International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 02 | Feb 2020 www.irjet.net p-ISSN: 2395-0072

SOLAR POWERED TRANSMISSION LINE INSPECTION ROBOT

Chethan M[1], Bhima Naika Y[2], Brunda S[3] and Ayesha Shamail[4]

[1,2,3,4]*Student, Dept. of Electrical and Electronics, Sri Siddhartha Institute of Technology, Karnataka, India*

Abstract - *This paper represents prototype of a solar powered transmission line inspection robot. It inspects the transmission line by recording certain parameters like voltage, temperature and sag and sends the collected data to mobile device using NodeMCU. It also has video playback regarding faults presents in the line. The robots furnished with inspection sensors, communication devices and instruments can perform on-line identification or assessment of mechanical or electrical defects without disconnecting power supply. The robot collects the information of these transmission lines utilizing different sensors which is sent to the control room with the help of transceiver equipped in the robot. The communication between control room and the robot happens without wires utilizing existing frameworks using RF technology or some other communication protocols. A GSM based model was utilized to precisely show and find the specific spot where fault has happened.*

***Key Words*: HV, IoT, MCU, IC, RISC**

1. INTRODUCTION

The proposed paper consists of an inspection robot and it eliminates the need or intervention of a human operator which rules out any human error. Long transmission lines run across the world to provide electricity in different states, territories, blocks and houses. They are the most widely distributed assets amongst the utility industry. The major objective is to improve on the reliability and efficiency of these transmission lines that is achieved by regular inspection, done either manually or by using helicopters (costly as well as risky modes of inspection).The inspection of high voltage transmission line is a very risky job and the cost of testing it is too high as the design of insulation suit of inspection person can be difficult. So this cost can be reduced by designing a robot which can be used for transmission line inspection, as the time required to inspect the lines by a robot is less when compared to a person which reduces the cost of inspection also. A line inspection robot autonomously inspects transmission lines to detect any faults in the conductors while transmitting the parameters of the line to any device. In this project, Arduino UNO from microcontroller family has been used as CPU. Whenever the robot starts inspecting on the transmission line it senses three main parameters such as current, voltage and temperature and it displays them on any connected mobile device using NodeMCU. The station side operator would be using a basic interface in which two operating buttons with commands like forward and reverse are present and this interface would also be containing space where the parameter readings, live video and images of the transmission line shall be displayed.

2. BLOCK DIAGRAM REPRESENTATION

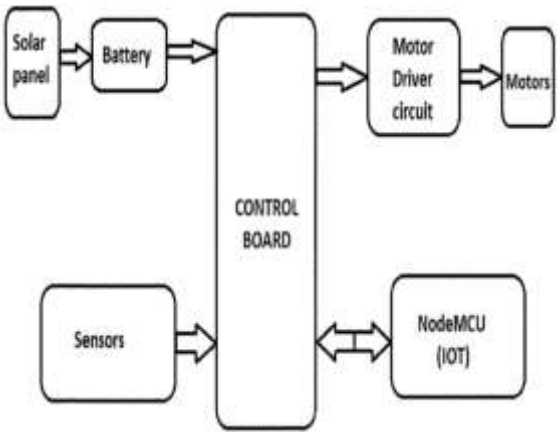
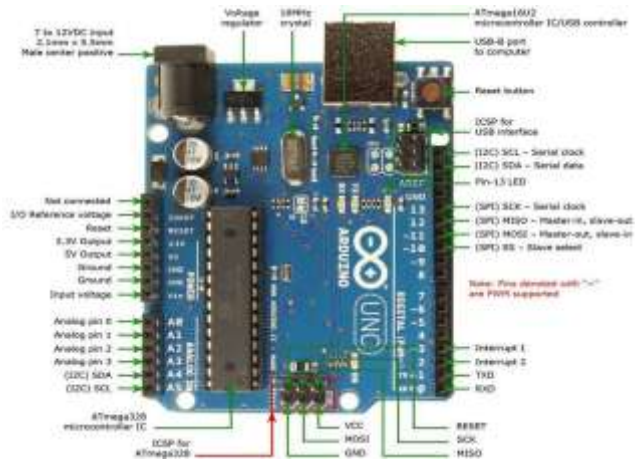


Fig -1: Block Diagram

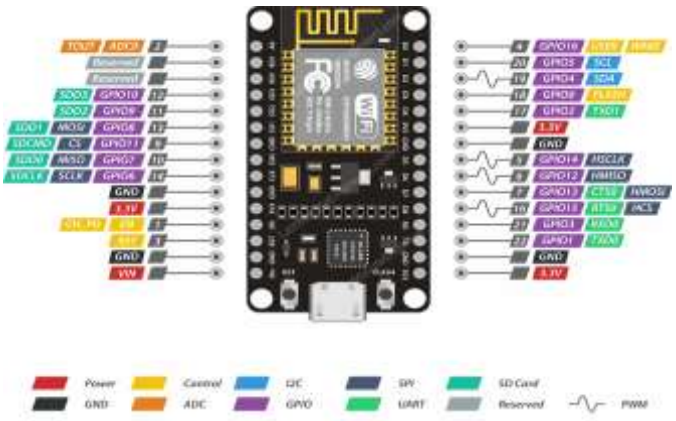
3. COMPONENTS

Arduino UNO



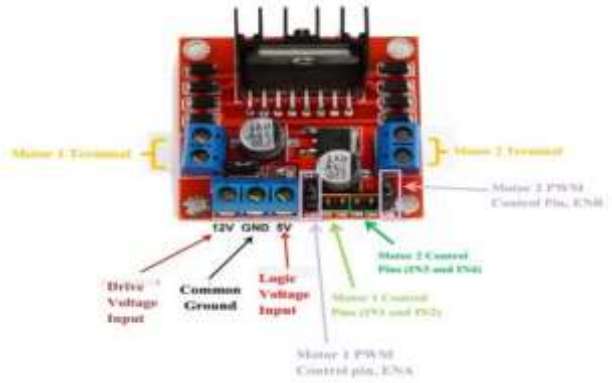
The Atmega328 Microcontroller has an operating voltage of 5V, 14 Digital I/O pins, 6 Analog input pins, 32KB of Flash memory, 2KB of SRAM, 1KB of EEPROM and a Clock speed of 16MHz.

NodeMCU



This is a Tensilica 32-bit RISC Microcontroller with Xtensa LX106 as its CPU. It has an Input voltage of 7-12V, 16 Digital I/O pins (DIO), 1 Analog input pin (ADC), 1 UART and a Flash memory of 4MB.

Driver Circuit



The driver circuit can be used to run two DC motors and speed and direction control is possible with the same IC. It has a motor voltage of 4.5V to 36V, maximum peak motor current of 1.2A, supply voltage of 4.5V to 7V.

Sensors

1) Voltage sensor:

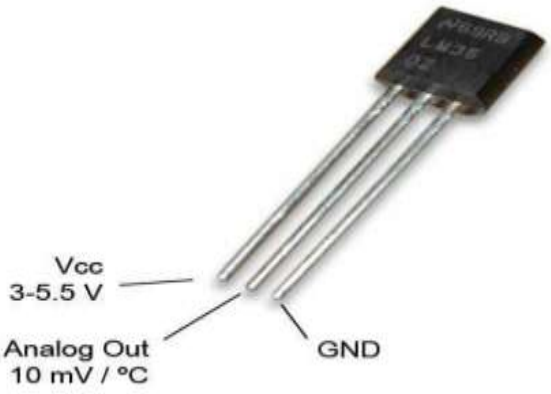
A voltage sensor is ideal for situations where power quality is an issue as voltage sensors facilitate the monitoring of supply voltage levels. They detect under-voltage or over-voltage levels and help protect critical motors and electronics. As these sensors have an industry-standard output of 4–20 mA, they can be easily coupled to a data logger, panel meter or PLC for the real-time monitoring and reporting of data. A step down transformer has to be used for converting the high voltage to a low voltage for further measurement.

2) Current sensor:

A current sensor is a device that can be used for both AC and DC sensing as it provides economical and precise values for any industrial, commercial and communications systems. The current sensing is made possible by a unique package that provides easy implementation without breaking original system. The applications include motor control, load detection and management, over-current fault detection and any intelligent power management system etc...The sensor consists of a low-temperature drift linear hall sensor IC with a precise temperature compensation circuit and a hole of diameter 9.0mm. Current can be measures by using system's own electric wire and bypass it through this hole to measure the passing current. The main advantage of this design is that it allows system designers to monitor any current path without breaking or changing original system layout. The current that flows through the given hole will generate a magnetic field which is sensed by the integrated Hall IC and is converted into a proportional value of current. The sensor leads are electrically isolated from the terminals of the conductive path which allows the sensor to be used in applications requiring electrical isolation without the use of opto-isolators or other costly isolation techniques which results in the reduction of cost.

3) Temperature sensor:

The temperature of a medium can be measured using temperature sensors. LM35 is a three terminal device which gives linear output voltage with respect to temperature and is optimized for the range.

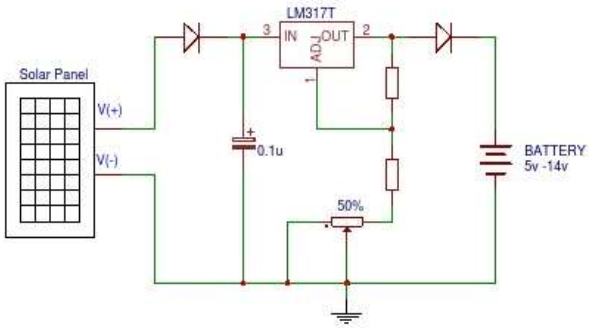


4) Ultrasonic sensor:

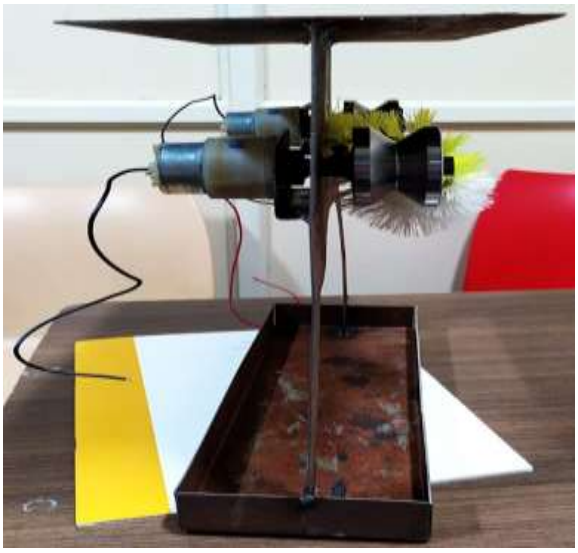
The distance to an object from the sensor can be measured easily using an ultrasonic sensor which produces **ultrasonic** sound waves and these waves give the sensor an approximate distance between them. A transducer present in the sensor is used to send and receive ultrasonic pulses which relay back information about an object's proximity.

Power supply

A 12 volt solar panel and a variable voltage regulator(IC LM 317) are used in the circuit. Each solar cell in the solar panel is rated at 1.2 volts. The voltage available from the panel to charge the battery is 12 volt DC. The direct current passes through diode 'D1' to the voltage regulator IC LM 317 and then the regulated voltage will pass through diode 'D2' to the battery.

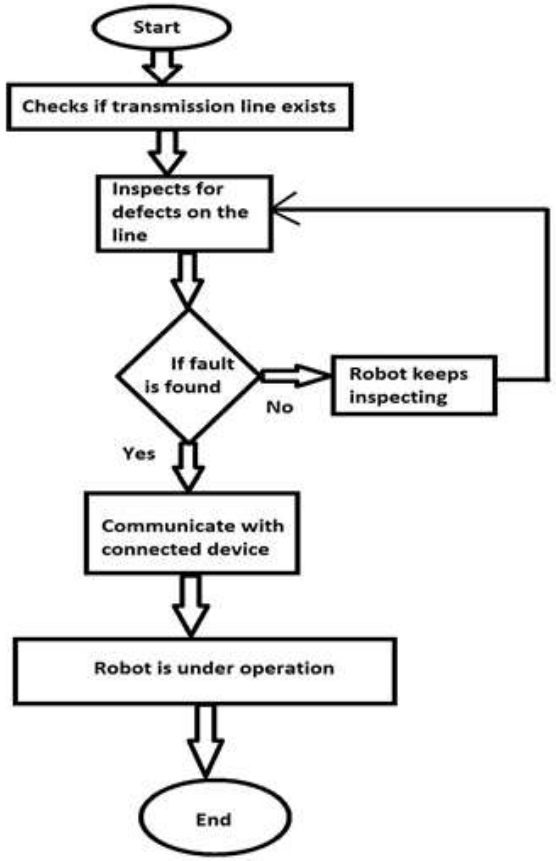


Fabrication of robot



3. WORKING

This project is designed to inspect overhead transmission lines. It consists of an inspection robot which is equipped with various sensors for sensing parameters. Main parameters such as current, voltage and temperature are recorded and transmitted to a mobile device using IoT (NodeMCU). After sensing the parameters of the transmission line, it moves further on the line and inspects the total length of the parallel line for any defects, deviations and sag in them. A user can also operate the robot using IoT through the application provided and also receive parameters as well as live video and images of the transmission line. The user would be using a basic interface in which two operating buttons with commands like forward and reverse are present and this interface would also be containing space where the parameter readings shall be displayed. Brushes are also provided so that the transmission lines are cleaned as the robot moves along the lines.



FLOWCHART

4. ADVANTAGES

- The robot detects faults in transmission lines.
- It reduces human work.
- It reduces corona discharge by cleaning the dust particles on the line.
- It detects any defects and sag on the transmission lines.
- It transmits the parameters and faults to sub-station using IoT.

5. APPLICATIONS

- The robot can be used to detect faults and defects in transmission lines.
- It can be used to reduce human error and work.
- It can be used to read the parameters of any particular transmission line.
- It can be used to transmit the parameters to any device connected to its network.
- It can be used in remote areas where it is hard to reach for the workers.

7. CONCLUSION AND FUTURE SCOPE

This transmission line inspection robot would eliminate the risk by 100% thus providing safety and increasing data accuracy. It will transmit current, temperature and voltage readings simultaneously and it will detect obstacles in both forward and backward direction, faults, defects and abnormal sag present in the transmission lines. It also improves efficiency as it cleans the transmission lines thus reducing corona discharge. . This work can be extended for complete automation where this robot can take decisions while traversing on transmission lines. It can be used for inspection of suspension bridge through wire crawling robots, transportation of materials to remote places through ropes, identification of power theft and mine inspections.

REFERENCES

[1] TRANSMISSION LINE INSPECTION ROBOT, Suraj Ghodake, Sameer Bonde, Harshal Gaikawad, Mr. Sunil M.More.

[2] Conceptual design for Transmission Line Inspection Robot, M.F. Abdul Jalal, K.S. Mohamed Sahari, A. Anuar.

[3] Robotic Power Line Inspection System, Sidhant Poddar.

[4] J. Sawada, K. Kusumoto, T. Munakata. "A mobile robot for inspection of power transmission lines," IEEE Trans. on Power Delivery, vol. 6, pp.309-315, 1991.

[5] Robots repair and examine live in severe condition. Electrical World, vol.5, pp.71-72, 1989.

[6] S. K. Kogyo. Automatic Overhead Power Transmission Line Damage Dectector.www.sato-k.co.jp

[7] S. Montambault, N. Pouliot. "The HQ liner over: Contributing to Innovationin Transmission Line Maintenance". In: Proceedings of IEEE 10th International Conference on Transmission and Distribution Construction

[8] Operation and Live-line Maintenance, Vol 4. Piscataway (NJ): IEEE, pp.33-40, 2003.