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Inspection Robot for Transmission Line

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ABSTRACT

The goal of the project is to develop a robot for effective inspection and maintenance of power transmission lines. The robot is designed to move autonomously in different types of power lines, such as control cables, transmission towers and insulators. The system has a number of sensors and observation systems that allow collecting information about the condition of power lines, for example through visible control options and voltage monitoring. To detect and locate such faults, such as broken wires, insulation or electrical anomalies, the collected data must be processed using advanced signal processing techniques and machine learning algorithms. The robot's control system allows it to move along power lines and make real-time decisions based on the data it collects. Energy management, the use of power line energy saving techniques and the use of efficient battery management systems to extend the life of the robot are also part of this project. The proposed transmission line robots aim to reduce reliance on manual inspection and maintenance procedures, ensure worker safety, and improve transmission infrastructure efficiency and reliability.

Keywords : Transmission Line Inspection, Robot Vision Systems, Transmission line, robot, RF module, inspection, power system, Suspended Robot

I. INTRODUCTION

Long power lines run around the world to generate electricity in different states, regions, cities, neighborhoods and houses. These are the most common products in the electrical industry. Currently, the most important thing is to maintain the reliability and efficiency of these transmission lines, which is achieved by regular inspections either by hand or by helicopter, which is considered an expensive and risky mode of transport (only used abroad). about inspectionAccording to Forbes, inspection and repair of power lines is dangerous seventh in the world. Professional verification of this system eliminates 100% risk and increases data accuracy. The works would be completed more quickly and thanks to better

management, the state of the electrical systems would improve. The transmission line was controlled mostly by hand or by riders with gondolas hanging from the lines looking at the ground with binoculars. In recent years, inspection work with an autonomous inspection robot of electric lines has increased. The main purpose is to check the physical condition of overhead lines carrying 440 KV load. The task of these systems is to actually walk these transmission cables, use their camera to inspect and visually inspect various transmission parameters (such as wires, insulation, etc.) and measure clearance or distance. between line and ground. An electrical transmission system consists of a system of wires that transports electricity from a power plant to distribution stations for residential and industrial use. An underground transmission configuration is environmentally friendly but very expensive compared to an overhead transmission system. As a result, overhead lines are more commonly used to transmit electricity around the world. These power lines, which sometimes pass through harsh environments (hot deserts, mountains, dense forests and bodies of water), are installed vertically on fixed towers using insulators, spacers and attenuators, among other things.

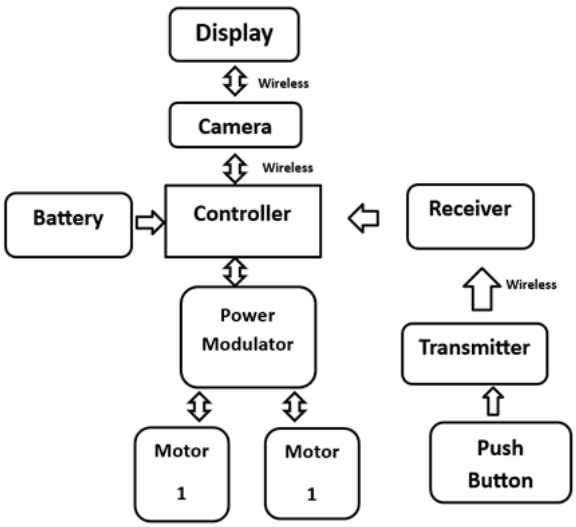
II. OBJECTIVE

- It can reduce risks of human life by 100 percent.
- We can change the speed operation according to whether condition
- The maintenance of robot is negligible.
- Increasing life of transmission line by 10 to 15 %.
- This robot can also minimize cost of inspection and maintenance.

III. LITERATURE SURVEY

- According to Pradnya B. Wale, Kamal Sandeep k paper considers robotic power line maintenance by applying transmission line monitoring and also power line damage detection. [1]
- According to an article by Ajit Paul Abraham and S. Ashok, the Line Recognition Robot can monitor subsidence, current, acceleration, vibration in transmission lines, temperature, hum... [2]
- By Alisson Fonseca, Ricardo Abdo and João Alberto This article provides a brief overview of the design and construction of an electric robot to inspect transmission defects such as broken conductors and broken chamber dampers... [3]
- A summary of the findings from Ahmad bala Alhassan, Xiaodong zhanga, Haiming shena and Haibo xu Transmission Line Inspection Robots: Future Research Trends and Challenges is presented in this paper. [4]
- According to Dr. Andrew Phillips, Eric Engdahl, Drew McGuire, Mark Major paper describes a video submission that provides an update on the development of a robot that autonomously inspects high voltage transmission lines.[5]
- According to Aibin ZHU, Yao TU, Weitao ZHENG, Huang SHEN and Xiaodong ZHANG, the authors of this study designed a high-voltage power line inspection and foreign object cleaning robot and demonstrated its ability to move on power lines and over separators. counterweights quickly and smoothly using motion simulation and prototype testing. [6].

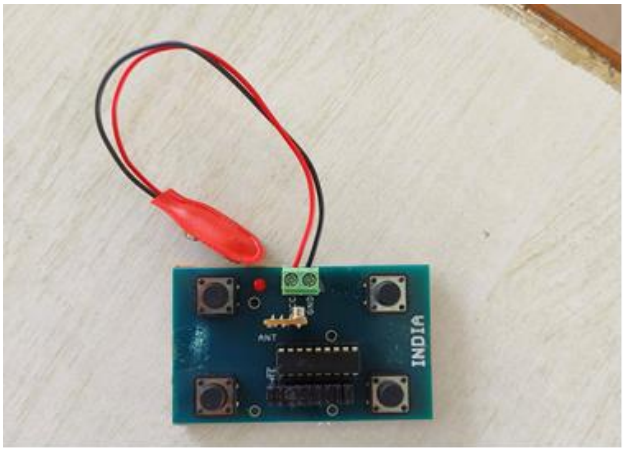
IV. BLOCK DIAGRAM



V. WORKING

It works with wireless technology, so it is safe to use and can be controlled wirelessly with a remote control. It is designed to operate in live mode, monitoring physical conditions, obstacles and simultaneously transmitting live data collected from the field. This information can be recorded when the inspector is not in the operator's room. The robot is installed on the transmission line to work according to the principle of walking stop detection. It works on the transmission line and precisely controls the physical parameter of the transmission line. It then transmits the collected data to the user sitting in a centralized location, in a secure location. The robot can overcome all the small obstacles like dividers, dampers and also the biggest obstacles like towers and jumpers etc. A comprehensive plan is prepared before the inspection. This includes determining the scope of the audit, determining the audit techniques and equipment to be used, and allocating resources such as personnel and time. This may include assessing the structural integrity of the transmission line, identifying potential hazards or risks, and assessing the condition of certain equipment. components or ensure compliance with safety regulations. Properly defined objectives help to focus the inspection work and ensure that the desired results are achieved. Determine the scope of the inspection, including the parts of the transmission line to be inspected and the components or structures to be inspected. Consider factors such as the age of the line, its operating conditions and recent events or maintenance that may affect the scope of inspection. Create a detailed schedule that takes into account resource availability, weather conditions, and potential line interruptions or disruptions. Determine appropriate inspection methods and equipment to be used. This may include visual inspection, aerial surveys by helicopters or drones, thermal imaging, ultrasound, ground measurements or other specialized methods. Choose the most suitable technologies according to your goals, the accessibility of the power line and the type of information you need. Determine the resources needed for the audit, including personnel, equipment and support services. Assign roles and responsibilities to members of the inspection team, taking into account their knowledge and experience in relevant areas such as electrical engineering, structural analysis or inspection methods. Ensure that the team has the necessary equipment and tools for inspection activities. Identify potential risks associated with the inspection, such as working at height, electrical hazards or environmental issues. To maintain compliance and ensure the safety and reliability of the transmission line, ensure that the inspection plan meets these requirements. Plan the collection, management and analysis of audit data. Create a system to organize and securely store the collected data. Consider using advanced data analysis techniques such as artificial intelligence or machine learning to help identify patterns or anomalies in audit data. Develop a framework for presenting audit findings and recommendations. Determine the form, content and details of the inspection report. Include photos, videos, and other relevant visual evidence to support your findings. Make sure the report is clear, concise and user-friendly, and includes instructions for any necessary repairs or maintenance.

5.1 REMOTE CONTROLLER



Only one switch is needed to control one motor in one direction to turn the motor on and off. What if you want your engine to change direction? The simple answer is to reverse its polarity. This can be achieved with four switches cleverly arranged so that the circuit not only controls the motor, but also controls its direction. Among many, one of the most common and clever designs is the H-bridge circuit, where the transistors are arranged in a shape that resembles the English letter "H". The H-bridge is an electronic circuit that allows the voltage to be. connected to the load in any direction. H-bridge circuits are often used in robotics and many other applications to allow DC motors to move forward and backward. In particular, a bipolar stepper motor is always controlled by a double H-bridge motor controller. The H-bridge is made by four switches such as S1, S2, S3 and S4. When switches S1 and S4 are closed, +ve voltage is supplied to the motor. Opening switches S1 and S4 and closing switches S2 and S3 reverses this voltage, allowing the motor to run in reverse. Typically, an H-bridge motor control circuit is used to reverse the direction of the motor and also to turn it off. engine If the motor stops suddenly because the terminals of the motors are short-circuited. Or allow the motor to stall while the motor is disconnected from the circuit. The table below shows the different functions of the four switches corresponding to the above circuit.

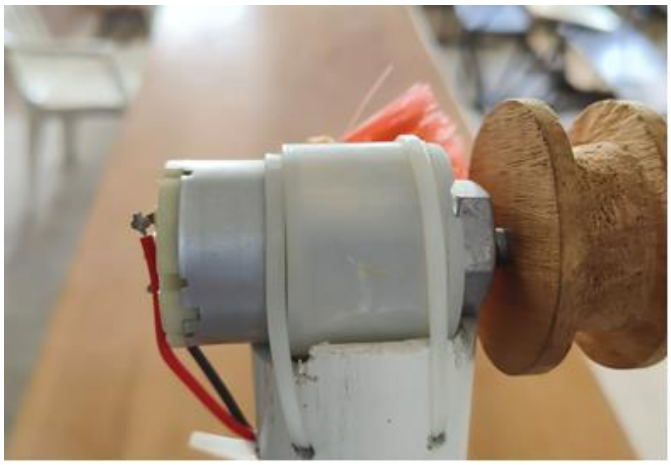
5.2 L293d MOTOR DRIVER

Even the simplest robot needs a motor to turn a wheel or perform a certain function. Since motors require more current than a microcontroller pin can normally provide, you need some kind of switch that takes a small current, amplifies it, and produces a larger current that still drives the motor. This whole process is carried out by the so-called engine controller. With the L293D motor driver IC, this task is easy and has served many applications with relative ease.

5.3 CAMERA

The camera has wireless connectivity options such as Wi-Fi or Bluetooth. It can create its own Wi-Fi network or connect to an existing network. Mobile App Installation: The user must install the mobile app provided by the camera manufacturer. This application allows communication between the camera and the mobile device. The mobile app provides a live view of the camera lens, allowing the user to see what the camera is seeing in real time from the mobile device's screen. It helps to crop and adjust images. The mobile app allows the user to remotely trigger the camera to take a photo or start/stop video recording. This can be done by touching the virtual trigger on the screen of the mobile phone or using other gestures or voice commands supported by the application.

5.4 DC Motor -10 RPM -12 VOLT



DC Motor 10 rpm, 12-volt gear motors are usually simple DC motors with a gearbox. It can be used in terrain robots and various robotics applications. These motors have a 3mm threaded hole in the center of the shaft, which makes it easy to attach to a wheel or other mechanical assembly.12-volt DC reciprocating motors are widely used in robotics applications. Very easy to use and available in standard sizes. You also don't have to spend a lot of money to control the motors with an Arduino or compatible board. The most popular L298N H-bridge motor controller with built-in voltage regulator can be used with this motor in the voltage range of 5-35 V DC, or choose the most accurate motor driver module from our wide range of motor controllers. category according to your special requirements. Nut and threads on the axle for easy connection and internal threaded axle for easy wheel mounting. Heavy-duty heavy metal geared DC motors, available in a wide RPM range and ideal for robotics and industrial applications, very easy to use and available with standard size nuts and shaft threads for easy shaft connection and internal threading for easy wheel connection. Speed.: Motor rotates at approximately 10 rpm (rpm). This means it will make one full revolution every 6 seconds.

ADVANTAGES

• This problem can be solved by minimizing human intervention in robots.

- This reduces the risk of human life by 100 percent.
- increases the life of the power line by 10-15 percent
- It can decrease. the time required to inspect the power line. And it requires less manpower, one person can operate this system
- We can change the speed according to the situation
- This not only extends the life of the components, but also reduces the repair cost, resulting significantly. lower payback time, which will definitely benefit the industry
- The main advantage of this method is that accurate inspection, maintenance and upgrading of PTLs can be done without interruption of the power supply.

7.APPLICATION

- It improves the quality of transmission line inspection due to the advanced techniques involved.
- Faster operation compared to manual inspection.
- Minimizes line downtime, which increases reliability.
- Most importantly, it minimizes or eliminates the associated risks. . . when checking power lines.

VI. CONCULSION

It has the potential to significantly decrease the risk of human mortality. This operation has no human intervention, so there is no risk of death. We can change the speed function according to the situation. By allowing the controller to specify an appropriate time frame for inspection, it can speed up the robot. In the evening, the robot keeps an eye on the power supply. Maintenance of the robot is negligible. It is easy to use. Extending the life of the power line by 10-15%. Maintenance is carried out periodically to prevent errors and reduce the need to diagnose the problem through regular inspection of electrical losses.

This robot can also minimize inspection and maintenance costs. This power line inspection robot would eliminate 100% of the risk, increasing safety and data accuracy. It simultaneously transmits current, temperature and voltage readings and detects both forward and reverse resistances, faults, faults and abnormal drops in power lines. Efficiency is boosted by cleaning electrical wires, which in turn reduces the discharge of corona. By automating the work, the robot can make decisions while moving along power lines. The application includes the ability to use wire crawling robots to inspect suspension bridges, transport materials using ropes from remote locations, detect electricity theft, and explore mine sites.

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