

Design And Implementation of Robot Based on Xgboost For Smart Powerline Maintenance

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Abstract- In scenarios of the overhead power line system, manual methods are inefficient and unsafe. This paper is devoted to sharing innovative robot applications for transmission line inspection & maintenance. As with any preventive maintenance technology, the efforts spent on status monitoring are justified by the reduction in the fault occurrence and elimination of consequent losses due to disruption of electric power and damage to equipment. In addition to sensitivity improvement and subsequent reliability enhancement, the use of robotic platforms for power system maintenance has many other advantages like replacing man workers for dangerous and highly specialized operations such as live line maintenance. Mobile monitoring involves the development of a robotic platform carrying a sensor array. This continuously patrols the power cable network, locates incipient failures, and estimates the aging status of electrical insulation. Monitoring of electric power systems in real time for reliability, aging status and presence of incipient faults requires distributed and centralized processing of large amounts of data from distributed sensor networks.

Keywords- PL-Power line, IOT-Internet of Things, TL-Transmission Line, RF Module-Radio Frequency Module, ADC-Analog to Digital Converter, MCU-Micro Controller Unit, RAM-Random Access Memory, SDK-Software Development Kit.

I. INTRODUCTION

In recent years, the demand of electricity in our country has increased due to rise in population. To supply power all over is a big task and it can be achieved by reducing the power losses and maintaining the power system efficiency considering human safety and nature conditions. Any failure in such lines may bring severe consequences to people's daily lives, affecting transportation, health, security, and sanitation, to mention just a few. Therefore, the proper maintenance of high-voltage TL is of extreme importance.

Preventive maintenance is the best way to avoid problems with infrastructure, by detecting them in an early

stage and responding accordingly with action plans for repairs or improvements. We introduce a robot for the purpose of monitoring the TL in real time conditions. The robot travels on the TL with the help of rollers and it will be suspended on TL. The utilization of human beings is minimized by using robots.

The robot can overcome any obstacles on PLs for this rigid robot having cameras for thermography image processing, power sources and power sensors are included. Maintenance of overhead (OH) TL is difficult, hence, to maintain the same, robotics plays a very important role in electrical system which will reduce time of maintenance. Considering worker's safety while working on OH line it will have good potential. Based on a survey of workers, the robot will segregate the data and will directly transfer to the control room. The robot traverses continuously on high voltage PL. In this technique, robots are equipped with voltage sensor used for measuring voltage, current sensor used for measuring current on TL. RF module for communication purposes. Visual Camera is installed in robot to capture the images and send them to the control area. This method is so advantageous in reducing cost, increasing efficiency, and enhancing safety.

As technology helps us to understand its importance like in urban areas. But the problem arises when a fault occurs in the cable and is also difficult to detect the exact location of the fault during the process of repairing that cable and the methods in existence till now follow some algorithm to identify the location of the fault. The fault creation is made by the set of Voltage Divider. The relays are controlled by the relay driver. In case of short circuit, the voltage across series resistors changes accordingly, which is then fed to an ADC to develop precise digital data to a programmed Esp8266 micro controller kit that further displays exact fault location from base station in kilometers.

II. OBJECTIVE

Power line detection plays an important role in power inspection systems. The improvement and subsequent

reliability enhancement, the use of robotic platforms for power system maintenance has many other advantages like replacing man workers for dangerous and highly specialized operations such as live line maintenance. Mobile monitoring involves the development of a robotic platform that helps to handle the power line easily. Therefore, the proper maintenance of high-voltage TL is of extreme importance. Preventive maintenance of the lines aims at detecting damage in the case or in the core of the cables and requires people to walk on the lines, a time-consuming and dangerous job, in spite of all the safety procedures applied.

Following are some important objectives of TL maintenance system:

- Design and implementation of robot for maintenance the high voltage transmission line.
- To get the information about the transmission line in real time via Thingspeak cloud service.
- To bring IOT based mobile monitoring solutions, anywhere, anytime.

III. LITERATURE SURVEY

H. Wang, Y. Feng, Y. Tian and W. Wang designed a system as the stability of the inspection robot during crossing the jumper lines of the live lines of the power transmission is very important. In this study, a novel inspection robot was designed, equipped with a centroid adjusting mechanism to increase the stability during crossing the jumper line. The various obstacle crossing modes of the robot and the corresponding planning are designed. The simulation is carried out to analyze the deformation of the jumper line when the robot is on it. The results can be utilized to plan the motion to improve the robot's efficiency and stability when the robot crosses the jumper line.

M. Chen proposed a power line inspection and maintenance robot to solve these problems. Manipulators are also installed to help the robot perform specific maintenance tasks. The results of lab experiments and field tests reveal that the robot could stably and rapidly cross obstacles, such as suspension clamps, vibration dampers, and spacers, and could perform three kinds of maintenance tasks on the line.

R. Shankar, M. Biessy, S. Selva Roja designed and presented an IoT Based Multiutility Auto Cut-Off Power Charger. The smart electronic device, which has sensors, software programmed controllers and network ports which enable to collect connected device's power level and the collected information is used to track the power level of the device. Moreover, the device can be cut off from the charger

thereby avoiding overcharging of the battery and improves the performance of the device.

IV. METHODOLOGY

The Proposed methodology describes how the Robot must be operate and what the Robot should do. The Robot is designed using the Node MCU with IOT. The current sensor provide required inputs to ESP8266 microcontroller provides value of current through transmission line will be updated automatically without a manpower interruption. In case of any fluctuation raised means can easily deviate. The updated value will be monitored by using cloud. Robot movement can be controlled by the user. ESP32 Camera Provides the image of the live transmission line values. The robot forming the core of the line inspection robot mobile sensor system must comply with several demands for the system to be useful. The robot must travel along the conductor of a high voltage Power Line, pass pre-defined obstacles on the PL i.e. all common obstacles, capture enough power for robot's use from the magnetic field generated by the conductor. The Robot pre-defined features on the PL, communicate with a base station. The camera works on the technique of XGBOOST. XG means Extreme Gradient. The performance of this technique is good. We can easily calculate the over current, under current, sparking current on PL through the Robot sensor. Mobile monitoring is done by using the thingspeak cloud service.

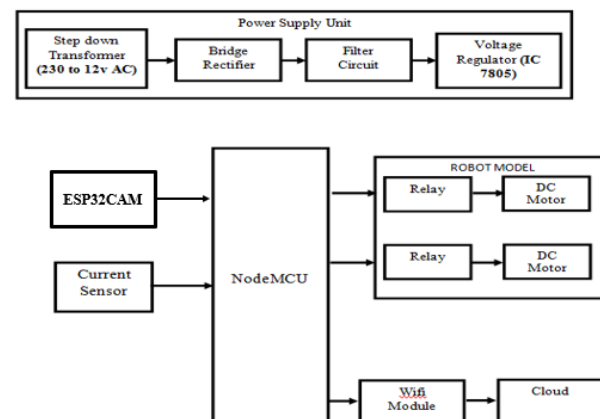


Fig.1. Block Diagram of the system

TRANSFORMER: Basic power supplies the input power transformer, and has its primary winding connected to the mains (line) supply. A secondary winding, electromagnetically coupled but electrically isolated from the primary is used to obtain an AC voltage of suitable amplitude, and after further processing by the PSU, to drive the electronics circuit it is to supply. The transformer stage must be able to supply the current needed.



Fig.2. Transformer

RECTIFIER: Rectifier circuit is used, to convert the AC input is converted to DC. The full wave bridge rectifier uses four diodes arranged in a bridge circuit to give full wave rectification without the need for a centre-tapped transformer. The current paths on positive and negative half cycles of the input. On each half cycle, opposite pairs of diodes conduct, but the current through the load remains in the same polarity for both half cycles.

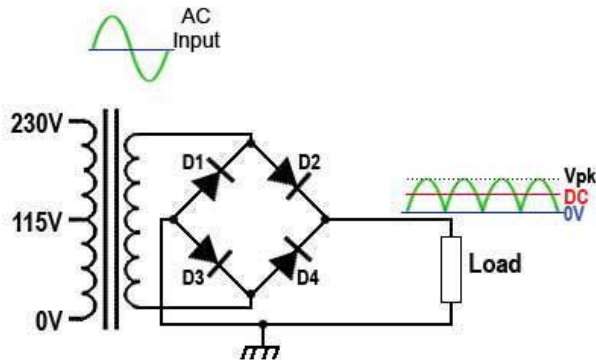


Fig.3. Rectifier

FILTER: A typical power supply filter circuit can be best understood by dividing the circuit into two parts, the reservoir capacitor, and the low pass filter. Each of these parts contributes to removing the remaining AC pulses. The filter gives the DC voltage.

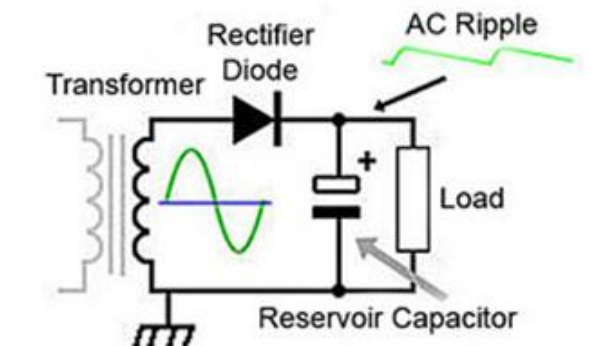


Fig.4. Filter

REGULATOR: Voltage regulator ICs are available with fixed or variable output voltages. They are also rated by the maximum current they can pass. Negative voltage regulators are available, mainly for use in dual supplies. Most regulators include some automatic protection from excessive current and overheating.

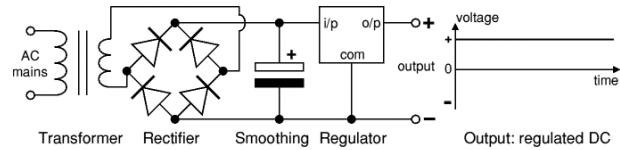


Fig.5. Regulator

NODEMCU: NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SOC from Espressif Systems, and hardware, which is based on the ESP-12 module. The term “Node MCU” by default refers to the firmware. It has many crucial elements like RAM, SDK, Wi-Fi, IOT. It has good memory and storage. Its common to all the designs is the base ESP8266 core. It has 30 pins.



Fig.6. NODEMCU

CURRENT SENSOR: A current sensor is a device that detects electric current (AC or DC) in a wire and generates a signal proportional to it. The generated signal could be analog voltage or current or even digital output. It can then be utilized to display the measured current in an ammeter or can be stored for further analysis in a data acquisition system or can be utilized for control purposes. IT WORKS ON input, current ranges 0-30A.



Fig.7. Current Sensor

RELAY: L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive in either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control

two DC motors with a single L293D IC. Dual H-bridge Motor Driver integrated circuit (IC).

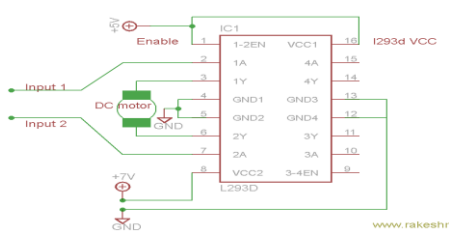


Fig:8. L293D Relay

DC MOTOR: A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. DC motor helps rotate the wheel movement. Dual shaft dc motor is used in the robotics technique.



Fig:9. DC Motor

RF TRANSMITTER AND RECEIVER: The wireless systems designer has two overriding constraints; it must operate over a certain distance and transfer a certain amount of information within a data rate. The RF modules are very small in dimension and have a wide operating voltage range i.e. 3V to 12V. Basically, the RF modules are 433 MHz RF transmitter and receiver modules. we must give the command forward,backward,left,right movement of robot on the transmitter. The receiver observes the signal they give to the ESP8266 MICROCONTROLLER. The relay operates the robot for giving command. The user can easily control the robot.



Fig:10. RF Transmitter and Receiver

V. VERIFICATION AND RESULTS

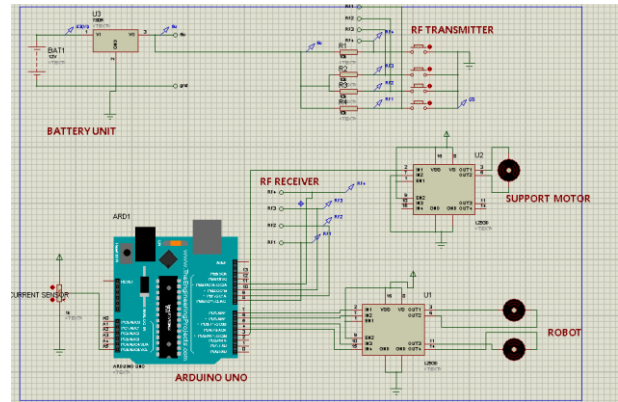


Fig:11. Schematic Diagram of the system

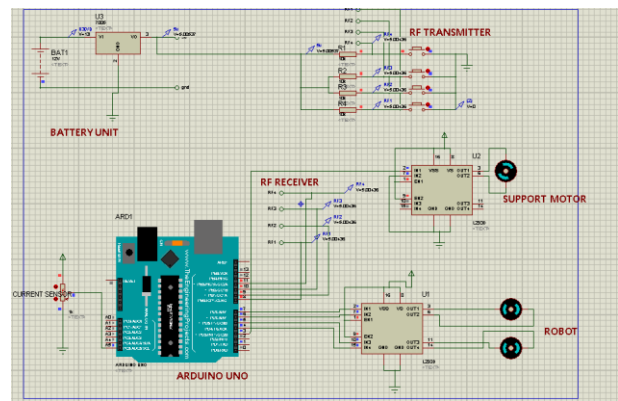


Fig:12. Output of the Robot Movement

In the Schematic diagram of Transmission Line inspection by Robot, Current Sensors are connected as transmitter in the ARDUINO to inspect the current in the Power Line. The Robot movement is controlled by the RF transmitter and receiver system.

VI. ADVANTAGES

- Designing robots is low cost.
- Robot operation saves man workers for dangerous.
- Monitoring gives the live line values.

VII. CONCLUSION AND FUTURE SCOPE

In this paper I propose a power line maintenance by using Robot can reduce the time which will affect the other system at the time of maintenance. Also important is the life of human beings, avoids hap hazardous 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 an automatic system by remote control system using RF transmitter & receiver. The major advantages

include utilization of man are minimizing, captures images of TL & surrounding areas, rolls on entire day with 1m/s speed, do live line work and ensure safety, both save money & time, can accommodate new devices. Tightens, loosens bolts & repairs broken cable strands.

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