptual model of the wall painting robot would be efficiently used in various home and industry applications in wall finishing and maintenance of other giant architectural and civil structures.

**Keywords:** Building Automation, Robotic, Wall Painting, Human Safety

## I. INTRODUCTION

In current era we have multiple technologies to increase the robotic painting automation in various industries. embedded system design is a used for many types of product design by implementing the software and hardware with input and output devices along with microprocessors. the main idea of this automation is to provide exterior wall painting automatically with the help of robot.. the main idea to make the robot to move easily along the walls and apply paint smoothly. people can avoid inhaling the toxic chemical while doing interior painting and also reduce the amount of time taken to complete the entire painting work. the advanced robots are accurate and deliver the results with exact thicknesses. many creators have an idea of inventing robots which will create works of art, instead of usual painting it makes them more creative. others have probe for ways to form the robots economical and used for commercial purpose in places like interior painting.

Automation and robotics have entered various pasture of the construction industry, and painting work. the traditional painting of the wall buildings which is carried out using platform has proved to be expensive. it is very unsafe to involve working preferable heights. the main objectives of the paper are painting chemical can cause severe damage to lever to save human life this robots are preferred, paint the wall automatic in perfect manner, to avoid accident of human while doing external wall painting robot ,to provide user friendly control application, normal painting by human is causing severe accident while doing external wall painting to avoid accident painting robot is used . in existing method they have used the microcontroller of arduino. it is the hardware used to control the all component and it produces the control signal and pwm signals to motors. the sensor used to control the direction of robot and control the moving direction; digital line sensor is used .dc motors can run in bi directions based upon the polarity of current through the motor. it is used in cutting of magnetic flux mechanism. these motor acclimated to move the robot forward and reverse direction. the rechargeable dc battery is used to give the proper voltage to the components and motors. arduino microcontroller runs only one program again and again and it delays the painting process. it does not support advanced programming languages like python or ruby to enable faster development.



The Arduino mega microcontroller board depends on atmega 1280. it consists of multiple digital input/output pins. in i/o pins 14 can be utilized as pulse width modulation outputs, sixteen analog inputs, four uarts, a sixteen mhz crystal oscillator, a usb connection, a power jack, an icssp header, and a reset button as shown in figure 1. to get started the complete support to the microcontroller is simply connect with a usb cable or power is given to ac-to-dc converter.

it is used to control all the sensors and motors to give the control signals (input and output signal).to give input to module and fetch the output to corresponding modules. digital write condition in arduino the motor can be controlled by sensing the input from digital line follower it sense the input black as 1 and white as 0, the input is given to the arduino by using digital write condition. the motor is turned on by using high condition; the required voltage is given to the motor driver with the help of batteries in order to run the motor smooth manner . the main command is given with the help of arduino, by using digital read easily.

## II. LITERATURE SURVEY

[1] P.Keerthanaa The project's main objective is to design, develop, and execute an Automatic Wall Painting Robot that will aid in the development of low-cost painting tools. Despite robots' advancements and its numerous uses, research on interior wall painting has been very limited. The chemicals used in painting can be dangerous for people. Issues with the eyes and respiratory system can affect painters. Additionally, painting is tedious, time-consuming, and requires repeated hand-rising due to its nature. The entire construction process can be better managed and time and labor savings are realized as a result of appropriately integrating construction employees and robots in constructing jobs.

[2] Shweta Kumtola Since wall painting is so repetitive, labor-intensive, and possibly dangerous, it is a great target for automation. In the auto sector, painting had already been automated, but not in the building industry. It is vitally important to use a mobile robot that can move in order to paint the inner walls of residential structures. The arm of the autonomous wall painting robot described in this work is mounted on a mobile robot base and scans the walls vertically in order to provide lateral feed motion to cover the painting surface. The design seeks to meet the demands of ease of use, lightweight, affordability, and quick painting. On the arm and the mobile base, ultrasonic sensors are installed to permit movement while modifying the mobility restrictions.To plan the mobile device's movement.

[3] Aishwarya Padalkar the chemicals used in painting have been discovered to be extremely toxic to people, causing issues with their eyes and respiratory systems. It is monotonous, time-consuming, and requires constant hand-rising during the painting process. The suggested system has evolved to address these issues. Systems with a belt drive mechanism were utilized to move the roller up, down, left, and right as the wall was being painted. And the sensor is being used to identify walls.

[4] Syed Mohd Bahrin This study's major objective is to build and create an autonomous wall-painting robot that can apply different colours. An autonomous painting system has been created in the planned robot to paint two different colours using a spray gun and an air compressor. Additionally, a vertical and horizontal system for mounting the spray guns for painting has been created. Five separate tests were used to evaluate the performance of the constructed robot: DC motor, stepper motor, paint, liquid level sensor, and efficiency testing. The planned project has a 96.476% accuracy and can paint an area of 0.270 m<sup>2</sup> in 26.760 minutes. There is a 96.296% efficiency for the painting system.

[5] Prof. Swati. Patil Robots are utilized often today in a variety of areas, including the military, healthcare, factories, entertainment, and the auto industry.However, the use of robots in the construction sector is still not very common. Robots are used in the construction sector to speed up and enhance the accuracy of field operations. Additionally, it can be employed for risky and dangerous building jobs. For instance, painting houses is currently done by hand. A unique dedicated robot can streamline this operation. Humans find it incredibly challenging and uncomfortable to operate in an upright position, especially for prolonged periods of time when painting, cleaning, or installing ceiling screws. Painting while standing up is quite hazardous to your eyes.

[6] K. Jeevitha one of the largest industries in the world is construction and building. The building business is likewise expanding quickly in this fast-paced world. But there aren't enough workers in the building sector. The difficulty of the task is the source of the shortage of labour in the construction sector. When working in towering buildings in the construction sector, buildings or in locations with more dangerous conditions, such in the centre of cities. There are further causes for the labour shortage, some of which may be related to higher educational standards, which have led some people to believe that certain occupations are not as prestigious as others. The construction sector requires a lot of labour and operates in hazardous conditions.

[7] Pranjali Suryawanshi Construction and building work is one of the procedures growing in this industry. The building industry is expanding swiftly in a world that is always changing. However, there isn't enough labour to finish this job. Painting tall buildings poses more dangerous problems than completing internal building work does. The increase in educational attainment has led to a perception among the public that this field of work is elite. The foundation of the construction project is the labour force. However, it is where the latency begins. Automation and robots are therefore developing more swiftly. The robot's assistance simplifies every operation. Here, we build a robot that works with paintings.

[8] Mohamed T. Sorour despite robots' advancements and its numerous uses, research on interior wall painting has not been very active. Chemicals used in painting can endanger human artists by causing issues with their eyes and respiratory systems. Additionally, painting is tedious, time-consuming, and requires repeated hand-rising due to its nature. The creation of an automated robotic painting system is motivated by these elements. There haven't been many research efforts, but those that have been done haven't yet led to a system that is mature and marketable. The "TAMIR" robot was created by Warszawsky and Kahane and utilized for four interior finishing chores, including painting, plastering, tiling, and masonry. The robot has 6 DOF (Degrees of Freedom)

[9] Utkarsha S. Bawane All paints require specific, finely ground solid colours known as pigments, a liquid that holds the paint in suspension until it is applied, and a binder or resin that has the ability to hold the paint together. Ability to cling the paint to the surface for a long time by drying or otherwise hardening (Bently and Turner, 1997). The relative proportions of the elements in paint determine its qualities. A typical paint contains about 21% fill forming and other components, along with 35% pigment and filler (Turner, 1998). There are organic and inorganic pigments, as well as manufactured and natural pigments. Early colours were merely ground clay or soil. Modern pigments, however, are frequently highly complex works of chemical engineering art.

[10] Sonali Patil Despite the advancements in robots and their numerous applications, painting is still regarded as a challenging procedure because it must cover the entire surface. Also one of the largest industries in the world is construction and building. The building business is likewise expanding quickly in this fast-paced world. But there aren't enough workers in the building sector. The difficulty of the task is the source of the labour shortage in the construction sector. When working in tall structures or in locations with greater risk, such as interior metropolitan areas, the construction sector. Additionally, it can be employed for risky and dangerous building jobs. For instance, painting houses is currently done by hand.

[11] Mohamed Abdellatif designed an aut e conceptual design of robot which contains arm that work vertically.the arm is fitted to give the motion to paint the wall area.This robot uses ultrasonic sensors.For the adjustment,the control system is used to guide the motion of the arm.The disadvantage is it can only be used for interior walls of building.

[12] Chavan Shubham Balasaheb,developed a man free wall painting robot that can be used to paint interior and exterior walls of buildings.Paint spraying equipment consists of a frame which is used for mounting all the components.The two conveyor roller is attached to the two ends of the frame with the aid of end bearing with bearing cap.The roller shaft is coupled to the permanent magnet motor with the help of spur gear mechanism.This system has achieved optimum benefits regarding to the reliability,safety and ease of use.The main disadvantage is that the robot continues painting even after the end of the wall.

[13] Jayant R and his team designed and fabricated the automatic spray-painting machine, with a paint sprayer. The frame is placed on the castor wheels, Vertical motion of the paint sprayer was achieved by using a threaded rod attached with a stepper motor that converts the rotational motion of the shaft to a linear motion. Hence it enables the paint sprayer to move up or down. The compressor is used for supplying the paint to the spray rotor end.

[14] Amgad Muneer,Zhan Dairabayev designed and implemented the automatic painting mobile robot.The proposed system aims to construct an automatic robot,that paints the building walls of any size.The experimental result showed that the robot can paint with an accuracy of upto 90% in a very efficient time,Hence the system was developed by giving the option for the workers to select among several optionsto ensure that the prototype can be used forvarious heights,The short coming of this system is due to the capacity of the paint tank. This system uses 1 litre of paint which inconvenient because the worker's has to fil the paint multiple times in some instances. Another disadvantage is that ultra-sonic sensor can work when used on a perpendicular wall. However, when painting edges, crevices and corners, the sensor can have the inconsistencies in the readings.

[15] Atharva c.Paralikar developed a spray-painting robot for painting irregular workpieces.The proposed paper aims to design a cost effective spray-painting robot which is capable of painting irregular workpieces with highly contoured surfaces.With advent of electrostatic spray-painting techniques, it is imperative to automate the painting process due to the electrical hazard .Intelligent robotic systems use d for painting need complex path planning algorithms and thus can become very costly.

[16] DebarghaRoy, proposed the idea of interior wall painting and designing the robot, that is capable of identifying the roughness of the surface, which is to be painted, to reduce the wastage of paint. Implementing complex designs are concerned, the time factor is expected to be higher. The colors are to be painted only in rectangular shapes. Drawback: Here in this system only rectangular shapes can be painted.

[17] Dipakshelar, et al. has presented a robot system that aims the automatic wall painting. The Arduino in it is used to control the DC motor and the moment of spray gun fitted on the slider. This machine reduces human efforts as well as time-consuming. It prevents the hazardous to human painter. The painting work is accurate and reliable. Drawback: spray guns are very expensive and they are operated manually.

[18] Amgad muneer, in his research gives the information about design and implementation of automatic painting mobile robot, though there is a strong need for a mobile robot that can move to paint the interior walls. The basic design of the proposed painting robot which consists of ultrasonic sensor and spray gun. In this to a pulley there is a spray gun attached which has a linear motion. Where the ultrasonic sensor detects spray gun after reaching to a certain limit. Whereas the DC motor moves to the clockwise and anticlockwise directions based on the given conditions on the ultrasonic sensor. Therefore, after doing the experiment the results indicate that the robot will be able to move and paint the walls smoothly. Drawback: there should be a person to control the robot through mobile and only a single colour can be detected.

[19] Che-seung cho, jin-dae kim, sung-gun lee., in their research they gave the information about painting on outer plate of ship. This proposed system tells about automatic painting robot that uses a permanent magnet wheel and vision system. This robot uses a permanent magnet wheel to move on the outer plate of the ship vertically and horizontally. They made this experiment a prototype to test the ability of autonomous tracking along the vertical walls surface. Drawback: painting on outer plate of ship is one of the dangerous parts for building ships because it is conducted by human workers in high altitudes with painting equipment.

[20] M. Abdullatif, A. Ramadan, and A. Abo-ismail, in their research, have devised a roller approach to a robotic arm system and use omni-wheels as base rollers to move the robot. The arm has 2 DOF while the base is designed mechanically as 3 DOF. According to the authors the usage of roller instead of a spray paint resulted in significant decrease in costs since spray setup is costlier to make. For feedback on the position of the robot the system uses four ultrasonic sensors, two each for left and right directions. Also, the system uses Arduino Mega board and Nema 23 stepper motors for running the system. The authors achieved a successful paintwork with a rate of 0.101 hour/m<sup>2</sup>. Drawback: This system needs constant monitoring. Robots are not creative nor innovative. In this system, the limbs have to carry the unnecessary load.

### III. CONCLUSION

Developed an Autonomous wall painting robot to paint the wall efficiently, which is used to cover the wall uniformly and reduce the painting cost of wall. It eliminates the exposure to paint poisonous chemicals in paint which leads to disorders like the respiratory problems and some skin problems. It reduces the human effort and avoids injuries in repetitive, hazardous and unsafe working environments such as radioactive sites, and high rise buildings.

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