ROBOTIC LADDER

Kumarakrishnan.V[1], Manikandan.B[2], Sanjairaj.A[3], Mohana Prakash.P[4] , Prasannabalaji.G[5]

[1] *Assistant professor,* [2] *student,* [3] *student,* [4] *student,* [5] *student*
Department of EEE
Paavai Engineering College (Autonomous)
Pachal, Namakkal, Tamil Nadu., India.

*Abstract :*The Automated Ladder Movement System with Safety Lockout is a novel concept designed to enhance workplace safety and efficiency. The system utilizes a robot model equipped with five relays, an Arduino microcontroller, and a keypad. Four relays are dedicated to controlling the robot's movement, enabling it to move forward, reverse, left, right, or stop. These movements can be input using the keypad.

The fifth relay is crucial for the system's safety feature, controlling the pneumatic upward movement of the ladder. Unlike traditional systems, this relay incorporates a safety lockout mechanism, ensuring that the ladder only rises when the user actively presses a button. This innovative design prevents accidental or unauthorized ladder movement, significantly reducing the risk of workplace accidents.

Furthermore, the system's user-friendly interface, consisting of the keypad, allows for easy operation and monitoring of the ladder's movements. Users can easily input commands and receive real-time feedback, enhancing overall operational efficiency. In conclusion, the Automated Ladder Movement System with Safety Lockout offers a safe, efficient, and user-friendly solution for automated ladder movement in industrial and commercial settings. Its innovative design and safety features make it an ideal choice for enhancing workplace safety and productivity.

INTRODUCTION

The Automated Ladder Movement System with Safety Lockout is a revolutionary concept aimed at improving workplace safety and efficiency in industrial and commercial environments. The system is designed to automate the movement of a ladder using a robot model, eliminating the need for manual operation and reducing the risk of accidents.

To address this issue, our system incorporates a safety lockout mechanism controlled by a dedicated relay. This mechanism ensures that the ladder only rises when a specific button is pressed, preventing unintended movement and enhancing overall safety.

Overall, the Automated Ladder Movement System with Safety Lockout offers a safe, efficient, and user-friendly solution for Its innovative design and safety features make it a valuable addition to any workplace seeking to enhance safety and productivity.

At its core, the Robotic Ladder is engineered to enhance safety for users working at heights. Equipped with state-of-the-art sensors and intelligent algorithms, it ensures stability and balance, reducing the risk of accidents. Its automated features also minimize the need for manual adjustment, further enhancing safety and efficiency.

OBJECTIVES

The objective of the Robotic Ladder is to provide a safe, efficient, and versatile solution for accessing heights in various environments. By incorporating robotics and advanced technology, our goal is to enhance productivity, minimize risks, and streamline vertical access operations across industries such as construction, maintenance, and emergency response.

RESEARCH METHODOLOGY

[1] Richard A. Stephans (2004) to produce a ladder, the safety system should be emphasized in all aspect to be safer and better quality to use it Safety system is the name given to the effort to make things as safe as practical by systematically using engineering and management tools to identify, Analyze and control hazard. The safety system effort is sometimes called an approach, a discipline, a concept, a doctrine and a philosophy. Things to be made safe can be systems, programs, projects, products, operations 7 or facilities. As safe as is practical may be express as the best degree of safety, optimum safety or optimum risk management within constraints (operational effectiveness, cost and time).

[2] J.P Den Hartog (1949) to produce a project must use strength of materials so that the project will be produce in good quality and durable. Theories of strength: After the loads on an engineering structure have been determined or properly estimated and when from these loads and the chosen dimensions of the structure the stress have been calculated, the sixty-four-dollar questions presents itself of whether the construction is safe or not., the questions reduces to that of the safety of an element of material subjected to a given stress pattern. During the last two centuries a number of assumptions have been made concerning the criterion of failure of such an element and these assumptions have been honoured with the designed "Theory of Strength".

[3] Davision & Graham W.Owens (2012) the use of steel and design also needs appropriate selection to provide good project folding ladder. Consideration of the whole structure is essential for the analysis of the stability portals of the folding ladder. It may also be more convenient to use a steel model of 9 the entire structure to assist with the organization of the load cases of governing actions. Design philosophy: Simple connections are defined as those connections that transmit end shear only and have negligible resistance rotation and therefore do not transfer significant moments at the ultimate limit state. This definition underlies the design of the overall ladder in which the steel are designed as simply-supported and the shear are designed for axial load and the small moments induced by the end reactions from the ladder Several automatic control systems have been developed to free users from the ladder

[4] Warren R.Merrill (1994) ladder stability is also very important to produce project Joystick. A ladder stabilizer comprising a telescopically adjustable leg having an upper end and a lower end a coupling mechanism for coupling the upper end of the leg to a ladder and allowing the leg to be pivoted and rotated with respect the ladder. Limiting means for limiting the extent to which the leg can be pivoted and rotated and a foot pivotally coupled to the lower end of the leg and having a gripping mechanism extended downwards therefrom for preventing the foot from slipping when placed on a recipient surface.

[5] Hugo Hoije (1978) painting of steel for ladder requires the right way so that the paint steel is not easily rusted and fragile. A method of preparing a steel surface for painting or enamelling in which the surface is coated with a tin-zinc alloy by electrodeposition from an aqueous electrolyte containing zinc sulphate, tin sulphate and sulphamic acid the proportion of tin sulphate to zinc sulphate being such as to provide a weight ratio of not less than 20:80 and not more than 60:40 between the tin and the zinc present in the solution It is an object of the present invention to provide an improved method of treating a steel surface which imparts to said surface the property of providing a strong adhesive bond with a coating of paint or enamel subsequently applied on said surface.

PROBLEM DEFINITION

Robotic ladder systems require sufficient power to operate autonomously for extended periods, especially in remote or inaccessible locations. Optimizing power consumption and ensuring adequate battery life are essential considerations. Ensuring the safety of both operators and bystanders is paramount. Robotic ladder systems must be designed with robust safety features to prevent accidents, especially when operating in dynamic environments or at heights. Maintaining stability and balance while climbing ladders, especially on uneven or slippery surfaces, can be challenging for robotic systems. Ensuring reliable traction and stability mechanisms is crucial to prevent falls or accidents.

OVERVIEW OF THE PROJECT

The scope or the limitation is the most important part to ensure the implementation of this project is in line with the objective. Therefore, this project must not be exceeding it goals and it functions. This project is restricted to users with 80kg weight and below. Overweight users cannot be accommodate and the folding ladder cannot be moved. The folding ladder only suitable to construction work such as wiring and painting for maximum height of 3m. Ceiling or any height place exceeding 3 meters are inconsistent. The main problem is, the difficulty of the users in term of moving

the folding ladder to another place. Suitable for construction work such as cleaning ceiling, painting and wiring. This includes researching and integrating cutting-edge technologies such as artificial intelligence, sensors, and automation to ensure superior performance and adaptability in diverse environments. Additionally, the project involves addressing regulatory compliance, user interface optimization, and scalability to meet the needs of various industries and applications.

ARDUINO UNO (HARDWARE)

Arduino/Genuino Uno is a microcontroller board based on the AT mega 328P . It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

RELAY

For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical. The coil current can be on or off so relays have two switch positions and they are double throw switches. The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil.

DC MOTOR

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The Arduino based DC motor speed control shown in figure 4.5. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

New: Creates a new instance of the editor, with the bare minimum structure of a sketch already in place.
Open: Allows to load a sketch file browsing through the computer drives and folders.
Open-Recent: Provides a short list of the most recent sketches, ready to be opened.
Sketchbook: Shows the current sketches within the sketchbook folder structure by clicking on any name opens the corresponding sketch in a new editor instance.
Examples: Any example provided by the Arduino Software (IDE) or library shows up in this menu item. All the examples are structured in a tree that allows easy access by topic or library.
Close: Closes the instance of the Arduino Software from which it is clicked.
Save as: Saves the sketch with the current name. If the file hasn't been named before a name will be provided in a Save as window.
Save: Allows to save the current sketch with a different name.
Page-Setup: It shows the Page Setup window for printing.
Print: Sends the current sketch to the printer according to the settings defined in Page Setup.
Preferences: Opens the Preferences window where some settings of the IDE may be customized as the language of the IDE interface.
Quit: Closes all IDE windows. The same sketches open when Quit was chosen will be automatically reopened the next time you start the IDE.
Undo/Redo: Goes back of one or more steps you did while editing when you go back you may go forward with Redo.
Cut: Removes the selected text from the editor and places it into the clipboard.
Copy: Duplicates the selected text in the editor and places it into the clipboard.
Copy-Forum: Copies the code of your sketch to the clipboard in a form suitable for posting to the forum, complete with syntax colour.

Copy-as-HTML: Copies the code of your sketch to the clipboard as HTML, suitable for embedding in web pages.

Paste: Puts the contents of the clipboard at the cursor position, in the editor.

Select-all: Selects and highlights the whole content of the editor.

Comment/Uncomment: Puts or removes the comment marker at the beginning of each selected line.

Increase/Decrease-Indent: Adds or subtracts a space at the beginning of each selected line, moving the text one space on the right or eliminating a space at the beginning.

Find: Opens the Find and Replace window where you can specify text to search inside the current sketch according to several options.

Find-Next: Highlights the next occurrence if any of the string specified as the search item in the Find window, relative to the cursor position.

Find-Previous: Highlights the previous occurrence if any of the string specified as the search item in the find window relative to the cursor position.

CONCLUSION

In conclusion, the Automated Ladder Movement System with Safety Lockout represents a significant advancement in workplace safety and efficiency. By automating ladder movement and incorporating a safety lockout mechanism, the system addresses key limitations of existing systems and offers a safer, more efficient alternative for accessing elevated areas in industrial and commercial settings. One of the system's key advantages is its enhanced safety features. The safety lockout mechanism ensures that the ladder only rises when a specific button is pressed, preventing accidental or unauthorized movement. This feature significantly reduces the risk of workplace accidents, making it an invaluable tool for improving workplace safety. Furthermore, the system's automation capabilities improve efficiency by eliminating the need for manual ladder operation. Users can easily control the ladder's movement using the system's user-friendly interface, consisting of a keypad. Real-time feedback on the ladder's movement allows users to monitor its position and ensure safe operation.

I. ACKNOWLEDGMENT

REFERENCES

1. K. Bouyarmane et al., "Exploring humanoid robots locomotion capabilities in virtual disaster response scenarios," in Proc. of IEEE-RAS Intl. Conf. on Humanoid Robots, 2012, 337–342.
2. J. Vaillant et al., "Multi-contact vertical ladder climbing with an hrp-2humanoid," Autonomous Robots, vol. 40, no. 3, 561–580, 2016.
3. H. Yoneda et al., "Vertical ladder climbing motion with posture control for multi-locomotion robot," in Proc of Intl. Conf. on Intelligent Robots and Systems, 2008, 3579–3584.
4. M. Kanazawa et al., "Robust vertical ladder climbing and transitioning between ladder and catwalk for humanoid robots," in Proc. of Intl. Conf. on Intelligent Robots and Systems, 2015, 2202–2209.
5. Y. Zhang et al., "Motion planning of ladder climbing for humanoid robots," in Proc. of Intl. Conf. on Technologies for Practical Robot Applications, 2013, pp. 1–6.
6. J. Luo et al., "Robust ladder-climbing with a humanoid robot with application to the darpa robotics challenge," in Proc. of Intl. Conf. on Robotics and Automation, 2014, 2792–2798.
7. Z. Lu et al., "Transition motion from ladder climbing to brachiation for multi-locomotion robot," in Proc of Intl. Conf. on Mechatronics and Automation, 2009, 1916–1921