

4 Axis Automatic Spray Painting

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Abstract: *It was developed as a solution to the problem of automated painting in small-scale organisations and as a preventative measure against a scarcity of skilled employees in small businesses. There is a possibility that our automated spray-painting method may assist smaller businesses. In order to successfully complete this project and fulfil its requirements, an automated paint spraying system equipped with a conveyer was developed and installed. In this manner, the paint is applied by squirting it on using compressed air. On the surface of the specimen, paint, ink, or varnish may be applied with the assistance of compressed air. Paint particles are steered in a particular direction by the high-pressure air that is produced by an air compressor. The spray pattern is one of a kind as a result of the fact that the size of the spray particles is controlled by the size of the airbrushes. Spray painter patterns and brushes provide for a wide range of creative possibilities. Fine art, nail painting, and photo editing are some of the things that fall under this category. It is inexpensive since it does not need any experienced labourers in order to increase output.*

I. INTRODUCTION

One of the most important aims of this project is to develop an automated spray-painting system that makes full use of all four dimensions of movement. This is one of the most important objectives. Other goals include conceptualising the system, making headway on constructing it, and ultimately putting it into existence in some capacity. These objectives are going to be reached by coming up with brand-new concepts for, persistently applying effort toward the production of, and, last but not least, materialising. These methods are going to be the means by which these aims are going to be completed. If this endeavour is successful in any way, then the accomplishment of this objective will be completed as a direct consequence of the accomplishment of this endeavour. [Case in point] It should go without saying that this takes into consideration the chance that the effort will be successful in some way. To be successful in reaching this objective, one has to be able to do this assignment without making any mistakes or falling short in meeting any of the conditions. Only then would one be considered successful.

It is not completely out of the question to hypothesise that the painting equipment that is being sold at a cheap price may have been manufactured with the aid of a robot at some stage in the manufacturing process. This is something that is not completely out of the question. This is not something that cannot in any way be considered a possibility at all. This is not something that in no way, shape, or form can in any way be thought of as a possibility at all. This cannot in any way, shape, or form be considered a possibility in any manner, shape, or form at all. It is not even remotely possible. This cannot in any manner, shape, or form be considered a possibility in any way, shape, or form at all. It is not even remotely possible. It is not conceivable in the slightest degree. This can in no way, shape, or form at all be thought of as a possibility in any way, shape, or form at all. It is not conceivable in the slightest degree.

It is not even somewhat plausible under any circumstances. At this time, there is no method that can definitively disprove the assumption that this theory is correct and provide data that contradicts it that is considered to be irrefutable. There is no manner, shape, or form that this assignment can be finished successfully. On the other hand, the act of painting the walls of an interior space does not have anywhere near the same level of influence as the invention of robots does on the way that we live our lives on a day-to-day basis. This is because robots are able to perform tasks that were previously impossible to perform. This is due to the fact that robots are capable of doing activities that were previously thought to be impossible to complete. This is as a result of the fact that robots are capable of doing tasks that were previously believed to be impossible to carry out. This is due to the fact that robots are now capable of doing duties that it was previously inconceivable for humans to carry out. As a consequence of this, this situation has arisen. The reason for this is because robots are capable of doing any task. Because painters are human, their eyes and respiratory systems are more likely to get irritated as a result of the hazardous chemicals that are used in the painting process. This is due to the fact that painters are exposed to these chemicals throughout the painting process.

Painters have an increased risk of experiencing irritability. The reason for this is because painters are exposed to a far greater concentration of these chemicals than the general population is. Because of the nature of the job they do, painters have a higher chance of having irritation in their eyes and respiratory systems than other professions. This occurs as a result of the fact that painters are exposed to these chemicals when they are really working on their paintings, which is the reason why this phenomenon occurs. The fundamental reason for this is because people who work in the painting industry often come into contact with hazardous chemicals, which is the source of the issue. Because of the nature of their work, painters are more prone to suffer aggravation than members of the general population as a whole. [Citation needed] Painters have a much greater risk of experiencing headaches compared to the general population as a whole. The reason behind this is because artists spend a significant amount of time stooped over their brushes.

It is very likely that as a direct result of this, human artists will be capable of producing a lower level of creative output than they were previously capable of, which may result in a general decline in the quality of the work that they generate. This may also result in a general decline in the quantity of creative output that human artists are capable of producing. This may also lead to a general fall in the amount of creative work that is capable of being produced by human artists. This may also have the consequence of leading to a general decline in the quantity of creative output that human artists are capable of generating in the future. This may be caused by the introduction of new technologies. This might also result in a general decline in the amount of creative work that is capable of being created by human artists. This would have a negative impact on the creative industry.

The possible ramifications of artificial intelligence make the existence of this option a real possibility. It is not at all out of the realm of possibility that something like may take happening. It is not possible to completely exclude this possibility. Painting is a challenging hobby for a number of different reasons, one of which being the need that you constantly elevate your hand as you work. Since of this, it is going to take some time and effort on your side as the painter because you are going to have to keep raising your hand. Painting is challenging for a great number of extra reasons in addition to its inherent complexity. Painting involves a broad array of challenges, such as this one, which need to be conquered in order to attain any degree of success at all. Painting is a pastime that may be challenging for a number of different reasons, and this is just one of them. Along with patience, you'll need a lot of it for this task. On the other hand, there are a significant number of additional ones. In addition to a very high level of accuracy, it calls for a very high degree of focus on the part of the one doing the task.

As one of the many challenges that will emerge as a direct consequence of your involvement in the activity, you will need to find a way to deal with this situation, which is only one of the many problems that will present themselves. This is only one of the numerous challenges that will be put in front of you in the future. This is only one of the many challenges that will need to be overcome. Painting is challenging for a great many reasons, this being only one of those causes; nonetheless, painting is challenging. In addition to this, there are a great many additional factors at play here. There is a very large number of other factors that need to be considered as well, and they must all be taken into account. Painting is challenging for a broad number of other reasons as well, some of which are listed below; nevertheless, they are only a few of the many more that exist: Painting is a challenging activity since it demands a significant amount of focus and attention. Painting is a challenging pastime due to the high degree of focus and attention that is required from those who participate in the activity. Painting is a hobby that requires a significant amount of patience in addition to the commitment of a significant amount of time before it can be completed in a manner that is deemed to be adequate.

Before painting can be completed in a way that is considered to be adequate, it must first be started. By using construction employees along with construction robots, it is feasible to realise considerable time and cost savings throughout the whole of the building process. These savings may be realised in a number of different ways. These cost-cutting measures could be successful. This is possible because to the synergy that results from the interaction of the two different aspects of the situation. The level of expertise held by construction workers is significantly higher than that held by construction robots; as a result, this possibility is now within reach. When compared to the level of expertise possessed by construction robots, the level of expertise held by construction workers is significantly higher. The context of the previously indicated possible cost savings can be found in the paragraph that came before this one, and it can be seen that the use of construction robots offers a large probability of realising such prospective cost reductions. It is possible that the realisation of these cost savings will take either a very short period of time or a somewhat longer length of time depending on the specifics of the circumstance and how quickly it will be viable to put into practise these techniques for reducing costs.

The timing of this occurrence will be determined by the degree to which it is feasible to make these improvements as rapidly as possible. The techniques for cutting costs that were discussed earlier in this piece have a chance of paying off in the long term, which is something else that has to be taken into consideration while reading this post. These tactics have already been discussed earlier on in this essay. These are the ideas that were mentioned directly at the start of the piece of writing. These methods were discussed earlier on in this piece of writing, when it was determined that they should be investigated. The scenarios that were just shown serve as illustrations of a few of the many possible outcomes that are described in this paragraph. There are a lot of different events that might happen. This paragraph discusses a number of distinct scenarios and their possible outcomes.

An earlier portion of this post included a more in-depth discussion of the subject that is now the focus of this conversation. As a direct result of this, it would be possible to limit or eliminate human exposure to demanding and hazardous conditions. This would significantly reduce the bulk of the safety concerns that develop when a large number of procedures are carried out at the same time. Because of the magnitude of the issue, firms are spending a significant portion of their easily available resources to the investigation and development of automated painting systems. This is happening as a direct consequence of the breadth of the problem. It's possible that the severity of the problem that's arisen as a direct consequence of the fact that the issue even exists in the first place is directly attributable to the existence of the issue itself. It is reasonable to conclude that the circumstance that was brought up earlier in this conversation played a significant role in the development of this event; as a result, it is conceivable to draw the conclusion that it was directly responsible for the occurrence of the incident.

II. OBJECTIVE OF PROJECT

For the creation of the wall-painting machine, the following goals were developed in order to find a solution to the problem:

To make the machine's structure simpler for ease of installation and safety. Secondly, to paint with just one colour throughout the whole process of creation. For example, the outside walls of civil structures, as well as those of buildings, may benefit from this technology. To protect the human body from the possibly hazardous effects of paint on the paint. Aiming to make things as simple as possible, the automated painting robot was supposed to be built. Due to the fact that this is a prototype design, the height of the painting portion is limited. Painting that is precise while still being fluid.

Material management systems for autonomous spray painting were examined in this phase. Materials were investigated for their painting procedure. There were two expensive motors and a compressor used to power the job we watched. We opted to employ an automated nozzle spray painting system that can paint/spray in all four directions when we looked at existing material painting machines. The machine concept and project strategy were developed in this phase. After considerable deliberation, we've settled on a final design for our self-driving painting machine. Many alterations were made to the initial conceptual design in order to improve performance and reduce costs. To build a cost-effective system that also performs well, careful consideration must be given to the materials used. During the selecting process, vibrations and variable loads were ruled out due to the materials' inability to handle them. Mild steel predominates in the construction of the system's components.

III. LITERATURE REVIEW

The name for its Mohamed Abdullatif the author of this study provides a demonstration on how to operate an automated wall painting robot machine as part of this research's framework. The author's original idea combines a plethora of information on the usage of robots to paint the inside walls of residential buildings, and it has been presented as a solution to a problem that has been around for quite some time.

The robot is able to retain a firm hold on the wall surface as it continues painting thanks to the roller that is attached to it. This is made possible by the fact that the roller is designed to work with liquid paint. Due to the fact that the roller is controlled by a robot, it is able to search for painted walls in either the horizontal or the vertical direction. The robot's movement may be controlled by adjusting its position in relation to the wall, which in turn has an influence on the robot's overall mobility. It is my pleasure to introduce you to Mr. Theodore Tsai. This article provides an overview of the production methods that are used by companies of a size range known as small and medium-sized businesses (often referred to as SMBs).

It has been said that components need to be painted in order to prevent them from rusting, and as a result, spray application requires the most time and paint, in addition to the necessity for a skilled individual to conduct the operation. As a result of this, a mechanism that employs a dipping technique with a semi-automatic arrangement to coat objects that are suitable for our needs and useful for small and medium-sized businesses must be developed in order to facilitate the creation of a more effective process that is more accurate, requires less time to coat, and costs less money. This is necessary in order to facilitate the creation of a process that is more suitable for our needs and useful for small and medium-sized businesses. In addition to that, this process has to be simplified so that it can be completed in a shorter amount of time. P. Keerthanaa They have devoted a large amount of their time and effort to the development of a system that would paint the essential wall surfaces for them automatically.

It is possible to determine the appearance of the wall via the use of flame receivers in conjunction with an infrared transmitter. A microcontroller, sometimes referred to as the "brain" of a DC motor since it manages its operation, is responsible for the motor's operation. The tediousness and time commitment that come with painting techniques that need painstaking copying and hand lifting are abolished by the robot. Similarly liberated from these burdens is the time commitment that comes along with these methods. In a similar vein, the use of the robot completely removes the possibility of making a mistake. While using the robot, human painters are able to avoid the hazards that are associated with the usage of paint chemicals. This is made possible by the robot.

It is feasible that using the robot would reduce the amount of money spent, the number of people necessary to accomplish a job, as well as the amount of time required to do the activity. These reductions might occur simultaneously or separately. Because the robot will paint the wall beyond the line that was initially envisioned for its completion, additional signalling systems, such as sirens, will need to be incorporated into the arrangement in order to compensate for the potential drawback of the project, which is that it will take longer than expected to finish painting the wall. This may be accomplished by including extra signalling systems into the configuration of the arrangement. In point of fact, the person whose status has to be determined in this circumstance is Berardo Naticchia. The findings of this research point to the possibility that using automated painting equipment might not only improve quality but also productivity. In order to complete this mission, we will require a robot arm that has a high degree of accuracy.

A system that is able to automatically translate the colour coordinates of the liquid into the movement speed of the robot end tool and the mixing board valves, in addition to the speed of the mixing board itself, is desirable for this application. You are going to have to put in a lot of effort if you want a solution to your problem that lives up to the expectations that you have set for it. Due to the fact that human-scale robots are made differently than full-scale robots, it is reasonable to anticipate that the resolution of human-scale robots will be lower than that of full-scale robots. This is because full-scale robots are formed differently than human-scale robots. Because human-range robots would not be able to access certain difficult spots in structures that are still in the process of being created, the miniature scale architecture provides an advantage.

This opens up a possibility for the design of the building. Takuya Gokyu The public may now look through the Wall-Surface Operation's building process to see how it was put together. The purpose of the robot is to make the process of restoration more effective by adding, changing, or establishing new cleaning responsibilities, as well as to automate as many steps of the process as is humanly possible and to automate as many steps of the process as is humanly possible. The use of the robot will be utilised in order to attain this goal. In addition to the basic tasks of painting pictures, either in a single colour or many colours, work is also done to remove tiles and restore them. This work is done alongside the core duties of painting images. The scenario that was presented before served as an illustration of what a 10-year inspection for the office building in issue may look like if it were conducted. Because of the vast number of structures that are identical to one another in every respect, it is projected that a considerable amount of profit will be made as a result of this situation.

IV. PROJECT WORKING

The development of a four-axis automated spray-painting system is the major purpose of this project, and its goals include its design, creation, and implementation. Robot that makes a contribution to the creation of more affordable painting equipment. Despite the numerous advancements that have been achieved in robotics and the various applications that have emerged from those advancements, researchers have not paid a considerable lot of attention to the practise of

painting the inside walls of buildings. The humans who do the painting might be placed in harm's way due to the chemicals that are utilised in the painting process; these chemicals could give them issues with their eyes and respiratory systems.

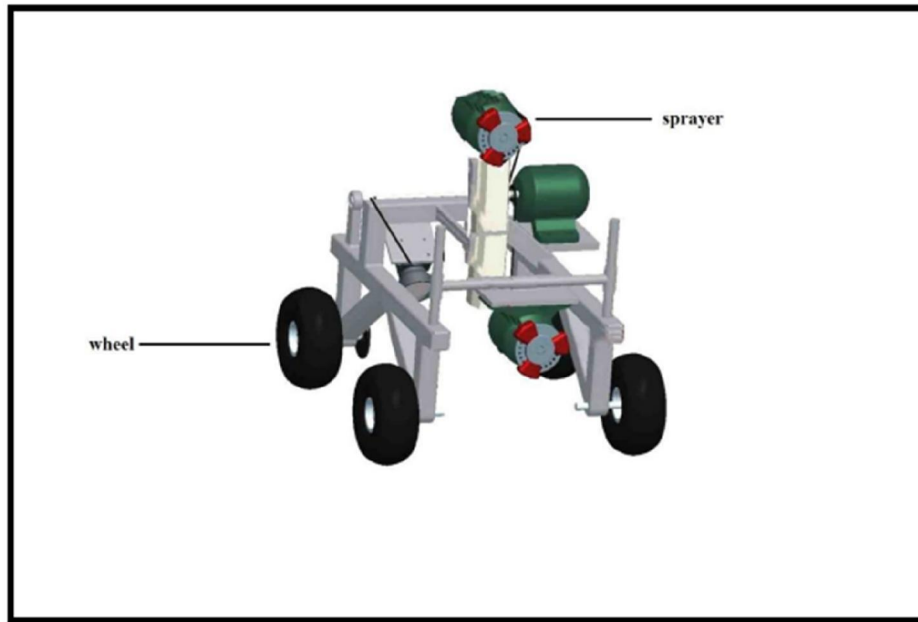


Figure 1: Project Drawing

In addition, the nature of painting technique, which involves conducting work in a repetitive way and rising one's hand, makes it tiresome, time-consuming, and labor-intensive. This is because painting method entails elevating one's hand. The whole building process has the potential to be better controlled when construction personnel and robots are effectively integrated into building jobs. This might lead to cost savings in terms of human labour and scheduling if the integration is done correctly. In addition to this, it would make it possible to lessen or eliminate human exposure to harsh and dangerous settings, which would alleviate the bulk of the difficulties associated with maintaining safety when a high number of operations are going on at the same time. When all of these factors are taken into account, it seems reasonable to advocate for the creation of an automated and robotic painting system.

V. RESULT AND DISCUSSION

When you take a close look at the manual spray shop on a regular basis, you will see that the waste of paint is still a significant issue. There is a significant association with manual spray guns, which cannot be utilised for qualitative or quantitative control. This is in addition to the employees' awareness and operating abilities. The automatic spraying can control the amount of paint that is sprayed, both qualitatively and quantitatively; it can also cut down on the amount of paint that is wasted; it can extend the life of the filter; it can cut down on the amount of sludge and ash that is contained in the spray booth; it can significantly extend the amount of time that the filter works; and it can cut down on the size of the spray booth. Because the automatic coating line is automated, it is capable of being sprayed at any time of the day or night, and the rate of production is consistent. There was a 30 percent improvement in the spray's effectiveness.

VI. CONCLUSION

The connected projects that our group was working on were successfully finished owing to the capable leadership of the project manager and the group's diligent efforts. This knowledge of the project will definitely serve us well in the years to come. Therefore, we are compelled to maintain that our senior year project was a vital part of our engineering education, helping to strengthen both our technical and practical abilities.

To reduce the cost of the engine, we aimed to move the largest amount of weight while using the least amount of power feasible. Consequently, we are able to fulfil our objective by constructing a suitable frame that enables us to get the maximum number of mechanical advantages. Due to the fact that the maximal torque required to lift the load is not instantaneously transmitted to the motor shaft, as we had expected when building the system. In order to lift the weight, the end shaft's speed must be lowered as required, and the torque must be raised to an appropriate level. As a consequence, the motor is functioning at its greatest capacity with the lightest load across its shaft.

REFERENCES

- [1] Mohamed Abdellatif "Design of an Autonomous Wall Painting Robot" Mechatronic and Robotic Dept. Egypt-Japan University of Science and Technology, Alexandria, Egypt, 7 February 2016.
- [2] Dhaval Thakar, Chetan P. Vora "A Review on Design and Development of Semi-Automatic Painting Machine" Int. Journal of Engineering Research and Applications, ISSN: 2248-9622, Vol. 4, Issue 4 (Version 7), April 2014.
- [3] P. Keerthanaa, K. Jeevitha, V.Navina, G.Indira, S.Jayamani, "Automatic Wall Painting Robot" International Journal of Innovative Research in Science, Engineering and Technology Vol. 2, Issue 7, July 2013.
- [4] Berardo Naticchia, Alberto Giretti and Alessandro Carbonari "Set Up of an Automated Multicolour System for Interior Wall Painting" International Journal of Advanced Robotic Systems, Vol. 4, No. 4 (2007), ISSN 1729-8806, pp. 407-416.
- [5] Takuya Gokyu, Masayuki Takasu, Sumio Fukuda "Development of Wall Painting Robot" Tokyu Construction Co. Ltd. 1-16-14 Shibuya-ku, Tokyo, Japan.
- [6] Pal Johan & Jan Tommy Gravdahl "A Real-Time Algorithm for Determining the Optimal Paint Gun Orientation in Spray Paint Applications" IEEE transactions on automation science and engineering, vol. 7, no. 4, October 2010.
- [7] Praneet Singh, Deepanshu Suneja, Prachi, Jitendra Kumar "Android Based, Arduino Powered Automated Wall" Praneet Singh et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 5 (3) , 2014, 4490-4491.
- [8] I. Aris, A. K. Parvez Iqbal, A. R. Ramli and S. Shamsuddin. "Design and development of a programmable painting robot for houses and buildings.," Jurnal Teknologi, Universiti Teknologi Malaysia, vol. 42(A), pp. 27-48, 2005.
- [9] B. Kahane, Y. Rosenfeld: "Balancing human-and-robot integration in building task," Computer-Aided Civil and Infrastructure Engineering, vol.19, pp. 393-410, 2004.
- [10] Warszawsky, Y. Rosenfeld: "Robot for interior finishing works in building: feasibility analysis," ASCE Journal of Construction Engineering and Management, vol.120 (1), pp. 132- 151, 1994.