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Rakshak – Electric Pole Climbing Robot

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ABSTRACT

This project is to create electrical pole climbing robot which can be used to reduce risk of electrician to connect the distribution lines for supplying purposes. Pole climbing robot, nowadays, is very common and interesting idea, which mainly works by connecting the distribution lines according to the directions given to it. In this modern era robots are being developed for various purposes to accomplish many tasks which seem to be complex and life endangering for humans. Benefits of using robots have been immense in terms of risk-free, speed and efficiency of doing required tasks compared to that of humans. The main objective of this work is to save human lives. Considering on that issue, a pole climbing robot has been designed. However, further modifications of this work might be able to perform the wiring and repairing tasks instead of an electrician. The developed robot works on the principle of linear motor, which is partially autonomous. With the installation of this project, risk of human injuries and death can be minimized while working in the distribution lines. It also contains a circuit breaker which interrupts the current flow while working which is the main consideration of this project.

Keywords : electric pole, dc motors, ESP8266 wifi module, manual reset, circuit breaker.

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I. INTRODUCTION

In this project it is proposed to implement ―Pole Climbing Robot. Here we are developing a wifi based pole climbing robot that will overcome the traditional method in which electricians are present on the electric poles thereby risking their lives.

Electricity is the most desired energy source in this modern civilization which made people's life a lot simpler and easier. For supplying electricity from the power station transformers and poles are required. To give a new connection or may be to connect any loosen wire, workers climb the pole keeping their life at risk. The aim of this work is to make such a climbing robot that can climb the electrical pole which might be used to perform those worker's tasks. Using circuit breakers, we may cut the current flowing through lines while working.

For many years working labors have been losing their lives or sustaining injuries performing risky jobs. Deaths and injuries from monotonous jobs in dangerous environments have been very common in developing countries. It has been observed that electrical injuries caused significant numbers of death in every year. The main causes for the numerous numbers of such accidents are due to lack of safety precautions, lack of proper training to the workers and dangerous working environments.

II. LITERATURE REVIEW

[1] This paper proposes a pole climbing robot that has an ability to climb pipes. The novelty of this design is that it uses no motors to climb on the pole. Till now many robots have been fabricated with the ability to climb pipes but most of them solely depend on DC motors. The use of DC motor induces the risk of loosening the grip of the robot in case of power failure that may lead to disastrous situations if robot is working on high altitudes. This could be easily

avoidable by the use of electro-pneumatics and by using self-locking circuits. We used two pairs of pneumatic cylinders as linear actuators for gripping the pole i.e. one pair for one claw. Besides this two more cylinders are used for climbing purpose. Unlike other mechanisms, installation is extremely easy. It is like controlling a radio controlled car. This mechanism can be easily modified for different payload capacities by simply using the appropriate diameter of the pneumatic cylinders. The robot can be controlled in tele-operated mode as well as autonomous mode which is a closed loop system. It has a high accuracy with 4mm error per cycle that has a cycle time period of 5 seconds. This robot can be very useful in oil industries for inspection of pipes and power poles in electric industries. It can serve of great help in cases of emergency situation caused during fire accidents.

[2] The application prospect of the climbing rod robot in the high-altitude field has been widely concerned. In recent years, it has gradually become one of the research hotspots in the field of robots at home and abroad. However, there are often some obstacles on some poles.The robot has two bionic mechanical arms, each of which is composed of a crawling guiding mechanism, a self-locking driving mechanism, a rotating disengagement mechanism, a transmission mechanism, and the like, and can adapt to guide rods of different diameters within a certain range. The working principle and characteristics of various components of the robot are expounded, and the design results and implementation methods are given.

[3] Having the windmill main components at the top of its high tower made its maintenance a very risky job for workers, and with an increase of use of wind turbines, the risk of accidents occurring is proportionally increasing too. For this, engineers started working on climbing robots and mechanisms to replace risking human lives. This research works on adding to this research topic, by proposing a full study of a new mechanism enhanced with calculations and modeling for it to be applicable and reliable. The proposed robot mechanism can circumference the tower of the wind mill and climb upwards through means of rubber chains.

[4] The design of climbing tower robot is mainly consisted of two parts, including structure and control system. The mechanical structure is composed of two under actuated gripper and a linear moving body. Based on the tower environment, the structure of gripper is designed. Further analyzing the stress of climbing gripper and optimizing the structure, the climbing gripper based on under actuated gripper is developed. The control system includes a control box and the robot body, the two communicate via WIFI. Finally the testing is doing in the condition of tower. The experimental results show that the design principle of the prototype is reasonable, and the structure of gripper is feasible and the control system is simple and easy to operate.

[5] Biped climbing robots alternately use their grip- pers for attaching to locomotion in truss-style environments. To implement autonomous climbing, pose detection and grasping of the target pole is one of the fundamental capabilities. In this paper, we present our methodology to efficiently detect and recognize a pole for grasping based on a low-cost depth-image camera only. Each pole, the element of a truss, is parameterized to describe the structural environment and to guide the sensor data processing. Acquiring depth and image data from the camera mounting on top of the gripper, efficient algorithms are then deployed to extract, recognize and parameterize the target pole. Feasible grasping pose are finally computed considering the geometrics of both the gripper and the target pole, and the movement of each joint is obtained by solving inverse kinematics and sent for servoing to fulfill autonomous grasping. A serials of experiments have been conducted to verify that the proposed methodology and accompanying algorithms satisfy the application requirement for biped climbing robots.

III. OVERVIEW

1. Wi-Fi Module:

The Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The module is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. It provides isolation from the mains.

2. Manual Reset

The circuit gives the required starting pulse to the microcontroller to start the operation from the very beginning. A low level on this pin for longer than the minimum pulse length will generate a reset, even if the clock is not running. Shorter pulses are not guaranteed to generate a reset.

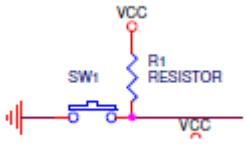


Fig 3 Manual Reset Ckt.

IV. DESIGN PARAMETERS

There are various type of parameters used in this project. They are:

ATMega 32
ESP8266 wifi module
RC oscillator
DC motors
Manual reset

ATMega32 : It is an 8-bit RISC based microcontroller. Belongs to AVR family. 32kb flash memory, 32 general purpose register, 54/69 I/O lines, external and internal interrupts.
First requirement is a 5V power supply. Next input is manual reset. Upon reset, micro controller execute program from beginning. There is an inbuilt RC oscillator. It can provide 1-8 Mhz frequency internally.

RC oscillator- The following robot contains an inbuilt RC oscillator. It is a linear oscillator. The sinusoidal output signal is generated at the output of the oscillator.
If requirement is more than this, we can connect a crystal of 16 Mhz externally. This combinely forms a crystal oscillator which will provide clock pulses. Input from wifi module is given, it will be communicating with controller.

ESP8266 WIFI module- is a low-cost microchip, integrated TCP/IP protocol stack that gives access of microcontroller to wifi network, it either hosts an application or offloading all wifi networking functions from other application processor.

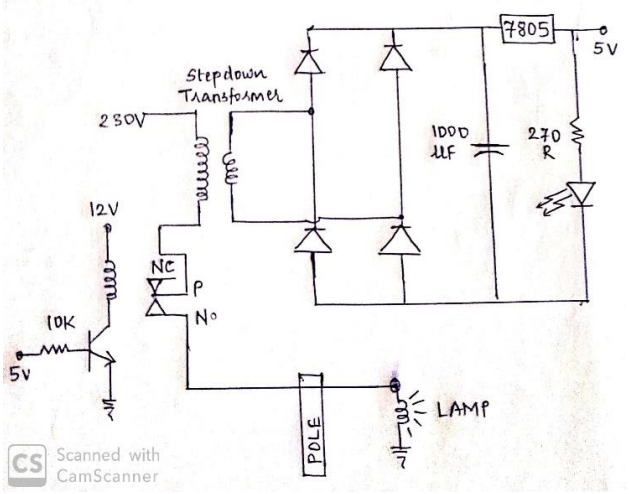
V. SIGNIFICANCE OF THE PROJECT

As there is no other way to detect the unexpected supply of current on the poles. There is an urgent need for a device to detect this current from the main power house which comes unexpectedly and harm the line man who is working on the pole. This Robot will replace this surprise factor and gives a heads up to the linemen working on the pole and save precious life that is saved. In Bangladesh and many rural parts of this democratic nation there is no system to communicate the line and the ground staff. Therefore this is a fantastic device for the former.

VI. WORKING ARCHITECTURE

The working of this robot is explained as follows-
A lineman (person who climbs the electric pole for repairing it) has been replaced by this robot, so as to overcome the problems faced by the electrician. This robot will climb the pole with the help of motor drivers attached to it. Robot contains two ARMS, one is used to check the terminal, whether the power availability is there or not. The other ARM will be carrying a wire with the help of a gripper fixed to it. This all process will be carried through a WIFI module. This WIFI module is connected to a mobile phone which contains a suitable application downloaded from the playstore. The input will be given from the mobile phone which probably act as a combination of client-server.

An additional circuit is attached to the robot known as “circuit breaker”. This circuit breaker acts as a circuit cutter. Circuit breaker is used to interrupt the circuit when the robot is repairing the errors in the transmission line. This circuit breaker will help us to cut the circuit connection when there is a sudden flow of the current through the transmission line, while working. The circuit diagram of the circuit breaker is as follows:-



VII. CONCLUSION

Thus here we conclude that this robot will be working in the place of lineman, hereby saving its life through dangerous current shocks. The robot will check the availability of the current in the line with the help of first ARM. The second ARM will carry the wire up-down, to-fro and will repair the errors in the transmission lines. The

circuit breaker will play an important role of cutting the sudden emerging of current through the lines while the robot is repairing. Leading to save many lives and hence it is named as Rakshak.

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