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High-Tension Line Surveillance Robot

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Abstract

Utility work is the essential for keeping electricity running into our homes, but it is a very dangerous task, linemen risk falls, electric shocks, burns, and injuries while on the job every day. This paper presents the "High Tension Line Surveillance Robot", a system operated robot to examine high voltage power lines. Its mechanism permits riding on the uppermost cable of high voltage power lines and crossing a group of mast tips similarly as smaller obstacles autonomously and therefore isn't restricted to only move from mast to mast. An arduino program controls the driver. An optical camera is mounted on the paradigm, which will rotate 180° and therefore the image will be transmitted wireless to the user's laptop monitor.

Keywords- Arduino UNO, HC-05 Bluetooth module, Servomotor, L298 Motor Driver, RF camera, DC motor.

1. INTRODUCTION

According to electrical safety foundation international (ESFI) 36% of all electrically related workplace fatalities were caused by high tension lines between 2011 and 2018 [6]. High Tension power lines are used to transmit and distribute electrical power along large distances, these power lines and their supporting infrastructure may fail over time due to ageing, natural phenomena or accidental contact by vehicles and humans, which are to be fixed by linemen, which is a very dangerous task. There are ways to protect themselves from the injuries and hazards, even after the linemen are following the best safety practices these accidents are continuing. There is a need to develop a system which helps the linemen to monitor the high tension line without physical contact and find the problem in the wires before the accidents take place. Our project gives a clear solution for this problem, using our project surveillance of high tension wires can be done without having a physical contact with the wires and predicts the problems before they actually occur by having the actual view of the wires and clear the problems before they become more hazardous. The operator controls the device remotely from a laptop/mobile through a wireless affiliation with Arduino computer code. The major objective of the project is that the modelling of a High-Tension line robot employing a wireless network like Bluetooth and an arduino board is used, so the robot will be controlled by a mobile. Also, the cameras are accustomed to record the activity and show it on the screen. This project is useful within the study of a wireless High-Tension line robot and to boost the performance of the robot.

2. LITERATURE SURVEY

The study and development of Robots used for the purpose of inspection and maintenance have increased drastically over the past few years. Many researchers have found new and better ways to perform the job. The various research work carried out over the past few years are: In line scout technology, which is built by Hydro Quebec sir, is an absolute system established in field for linemen. It is controlled by a semi-movable ground station consisting of transceivers set on a tripod and a portable table with a robust, military type field tablet PC (Montambault and Pouliot, 2006).It is independent till an extent and made for the work of transmission line. This device is a mature prototype tested in field conditions and can overcome a variety of obstacles in an efficient manner.

Thailand, 2001; S Peungsungwal et al.[4] This robot is very different. This is a small construction, built on the concept of gathering power from the magnetic field around the transmission line and using that power to propel a robot along the wire. The robot is little more than an iron core around the wire with a motor and 28 wheels to propel it and a minimum of other components (including a camera). This mechanism will for obvious reasons not clear any obstacle except maybe a compression splice. In its simplicity lies the beauty; this robot is cheap, simple and it does the job it set out to do but nothing else. It shows that at least this small robot can operate on a live wire without sustaining damage from the electric and magnetic fields. Generally, previous analysis shows that Arduino based mostly microcontroller applications are very productive in robotics design, development and implementation. It is very clear that Arduino created it simple to develop robotics applications simply, yielding folks to target FOSS applications.[3]

3. EXISTING SYSTEM:

At present, this work is completed by teams on foot, moreover as by chopper missions. Inspections on foot would really be slow and in sometimes are even impracticable at grounds like mountains or steep valleys. The chopper missions are somewhat quicker but very slow, tedious, and hard, notably for the pilot since he needs to fly at minimum distance to the power lines. The probability of durable facet winds in addition turns this task into a dangerous state of affairs. In EE, live line in operation, together referred to as hotline maintenance, is that the upkeep of electrical instrumentality, usually operational at high voltage, whereas the instrumentality is energised. Though, this may be heaps of risky for personnel than functioning on electrical instrumentality with the power off, live-line maintenance techniques are used within the wattage distribution business to avoid the disruption and high economic costs of going to brag power to customers to perform essential periodic maintenance on transmission lines and completely different instrumentality. The first techniques for live line in operation were developed inside the first years of the 20th century, ways were developed inside the laboratory to alter field workers to come back into direct contact with high voltage lines.[1] Such ways are typically applied to alter safe work the best possible transmission voltages. In general, there are three ways of live line in operation that facilitate workers avoid the considerable hazards of live line in operation. In varied ways in which, all of them serve to forestall current flowing from the live instrumentality through the worker.

4. PROPOSED SYSTEM

The High-Tension wires that carry an oversized quantity of current are important to move current through an oversized distance because the power supply is sometimes at remote distances from the cities. Hence, the employment of High-Tension wires is incredibly helpful for this purpose. However, these wires if uncurbed will get broken and might dissipate high current that causes wastage of helpful energy and to cut back the chances of risk on humans and to conduct the upkeep procedure with nice preciseness, the employment of a robot is finished to examine and maintain the High-Tension lines. This robot uses V-grooved wheels to grip the road and might pass obstacles like splices. It is equipped with a video camera to assist in line review. The operator controls the device remotely from a laptop/mobile through a wireless affiliation and an Arduino software system. The means within which this device moves down the facility line permits compactness whereas still having the ability to beat in-line obstacles up to a size. During this project, a mobile robot is bestowed as a tool to automatize the operations of review. This robot, that is tele operated, travel upon the wires, gathers cable pictures through cameras and sends them to an operation base.[3] The major objective of the project is that the modelling of a High-Tension line robot employing a wireless network like Bluetooth and an Arduino board is used in order that the robot are often controlled by a mobile.

5. HARDWARE DESCRIPTION

5.1 ARDUINO UNO

Arduino/Genuine uno is a microcontroller board supported the atmega328 (datasheet). it is fourteen digital input/output pins (of that six will be used as PWM outputs), six analog inputs, a sixteen megacycle per second quartz, a USB attachment, a power cord, an ICSP header and a reset button. It carries everything required for a micro controller, we can just connect to a computer directly with a USB Cable also you can charge it with an AC to DC adapter or a lead acid battery. You can tinker along with your UNO without concern an excessive amount of regarding doing one thing wrong, worst case situation you will replace the chip for some bucks and begin it again[5].

Fig-1: Arduino UNO Board**.**

5.2. BLUETOOTH:

Bluetooth is a wireless technology norm for interchange information over short distances from mobile devices and building personal space networks (PANs). Bluetooth networking transmits information via low-power radio waves. It communicates on a frequency of 2.45 gigacycle per second (between 2.402 GC and a pair of 2.480 GHz, to be exact). This waveband has been put aside by international agreement for the utilization of commercial, scientific and medical devices (ISM). By comparison, the foremost powerful cell phones will transmit a wave of three watts. The low power limits the vary of a Bluetooth device to concerning ten meters (32 feet), cutting the possibilities of interference between your ADP system and your mobile phone or tv.

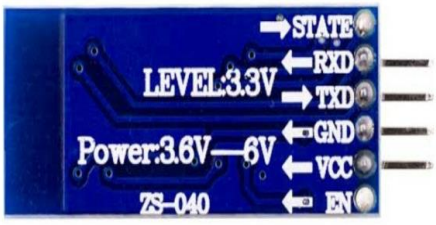

Fig-2: Bluetooth Module.

5.2.1 SPECIFICATIONS

- Runs in the 2.4 GHZ band which is universally available.
- It possesses 79 channels.
- Based on FHSS, GFSK modulation.
- 1600 hops per second.
- Maximum 8 devices are supported in a piconet.
- Low cost.
- 1mW power.

5.3 DRIVER CIRCUIT (L298)

L298 is a high-power version of L293 motor driver IC. It is a high voltage, high current, twin full-bridge driver designed to simply accept normal TTL logic levels (Control Logic) and drive inductive masses like relays, solenoids, DC, and Stepper motors. 2 alter inputs are provided to alter or disable the device respectively of the input signals. The emitters of the lower transistors of each bridge are connected on and thus the corresponding external terminal are used for the association of an external sensing resistance.

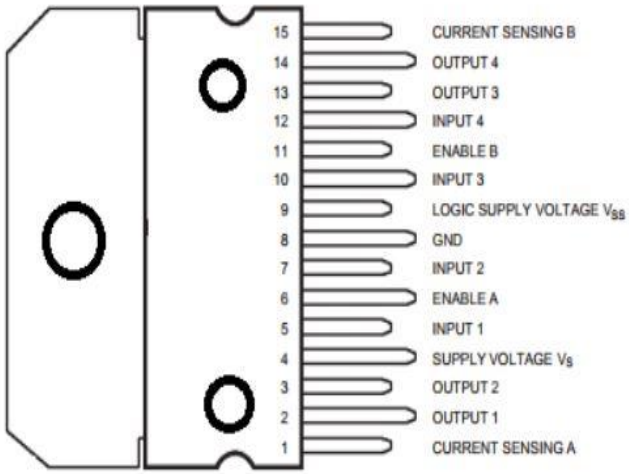

Fig-3: L298 PIN diagram.

L298 LOGIC:

- **At Pin 2**we use **Logic 1** and **AtPin 7** we use**Logic 0**| In Clockwise Direction
- **At Pin 2**we use**Logic 0** and **AtPin 7** we use**Logic 1** In Anticlockwise Direction
- **At Pin 2** we use**Logic 0** and **AtPin 7**we use**Logic 0**In Idle State [No rotation] In Hi-Impedance state
- **At Pin 2** we use**Logic 1** and **AtPin 7**we use**Logic 1**In Idle State [No rotation]

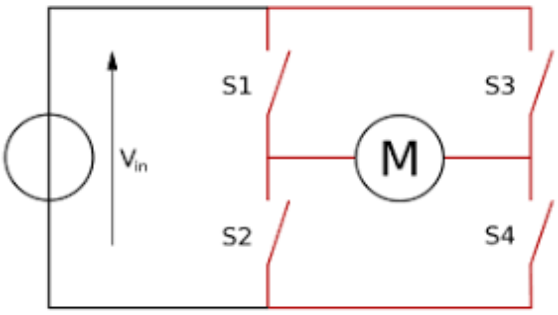

Fig-4: H-Bridge principle.

5.4 DC MOTOR

A machine that converts DC wattage into mechanical power is understood as a DC motor. It's operative depends on the principle that when a current carrying conductor is placed in a magnetic field of force, the conductor experiences a mechanical force. The direction of this mechanical force is given by Fleming's left-hand rule. According to Fleming's left-hand rule when an electric current flow through a coil in a magnetic field, the magnetic force generates a torque that turns the DC motor. The direction of this force is perpendicular to each of the wire and also the magnetic field of force. It is that the most typically used rotatory actuator for generating continuous movements and whose speed of rotation will simply be controlled, creating them ideal to be used in applications were speed management, servo type control, and/or positioning is needed. A DC motor has two parts, a stationary part called "Stator" and a "Rotor" which is the rotating part.

Fig-5: DC Motor.

5.5 SERVO MOTOR DRIVER

The pulses must be compelled to incline at frequencies of regarding 50Hz to 60Hz. For precise position management, the controller that is chosen must have timers that have the desired resolution. Also, if quite one motor should be controlled simultaneously, the processor clock should be quick enough. The electric load's tolerance of ripple dictates the minimum quantity of filtering that must be provided by a power supply. In some applications, high ripple is tolerated

and so no filtering is needed. As an example, in some battery charging applications it's supplied to implement a mains-powered DC power supply with nothing quite an electrical device and one rectifier diode, with a resistance with the output to limit charging current. A servo consists of a Motor (DC or AC), a potentiometer, gear assembly and a dominant circuit. First, we have a tendency to use gear assembly to cut back revolutions per minute and to extend torque of motor. When a servo motor shaft is initialized, the potentiometer knobs position is designated there is no electrical signal generated at the output port of the potentiometer ,currently an electrical signal is given to a different input terminal of the Arduino Board. Currently distinction between these 2 signals, one comes from potentiometer and another comes from different supply, are going to be processed in feedback mechanism and output are going to be provided in term of error signal. Currently motor shaft relates to potentiometer and as motor rotates that the potentiometer and it will generate an indication. Thus, because the potentiometer's angular position changes, its output feedback signal changes. When it slows down, the position of potentiometer reaches at a grip that the output of potentiometer is same as external signal provided. At this condition, there'll be no sign from the amplifying device to the motor input as there's no distinction between external applied signal and also the signal generated at potentiometer, and during this state motor stops rotating.

Fig-6: Servomotor.

5.6 WIRELESS CAMERA

Wireless camera that is employed to watch the functions on high-tension lines like, checking the mutilation of wires. This camera provides the captured info through Bluetooth app we will monitor the rotation of camera up to one hundred eighty degrees. Wireless cameras are proving very talked-about among fashionable security customers because of their low installation prices (there isn't any ought to run pricy video extension cables) and versatile mounting options; wireless cameras may be mounted/installed in locations antecedently untouchable to plain wired cameras. Additionally, to the convenience of use and access, wireless security camera permits users to leverage broadband wireless net to supply seamless video streaming over-internet.

5.6.1 FEATURES

- Wireless transmission and reception
- Small size and less weight
- Low power consumption
- High sensitivity
- Easy

Fig-7: wireless camera with receiver.

5.7 TV TUNER CARD

TV tuner card acts as interface between laptop and radio receiver. Wireless camera senses the captured data to the radio receiver. The radio receiver is tuned to the frequency of the wireless camera. Thereby, a communication link is established between the camera and radio receiver. The radio receiver is interfaced to TV tuner card using a software called i-ball claro the data received can be monitored.

6. SOFTWARE DESCRIPTION

Arduino software system (IDE) - contains a text editor for writing code, a message space, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to transfer programs and communicate with them. Programs written utilizing Arduino software system (IDE) are referred to as sketches. These sketches should be within the text editor and should be saved with the file's extension .ino. Options such as cutting, pasting and for searching, replacing text are present in the editor. The message space offers feedback whereas saving and convey and displays errors. The console displays text output by the Arduino software system (IDE), together with complete error messages and alternative info. Rock-bottom right-hand corner of the window displays the designed board and serial port. The buttons available in the toolbar allows you to create, open, verify programs, transfer programs and save sketches and the tool bar buttons can open the serial monitor.

7. FLOWCHART

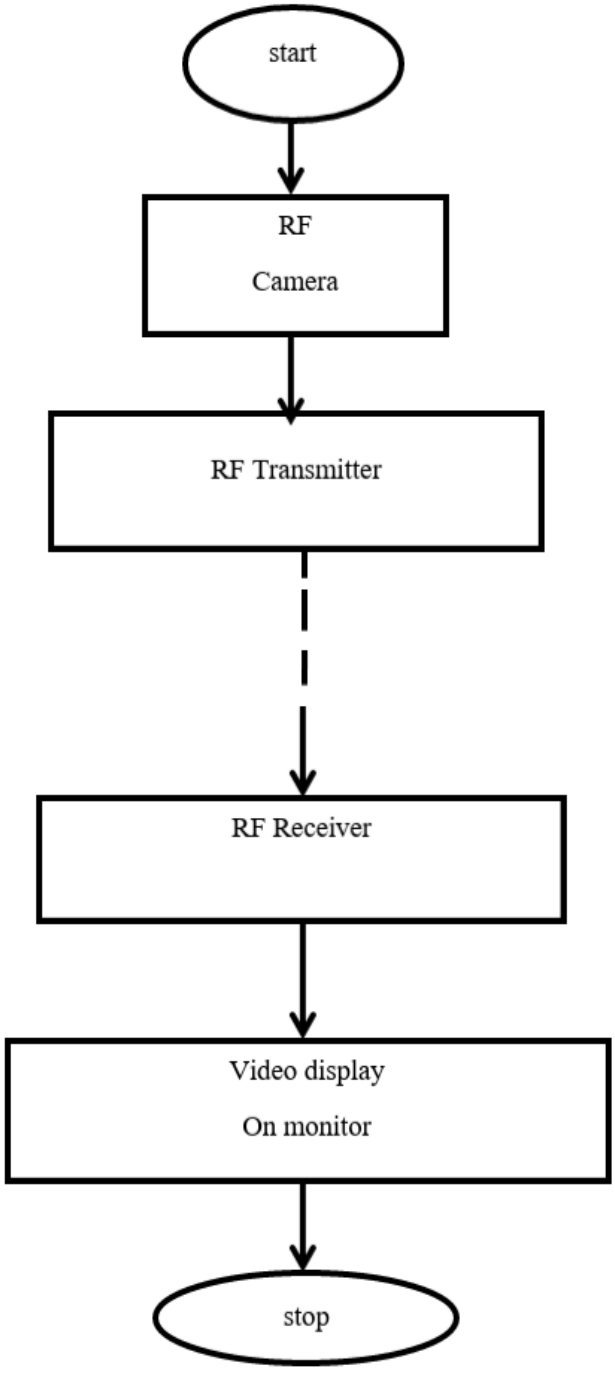

Fig-8: Flowchart of wireless camera.

Transmitter is connected to the camera and receiver is connected to the monitor. Once we give the power supply there is wireless transmission of the signals from transmitter to receiver and we can see the video on the monitor by tuning the receiver to the perfect frequency.

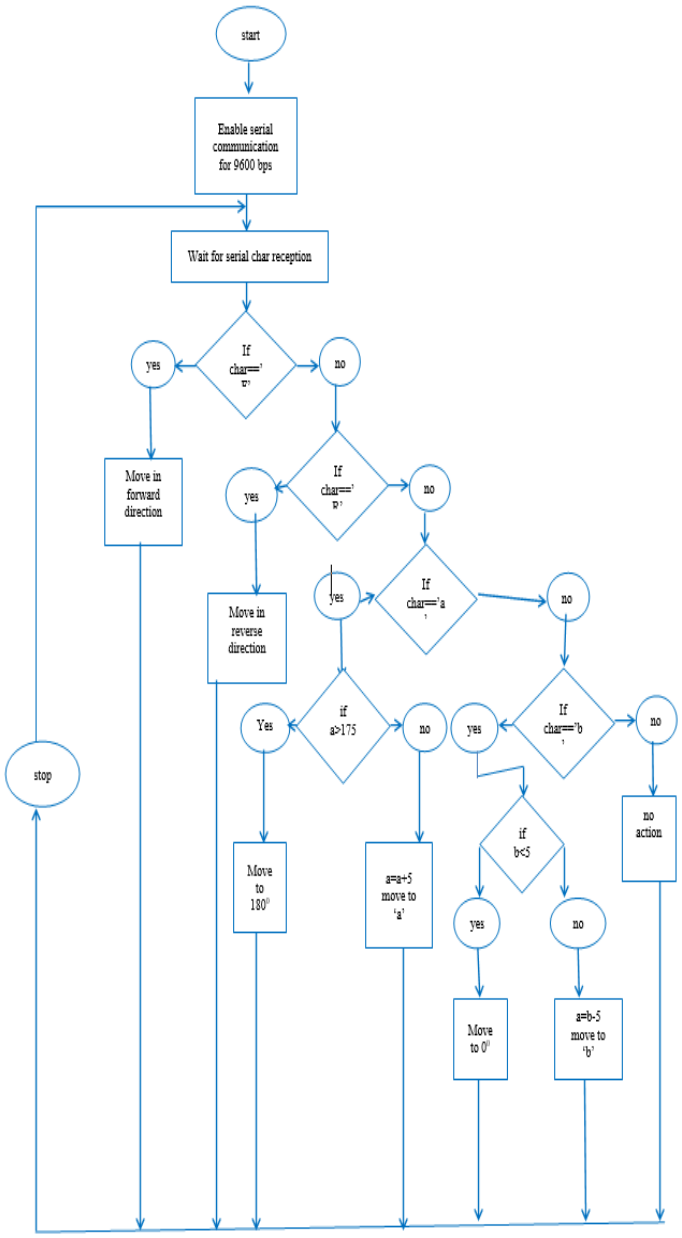

Fig-9: Flow chart for working of Arduino in the project.

After giving the power supply we need to give instructions for the robot to work in the desired manner. Here we are using Bluetooth for serial communication. After connecting the vehicle to mobile through Bluetooth we are required to give a character such as 'F' for moving forward, 'R' moving backward , 'S' for stopping the vehicle these instructions are related to DC motors for the movement of the robot. Characters such as 'a' or 'b' are to be given for the rotation of the camera connected to a servomotor, if 'a' is given the camera moves to the left and if 'a' is greater than 175 degrees it is turned to 180 degrees if not 'a' is increased by 5 degrees. If 'b' is given as input .if 'b' is less than 5 degrees, then the camera moves to 0 degrees if not b is decreased by 5 degrees. Hence, we can operate both servomotor and DC motors in the desired manner.

8.CONCLUSION

This project elaborates the design and construction of a surveillance robot used for electrical purpose it reduces the work of the line men who need to find the fault in the wire every time there is a damage caused to the wires which is a difficult task to search for the place of fault. By this project it is easy to find the damaged place and repair the place only where there is a fault instead of the whole wire. This project also provides continuous monitoring of the quality of the High-tension wires.

9. FUTURESCOPE

In this paper we have proposed the system that can be used to monitor the High-tension lines. In addition to this we can add brushes to the system which can be used to remove the rust of the wires and also use different wireless technology to increase the range of operation.

10. RESULT

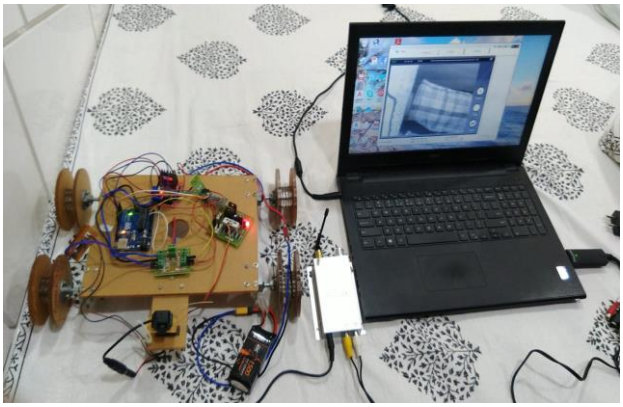

Fig-10: Displaying whole setup of the project.

In the above figure shows the whole setup required for the project along with the monitor and transmitter and tuner for accurate results, that is monitoring of the High-tension wires.

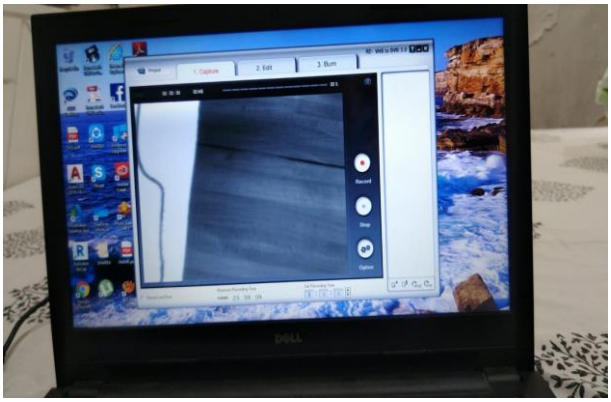

Fig-11: Monitor screen displaying live video streaming.

The above figure shows the monitor screen where we can see the video streaming done by the wireless camera through wireless communication.

Table-1: Directions given to vehicle using mobile keypad for servomotor.

Character	Direction
A	Clockwise
B	Anticlockwise

Table-2: Directions given to vehicle using mobile keypad for DC motor.

Character	Direction
F	Forward
R	Backward
S	Stop

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