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## Stepper Motor Controlled Electric Pole Climbing Robot

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**ABSTRACT:** The basis of this project is to create a pole climbing robot which can reduce the risk of an electrician to connect the distribution lines for supplying purposes. Pole climbing robot, nowadays, is a very common and interesting idea to the people. We call it as EPDRO (Electrical Power Distribution Robot). In this modern era robots are being developed for various purposes to accomplish many tasks which seem to be too 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. Our goal is to save at least a life where a number of people die from electrical injuries every year. Our robot works on the principle of stepper motor. This makes the robot efficient and simpler to handle. With the installation of our project, risk of human injuries and death can be minimized while working in the distribution lines which is the main objective of this paper.

**KEYWORDS:** Objective, Control Circuit, Hardware Components.

### I.INTRODUCTION

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. One of the countries is Bangladesh where electrical injuries constitute about one third of the total burn injuries in the country. Electrical injuries caused 42% of the deaths. 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. These are few of those many problems prevailing in our country that needs to be eradicated if the human deaths are to be reduced. During the last decade, different types of pole climbing robots were developed for numerous purposes. So it is an outstanding idea to develop a pole climbing robot for a unique application. Hence building up a pole climbing robot that can imitate the actions of an electrician and does his work can save his life. The robot can be made to inspect the dangerous situations by climbing mechanism, thus risk of human lives can be reduced.



Fig.1.1 : Electrician at Work



Fig.1.2 : Accident while Working



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The pictures above are of the accident that took place on the 1st of January 2015 in Bhavanipur near Bogra. The body hanging on the wire is not of someone working but the dead body of the worker. Due to the negligence of the electricity board, the worker had to lose his life. He was working on the repair of the wire, knowing that the electricity would not be back before a few more hours. But then the electricity came back all of a sudden and the electric shock took away his life.

## II.OBJECTIVE

Pole climbing robot is a multifunctional robot which can serve several purposes according to our demand. Accidents are very common and it's increasing day by day. That is why we became motivated to do something to reduce the sufferings of the people. The goal is achieved by using the gripper which is covered with rubber material and it helps to climb the pole smoothly. An additional sensor has been used to determine the pressure of the gripper so that we can avoid extra pressure, power loss and mechanical damage to our robotic hand and the pole as well. When the robot goes up and reaches the point we want it to be, it automatically stops and starts its further command. According to our command stored in the Arduino, the robot stops climbing by getting the signal from a sensor that has been used for this dedicated purpose. The robotic hand has been made of steel sheet to reduce the weight of the robot which is very important. As the robot goes up, the pressure becomes high. The only effective way to minimize this problem is to reduce its weight. Our objective is also satisfied.. This steel hand has been connected with motors to rotate its direction. This part of our robot has been manually controlled through Bluetooth devices. That's how we are going to fulfil our objective through this robot. If it works properly, the sufferings, risks and deaths related to the work of distribution line can be minimized. If we can save one people through this project or through this paper by making people concern about these hazards, we will feel very satisfied with our project.

## III. CONTROL CIRCUIT

The control circuit has been implemented for EPDRO to serve its purpose. Bluetooth controller is used to give the robot instructions when to start climbing or when to break. As soon as the controller gives a signal to the bluetooth shield, connected to the arduino, gives signal to the arduino for running the climbing program. Motors work according to the arduino command. Depending on that feedback arduino continues working. Motors are actually connected through controllers. Controllers give signals to the motor, which rotates either in clockwise or anti-clockwise direction. A Bluetooth device is used to control all these process manually.

## IV. HARDWARE COMPONENTS

### 2.1.A. MULTIWOOD

Multi-wood is a white sheet made of U PVC polyester resin and is made in an extruded polymer profile form. It is 100% water proof, corrosion free, termite and borer proof , high strength , and fire retarden and is mainly used for wet area application. It has long lasting properties and can withstand any climatic conditions. Because of comprehensive application of multi-wood we used it for making many of the body parts of our robot.

### 2.1. B. FSR

Force sensing resistor (FSR) is basically a polymer thick film device. It is a device whose resistance varies when a pressure is applied to it. It shows a relation between the increase in the force applied to its sensing area and the decrease in resistance. The FSRs used in this project are of a length of 1.75" and width of 0.28" having a sensing diameter of 0.16" each. These sensors determine the pressure applied to the pole by the grippers to ensure proper gripping.

Sometimes proper gripping may occur before a motor contracts fully and it may cause power losses. Again, excessive pressure on the pole by the grippers may break the robot's arm. FSRs are used here for the safety of the arms and also to minimize the power losses.

### 2.1. C. ARMS FOR CLIMBING

The pole climber has been given four arms (Upper and Lower) in place of wheels for climbing to avoid slipping and toppling over. The robot's arms too are made of steel so that they can carry the weight of the body without breaking. One arms are connected by a motor.one arm is remains fixed while the other arm's closing or opening is determined by



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the motor. They are cross connected to maintain a balanced pressure on the motor. The steel grippers are welded onto the arms.

## 2.1.D STEPPER MOTOR

A stepper motor or step motor is a brushless DC electric motor that divides a full rotation into a number of equal steps. We are using three stepper motors. The functions of the stepper motor are the same. One is used for holding the arm properly and the remaining two motors are used for climbing purpose. The controller circuit A4988 are used for controlling the motor operations. Each motor has separate controller circuits. The upper and lower motor rotates until the FSR senses high pressure. And the middle motor rotates from 0 degree to 180 degree in clockwise direction for extension purpose. And for contraction the motor rotates from 180 degree to 0 degree in anticlockwise direction.

## 2.1.E. ARDUINO UNO

Arduino UNO is a microcontroller board based on the ATmega328. The advantages of using Arduino are inexpensive , cross platform , simple , clear programming environment , open source and inextensible software and hardware.

## 2.1.F. BLUETOOTH SHIELD

Entire project is controlled by Bluetooth shield. Bluetooth shield can be easily used with Arduino for transparent wireless serial communication. Bluetooth controller is used for grabbing , releasing , climbing up and climbing down the robot according to the programmer.

## V. RESULT AND DISCUSSION

After numerous experiments carried out on the pole, our robot finally worked according to the algorithm autonomously. As per our set target, it climbed up and down sensing the pressure. The diameter range of the robot is 10-14cm.

## VI. FUTURE SCOPE

Future improvement that can be done is the robot's arm can have a sensor to detect the obstacle . This way the robot can make sure the path is clear and can make the connection smoothly. Furthermore, the robot can have a backup power source attached to it so that in case of a power failure the robot can safely get back to the user. A video camera can be attached on the extra hand which may enable the user to have a good look if the robot has connected the desired point.

## VII.CONCLUSION

The technology in the field of robotics has advanced remarkably in the recent years. In this modern era robots are being developed for various purposes to accomplish many tasks which are dangerous and complex for humans. This paper comprises of all the steps and procedures that have been undertaken to build the pole climbing robot that would climb a pole, inspect the situations and then climb down. The robot has been designed and programmed to climb up the pole by sensing pressure and get down in a similar manner. This robot promises to be beneficial to the electric industry .This robot is very helpful to the society in terms of reducing the number and risk of accidents that usually happen to electricians while connecting wires

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