

Maintenance of Transmission Line by Using Robot

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ABSTRACT

This paper deliberates Maintenance of transmission line by using robot by application of monitoring transmission line and also for the transmission line damages detection. Managing maintenance of overhead transmission line is difficult, hence in order to maintain the same, robotic will play very important role in electrical system.[12] Which will improve time of maintenance and predictive maintenance for transmission line. Considering workers safety while working on overhead line it will have good potential. Now-a-days inspectors are carrying inspection of transmission line by survey through aviation method which is cost to electricity board. On the basis of survey of workers, the robot will segregates the data and will directly transfers to control room.[1] The robot continuous run to transmission line in 500kv power line. In this techniques equipped with voltage sensor used for measuring voltage on transmission line, current sensor used for measuring current on transmission line. RF module for communication purpose. Visual Camera are installed in robot to capture the images and sent to the control area. Simulation is done by Proteus software.

Keywords: Transmission line, Robot, RF module, Inspection, Proteus software, Power system.

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I. INTRODUCTION

In recent years, demand of electricity in our country is increased due to population and supposes power generation capacity in our country is low. To supply the power all over it plays very vital role and it can be achieved by reducing the power losses and maintaining the power system efficiency. Considerably human safety and nature conditions. We introducing the robot and for purpose of monitoring transmission lines in real time conditions.

The robot will travels on the transmission lines with the help of rollers and it will suspended on transmission lines. The utilization of human being is minimized by using robots. The robot can overcome from any obstacles on power lines for this we need rigid robotics having cameras for thermography image processing, power sources and power sensors.

Basically the robot is constructed from lightweight carbon fiber material forms the body. These carbon fiber materials have strength of higher insulations and mechanical strength too. Two numbers 12V dc batteries are provided in order to illuminate the LCD display which is mounted on robot and it will display the technical parameters with correct fault conditions. Another battery is utilized for working two DC

motors which will cause of movement of wheels of robot and balance for controlling of other controllers.

The robot is consist/forms by the following components i.e. current transformer used for measurement of transmission line current, voltage transformer used for measurement of transmission line voltage. Carbon fiber type robot frame for entire system mechanical support visual camera are installed in robot module which captures images of transmission line and surrounding area. Rotating shaft for robot movement with small geared wheel assembly.

For communication purpose transmitter and receiver which is made from RF method to have better communication between robot and control room. The robot movement will be handled by or controlled by remote control. Finally the microcontroller which will gather all the data received from different sensors and it will transfer to the transmitter.

II. TRANSMISSION LINE INSPECTION PROBLEMS

Most of transmission lines made of galvanized conductors that is ACSR conductors. Climate conditions like rainy, high

temperature, snowing, wind which affects life of support insulators like minor air pack on insulators or due to very high arc current causes thermal cycling. These are the main reason of cracking supporting insulators. These cracks allows water entry into insulators which leads to damage insulators.

Aging of conductors is big phenomena in overhead transmission lines because of conductor's corrosion, moisture and dusty climate due to wind huge vibration are taken place causing damages to supportive structure.

Due to discharge of leakage currents in transmission lines several damages are getting rises. Due to conductor ionization it leads to generation of corona effect means ionization of current and atmospheric air. This corona effect produces ultra-high frequency range radio active noise.

This discharge current can be used for measurement purpose.

III. EXISTING POWER LINE INSPECTION METHODS

Initial Inspection

After the construction transmission lines inspected and it is completed before energizing line. Linemen or wiremen should climb each structure and check the following:

1. Conductor condition.
2. Conductor sag and clearance to ground, trees, and structures. Insulator conditions.
3. Line hardware for roughness and tightness.
4. Structure vibration and alignment.
5. Ground-wire connections and conditions.
6. Ground resistance at each structure.
7. Structure footings for washouts or damage.
8. Obstruction light operations for aircraft warning.

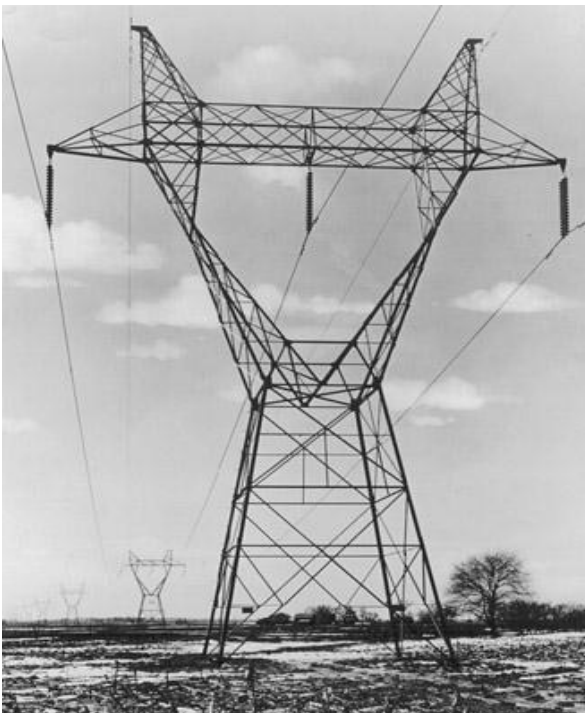


Figure1: Extra-high-voltage ac electric transmission line completely

Aerial Inspections

Presently Aerial inspection is going on by using aviation method by observer, we can say that helicopter or fixed type blades jets, in this helicopters or Jets are driven by pilot &

observer. This method is adopted since long time & it is carried by taking long time high voltage transmission line outages. The observer will observe the damages to transmission line, insulators, any hardware's is missing or any accumulation of dust on electrical system.



Figure2: A helicopter flying along an electric transmission line, with a lineman

The purpose of inspecting PTLs is to monitor the running conditions and find out the damages of the power grids. Presently, this inspection task has been carried out manually by a worker with a telescope on the ground. For improving inspection quality, the worker sometimes has to climb the tower and ride in a gondola suspended on overhead ground wires (OGWs). The manual inspection method has many disadvantages, such as long inspection cycle, high working intensity and risk. A helicopter with a video camera is also used to inspect PTLs. However, this method is very expensive, and the video images provided from the helicopter are usually out of focus. Compared to the methods mentioned above, using a mobile robot is often advantageous in reducing costs, increasing efficiency, enhancing safety, and so on. Over the past few years, many research teams have presented their work on robotic technologies for inspecting PTLs, and some prototypes have been developed.

In addition to robotic technologies on complete systems, many significant progresses focused on particular subsystems or specific functions of mobile inspection robots, including approaches to locomotion and obstacle crossing, computer modeling and simulations, control strategy, obstacle detection and identification, energy harvesting from the power line, and so on, have been made by some research.

IV. PROPOSED INSPECTION METHOD

We have established temporary HT towers with the transmission lines of ACSR type. The robot is placed on ACSR conductors, the robot will mount on transmission line by the support of nylon wheels. On the robot placed receiver system. A controller board and the GPRS modem for data connection. This method is used only for data collection at sending and receiving end. The robot is used for data collection at fault location from live line.

Basically the robot is consists of a current coil for the purpose of measurement of insulation strength. 12V dc supply operated motors, composite type robot frames,

thermal imaging camera, rotating gears & rotating shaft, micro-wheel assembly, transmitter, receiver, GPS and a micro-controller unit, Current coil has placed to determine the flow of current factor through the live transmission lines and the change in the current coil reading gives the quality of insulation. It is also used to determine the transmission voltage level. Thermal imaging camera is used to measure the temperature of components & also for identification of any obstacles at the time of forward reverse movement of robot system, this captured image will directly send through transmitter & receiver to the control room by using GPS software.

The robot will be placed on transmission line by switching on its control supply which is being taken from 12V DC battery. On ACSR transmission line, suppose high current flows through lines current coils will measure the current flowed through the lines. By same method the voltage will be measured by voltage transformer. Referring to received current from CT we can conclude that system is healthy or not healthy which will be displayed on the LCD display mounted on robot system. By this method we can take the live pictures which will show us on line images & any obstacles may hamper the life of transmission lines. Same information's may transfer to control rooms using GPS software's, RF transmitter & receiver.

Facilities available:-

The following facilities to carry out dissertation work are available at.

1. Transmission poles and wires
2. Robot body structure material i.e. wheel, Arms, Insulations.
3. Electrical Motors-DC motors
4. Parameter sensing equipment.
5. Voltage sensor, Current Sensor.
6. Microcontroller
7. RF transmitter & receiver
8. Battery 12v
9. Camera
10. Image Transmitter, Image Receiver.
11. GPS Software

V. ROBOT INSPECTION BLOCK DIAGRAM

The basic block diagram of robot inspection is interpreted as below in figure 3.

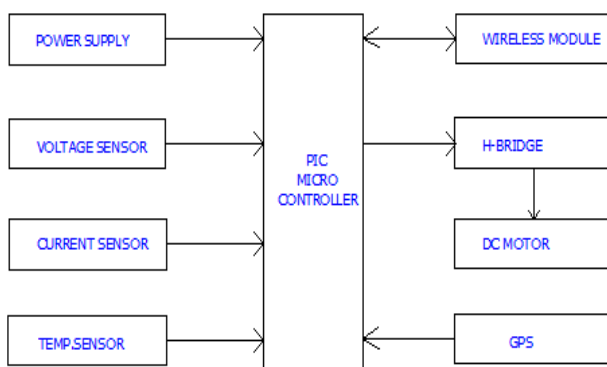


Figure3. Block diagram of Robot Inspection

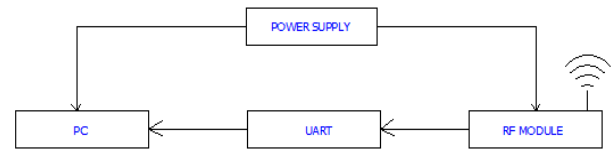


Figure4. Monitoring System

Description:

The images on transmission line and surrounding area captured from the camera are received by the controller through the RF module. The images of transmission line conditions are observed on our PC in a control room. In case if any defects found then Red LED glows and LCD indicates transmission line faulty.

VI. SIMULATION

The simulation results of the proposed inverter are carried out in MATLAB Simulink model. Simulation circuit diagram is demonstrated as shown below in figure 5.

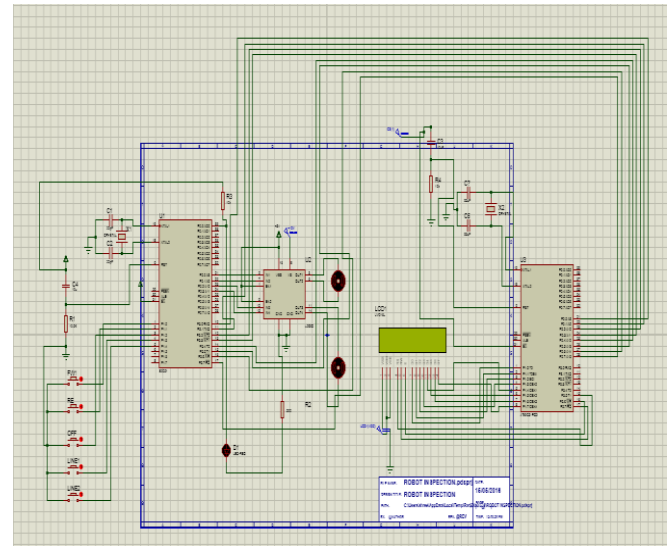


Figure 5. Simulation block diagram

Proteus software used for simulation of robot monitoring inspection. There are four switches are used. Function of each switch is different. First switch is used for Robot movement forward direction, second switch is used for reverse direction, third switch is for Robot stop and last switch is for the current and voltage measurement and displayed on LCD. In case of defect found on the transmission line, buzzer gets on and which fault is there displays on the LCD i.e. transmission line is faulty.

VII. CONCLUSION

Considering above details conclude that by using robot for maintenance of transmission line we can reduce the time which will affect the other system at the time of maintenance. Also important is the life of human being, avoids haphazardous considering to safety point & reliability of system. To carry servicing of transmission line it will be helpful in future use of robot. This system works on

automatic system by remote control system using RF transmitter & receiver by sending images & video's.

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