Next-Generation E-Line Fault Robots: An IoT Approach to Power Line Maintenance

Elif K. Yilmaz and Ahmet T. Demir
Department of Electronics & Communication Engineering, Middle East Technical University, Ankara, Turkey

ABSTRACT

Power line inspection is of the atmost importance for the reliability and stability of electric power distribution. However, manual inspection is a hazardous, slow, expensive and unreliable task. Therefore, new highly specialized robots are required to improve the overall quality and safety of the power line inspection. The research conducted so far has been mainly focused on the development of climbing and flying robots. This paper first addresses the main achievements in the field of robotic power line inspection.

The proposed solutions are critically assessed and the associated problems are outlined. Based on these findings, a new concept for robot-assisted power line inspection, combining both climbing and flying principles, is proposed in the second part of the paper.

The proposed concept is critically assessed and related to the other established concepts so as to demonstrate its advantages and feasibility for a routine power line inspection. Current inspection techniques are either performed from ground level giving the operator a limited view of components, or by the use of ladders which is also a risk task. In recent years, the use of mobile robots for automated power line inspection has been proposed. In this sense, a lightweight, portable, and flexible smart manipulator, made of insulated material is proposed. Using the system, the operator is able to perform inspection from control room, thereby increasing efficiency and safety.

Keywords: DC –Direct current electricity
IR - Infrared
PEP – Python enhancement proposal
PIR – Passive infrared
IOT – Internet of things
LED – Light emitting diode
TTL – Transistor transistor logic.

I. INTRODUCTION

Electric power distribution networks are undeniably strategic assets for every nation. Moreover, in the last decades, industrialized countries witnessed technological developments that lead to a dramatic increase in electric power demand. As a consequence,the numbers of utilities in charge of power distribution have sharply increased, and the application of rigorous maintenance strategies to distribution networks and facilities became therefore essential. Maintenance is the process of preserving or restoring a desired state of a system, or facility, and includes three major activities: inspection, planned maintenance and disturbance handling. Among these activities, inspection is a vital step to maintain high efficiency and safety in power distribution lines. During inspection,information about the state of a specific component is monitored to allow prediction or early detection of disturbances. Therefore, interest in developing optimized methods and tools has sharply grown in the last decades.Among several power distribution structure types, overhead power lines generally present the lowest cost, due to the fact that most of their insulation is provided by air.As a consequence, this type is widely used for transmission of large amounts of electric power. More specifically, overhead power lines are electric power transmission cables suspended by towers in case of high voltage, i.e., greater than 100kV, and utility poles for medium and small voltage, i.e., 1kV.Despite of their benefits, overhead power lines are located in high positions, thus leading to inspection problems faced by utility operators. Due to the large number of utility poles in service in urban and rural areas, improving efficiency of such a task is a great challenge. Furthermore, it is important to point out that such poles are often placed in cloud environments, i.e., surrounded by trees or several kinds of obstacles. The main function of utility poles is to carry uninsulated wires supported by insulators mounted oncross-arms.During the inspection of utility poles, the electrician faces the need of reaching high positions in order to check the state of several components, such as wire connectors, insulators and

wooden cross-arms. Hence, utility operations perform periodical inspections to ensure reliability and safety. However, this activity is not an easy task due to the high risks of accidents. Moreover, this operation is time consuming, costly and demands strict standardized procedures.Provision of high quality and reliable electric power has become a necessity like air and water to the modern world. Any failure in today's power systems results in to massive losses and inconvenience to consumers. Overhead electricity lines are normally bare (uninsulated) and if an object gets too close it is possible that a flashover can occur,where electricity will jump over a distance to reach earth via the object. This can kill or cause severe shocks and burns to any person nearby. In this project a robot is designed to avoid this problem.

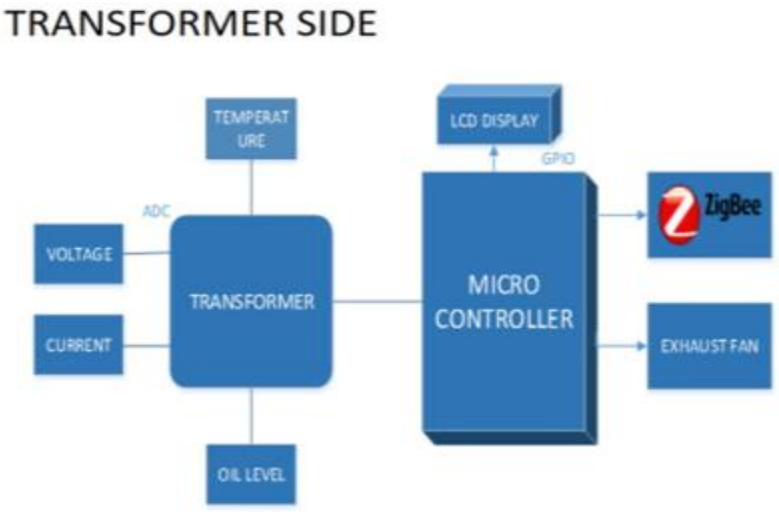
II. MATERIALS AND METHODS

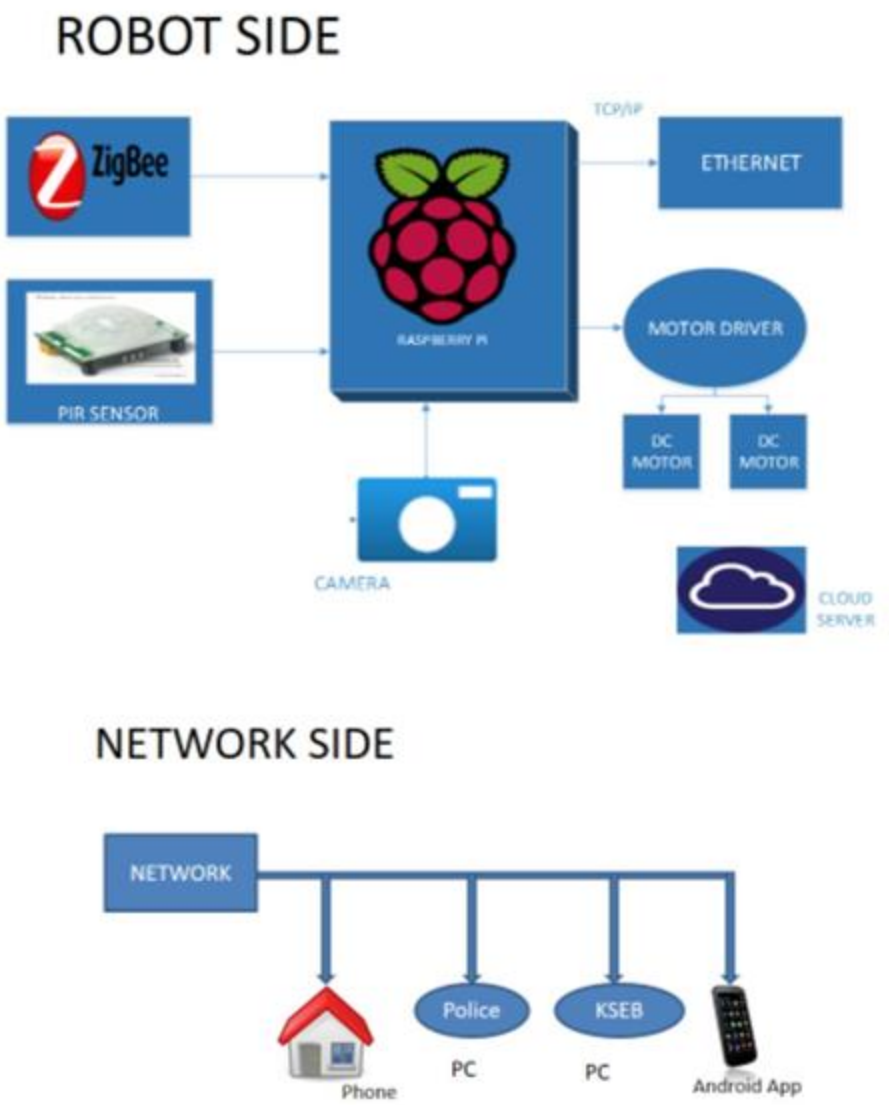
Functional block diagram

It is basically divided into three sides- the transformer side, the robot side, the network side. Our functional block diagram consists of temperature sensor, to detect temperature variations. An exhaust fan is provided to lower temperature, when the temperature goes high. Oil level is detected by an IR sensor, whenever the level goes below the threshold, it will automatically detect and send the information to the authorities. The authorities can provide command from the control room to operate the exhaust fan so that the temperature gets reduced. When the oil level decreases from the threshold level it is detected by the IR sensor and the information is passed on to the KSEB. Voltage and current variations are monitored and the corresponding readings are shown in LCD . Touch Screen LCD for Raspberry Pi with HDMI Interface.

These datas are send to robot side using zigbee. PIR sensors and a high-definition camera to detect obstacles which will cause the power failure. It detects the exact position of fault and send photographs along with the message. Camera continuously takes the photos, if a robbery occurs. If any fault is occurred in the power line, then a message is send to KSEB. Cloud server for IOT transmission of information. There is a complaint booking facility through which user can register complaints to KSEB. We also develop an android application which shows these parameters.

Figure:





III. RESULTS AND DISCUSSION

The transformer section, the robot section, and the network side was developed. If any faults takes place in the transformer section the information is send to the network side by zig bee. The network side was socialized rather than developing a new android application. It was done in telegram app, which is much user friendly.

Tables:

EXISTING SYSTEM	PROPOSED SYSTEM
In the present senario, the current inspection techniques are performed from ground level by electrician. The electrician faces the need of reaching high positions in order to check the state of several components. The use of ladders leads to high risk of accidents.	In our project we use unmanned distribution power line inspection system using E line robot .This perform inspection from control room itself. It provides easy circumstance for labour, monitoring and maintenance is reliable it also ensures the efficiency and safety of the line workers.
The parameters like voltage, current, temperature and oil level in transformer are not measured frequently. If any variation occurs in this parameter causes transformer failure.	The parameters like voltage, current, temperature and oil level in transformer, and power theft are monitored through the smart inspection system. This strategy allows inspection from ground level or control room itself.
There are several criminal activities happening in our city. Due to lack of evidence most of the cases remain unsolved.	Criminal activities at night in Kerala is increasing day by day , we provide a night surveillance camera on the robot that can be used for police investigation. It detects the presence of intruders.
Contacting KSEB to register complaints is very difficult because it is unsure whether they will pick up the phone	We introduced a complaint booking facility that allow the users to register their complaints to the KSEB. The network side was socialized rather than developing a new android application. It was done in telegram app, which is much user friendly.
No effective method to find power theft.	KSEB can access voltage and current values whenever they need. Hence this system provides an effective means to find power theft.

IV. CONCLUSION

In our project we use unmanned distribution power line inspection system using E line robot This strategy allows inspection of different parameters from ground level or control room itself. Monitoring and maintenance is reliable and it Ensure the efficiency and safety of the line workers.

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