DESIGN AND PROTOTYPE IMPLEMENTATION OF SYSTEM DETECTING MAINTENANCE EARTH ROD ON OVERHEAD LINES IN TRACTION NETWORK

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Abstract

Unlike transmission lines, Traction Over Head lines requires more maintenance. In metros it is even more complicated due as there exist structures above Over Head lines. During maintenance it is mandate to provide earth rods on Over Head lines to avoid electrocution due to induction voltage and false operation by operator. In metro system Energisation of Traction Over Head lines is done remotely through Supervisory Control and Data Acquistion (SCADA) system from Operation control Center by Traction Power Controller (operator). During energisation it is duty of Traction Power Controller (operator) to get confirmation from filed staff for removal of earth rod. There has been a regular incident of human error leading to energisation of Section with earth rods unremoved. This poses heavy risk for operation team and also stresses the system. Hence it warrants a system to detect the presence of earth rod on Section before energisation. The system proposed uses a electronic circuit to that injects a current in to the secondary of potential transformer which responds differently when the primary circuit is open circuited and close circuited. Based on the output of system designed Interlock in shall be provided in Remote Terminal Unit preventing Operation of circuit breakers.

INTRODUCTION

The events that brought about the signalling systems of today, the primary functions and technology of the signalling and the underlying design principles. It looks at the operation of The the railway as a system and in particular at the role of train control systems. This includes the role of Automatic Train Protection (ATP) in a modern metro environment, the application of automatic train regulation, and automatically driven trains protected by a moving block, radio based, signalling system. The need for synergy between the designs of the rolling stock and signalling systems is demonstrated by a review of current practice, and a way forward towards a more systematic approach is outlined. The role of signalling in gathering and disseminating information and the potential for integrated customer information management, the needs for management information and the potential benefits of improved real time maintenance information are outlined. Whilst written primarily from the point of view of a rapid transit railway signalling engineer the author makes use of some passing acquaintance with bigger trains and other technologies(1).

The design and development of Remote Terminal Unit (RTU) circuit and hardware implementation which represented in Distribution Automation System (DAS). The design based on microcontroller using PIC16F877A and also introduces the Orcad software to design circuit for the RTU. RTU is a standalone data used to monitor status and alarm, sequence of events, counters /pulse accumulators, binary code decimals and analog inputs. The function of RTU is to collect all the data from the plant, digitize them and send to the master station to the communication network. RTU also receives command from control center (master station) and executes it at the substation.(2).

The development of Supervisory Control And Data Acquisition (SCADA) based RTU for customer side distribution automation system. It is to apply automation technique for operating and controlling low voltage downstream of 415/240 V. The SCADA system developed provides fault isolation operation , monitoring and controlling functions for the operators and data collection for future analysis . An embedded Ethernet controller is used as RTU to act as a converter for Human Machine Interference and to interact with digital input and output modules. Two proprietary software systems are used to develop algorithm for the controller and to develop HMI for monitoring and controlling functions for the operator.(3)

The different recognized methods of conducting load tests on more than one transformer without applying actual load, also methods of making such tests where one single phase transformer only is available. The actual loading of transformers for test purposes is very expensive, and therefore, the motor-generator method is most suitable whenever more than one single-phase transformer or any number of three-phase transformers are considered. The load and excitation is applied to the high voltage or to the low voltage windings depending upon the rating, etc of the transformers. When one unit only is available a heat test may be made which consists in applying intermittently an over-voltage core loss with an over-current impedance loss. Approximate values of temperature only are obtained by a combination of an ultimate open-circuit heat run followed by an ultimate short-circuit heat run, and should be used only where not expedient to use the other method. Tables show results of the above methods on different transformers as compared with dead load and motor-generator methods. Upon the characteristics of the transformer will depend the over-voltage and over-current for the intermittent runs, so as not to injure the transformer and also to eliminate errors. All the motor-generator methods. When one single-phase transformer is considered, the intermittent run method is recommended and this method may be modified so as to obtain a closer refinement.(4)

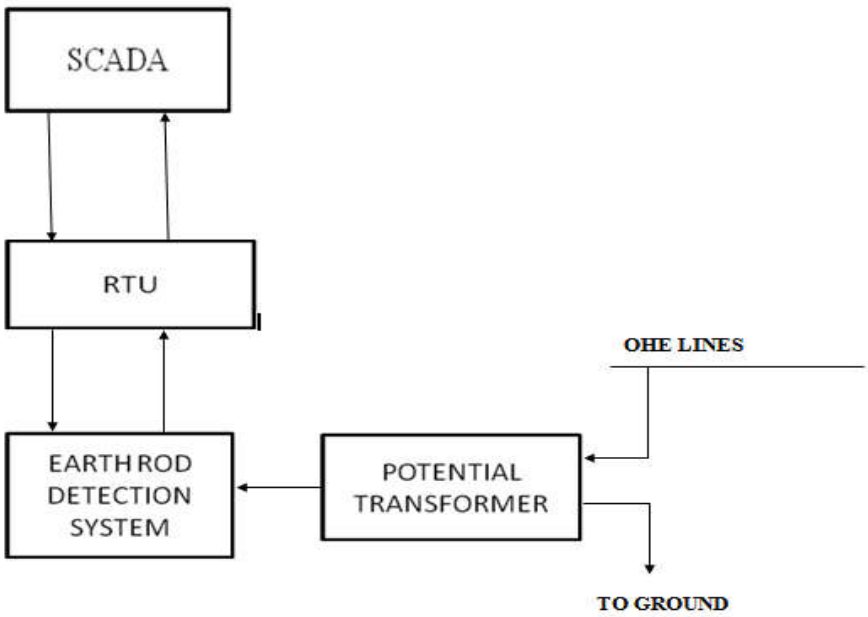
EXISTING SYSTEM

In the existing system the exchange of information about providing and removing of the earth rod is through oral communication between the TPC (traction power controller) and the JE (junior engineer).The TPC has the ‘power block’ authority. If the OHE line is to be de-energized for the maintenance purpose, the JE has to obtain a ‘power block’ from the

TPC.After the power block is issued, 'work permit' has to be obtained. If the work permit is issued, the JE gives intimation about the earth rod to the TPC. The TPC acknowledges it and issues permission for laying earth rods.[5-8] After this the TPC de-energizes the line through SCADA control and communicates to the person in the field to erect earth rods. Once the maintenance work is over, the TPC verifies for the presence of the earth rod and energizes the line again. The main disadvantage is, there may be miscommunication of information. Since there are multiple earth rods put for maintenance there evolves chaos in switching on and off the lines. There may be failures in communication. The TPC may energize the lines with the earth rods unremoved, which may result in accidents. The field staff may remove the earth rods without intimating any information to the TPC. There are chances of the workers being electrocuted due to these kinds of miscommunications.

PROPOSED SYSTEM

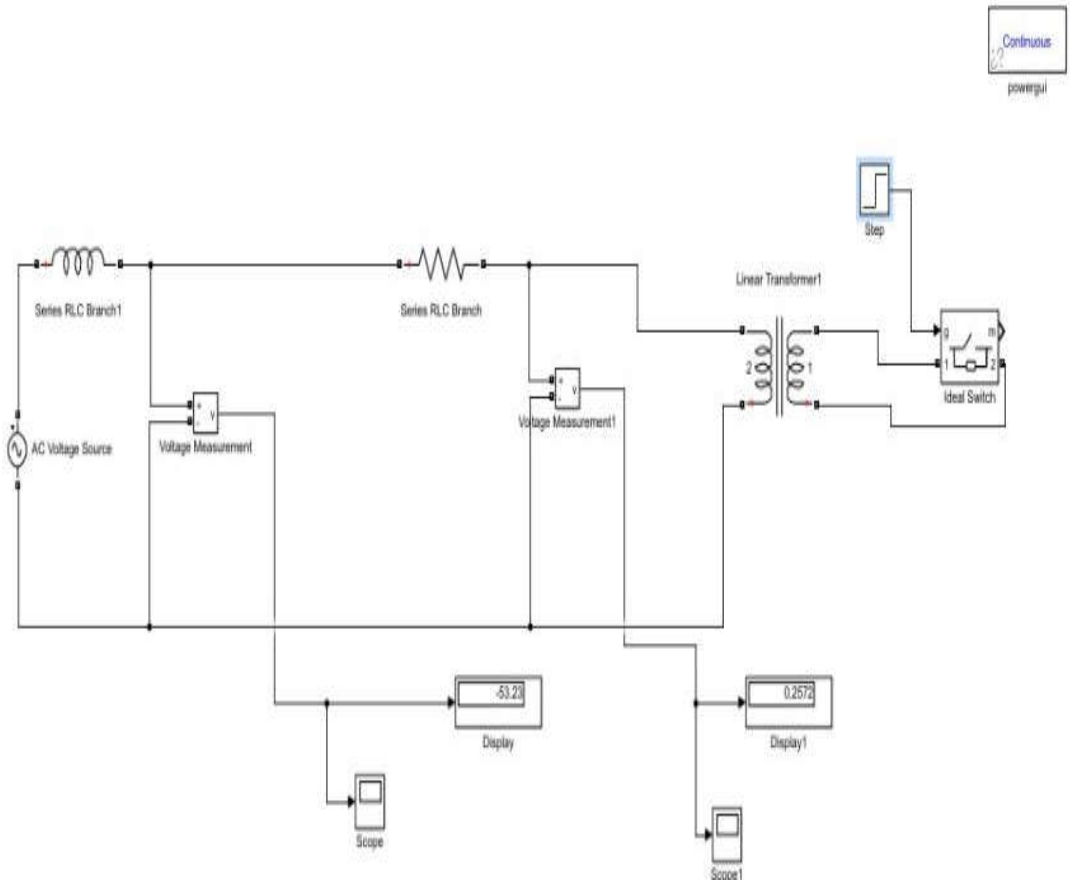
Initially the JE opens the isolators on either sides of the OHE line part that is to be maintained. The purpose of opening the isolator on both sides is to ensure security. Then the earth rod which consists of two clamps , where both are connected to the rail for ensured earthling. Next, the earth rod's tip which consists of a hook like clamp is fixed to the OHE line. Then under the JE's supervision the maintenance work is carried out. Once the maintenance work is over, the hook like clamp fixed to the OHE line is removed first. After that the two clamps fixed to the rails for earthing are removed. At last the isolator is closed and the line is energized again, after getting a conformation about the earth rod removal orally from the field staffs.



The potential transformer will measure the voltage in the over head lines after de energizing the line by Traction Power Controller. Then it gives indication to the earth rod detection system where the earth rod is detected. If the earth rod detection will be indicated to Remote Terminal Unit which is the hardware of SCADA software. The Supervisory Control and Data Acqustion System will give indication to the TPC system weather the earth is present or

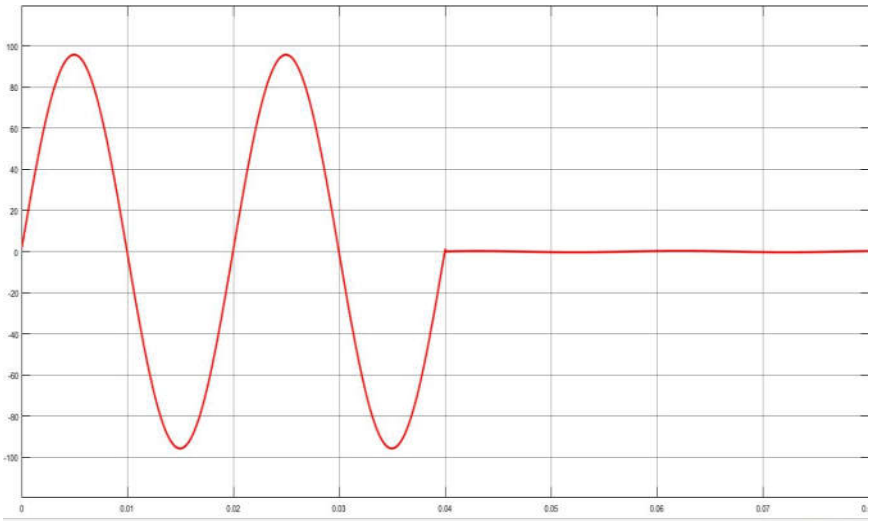
absent. Then the TPC can energize or deenergize the over head lines without the help of field staff. The advantages of the proposed systems are it is used for the safety of field staff, There won't be any miscommunication of information, The TPC can energize or de energize the over head lines without any communication with field staff, The earth rod will be detected in the TPC system by using SCADA and there is no chance of the being electrocuted.

SIMULATION DIAGRAM:



Here the 230v/12v center tapped transformer is used as an potential transformer which measures the voltage in the over head lines and indicates weather the earth rod is present or not. We are assuming the switch as an earth rod .

SIMULATION OUTPUT:



The load test on transformers such as open circuit test and short circuit tests are done. During the open circuit test there will presence of some voltage in the over head lines and if the voltage is it there is no earth rod in the OHE lines. And during the short circuit test the voltage will be zero and it indicates that the earth rod is present on over head lines. And the Traction Power Controller can energize or deenergize the OHE Lines.

HARDWARE SNAPSHOTS:

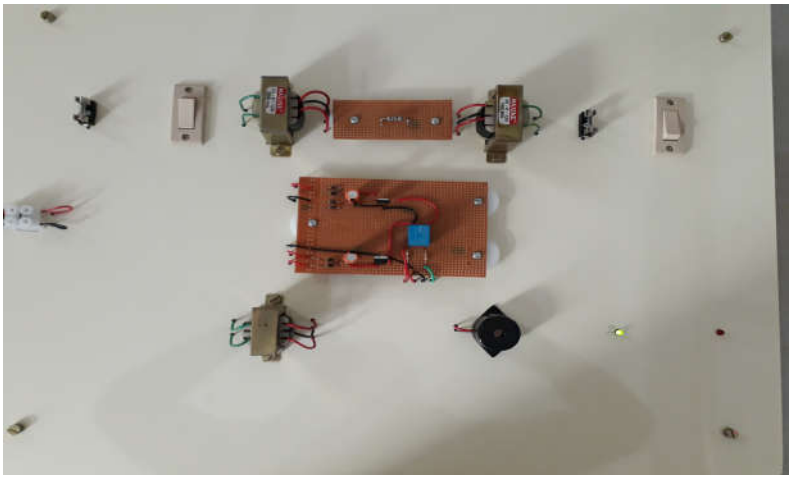


FIG.1 ABSENCE OF EARTHH ROD

The green light indicates that there is no earth rod and the Traction Power Controller can energize the Over Head Lines in Traction Network.

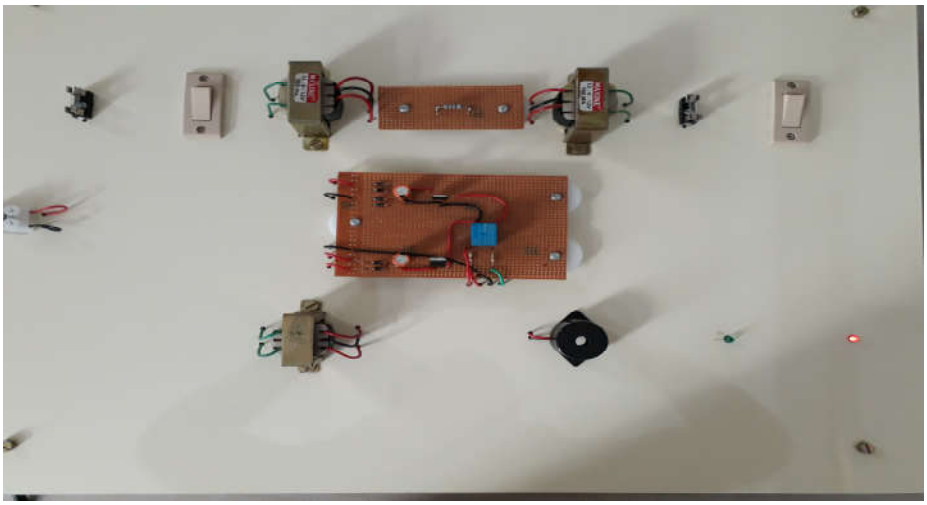


FIG.2 PRESENCE OF EARTH ROD

If there is presence of earth rod there will be a buzzer sound and the red LED will blink. At that time the Traction Power Controller should not energize the Over Head Lines.

CONCLUSION

The design and implementation of detecting earth rod is to maintain safety for the workers who work under the maintenance of over head lines in metro. The potential transformer provided in the detection of earth rod project model consists of multi tapping which is used to measure the voltage present in the over head lines. Potential transformer measures the voltage present and indicates weather the earth is present or absent. And that information will be indicated to the SCADA. The Traction Power Controller has to energize or de energize the over head lines by the indications given by SCADA software in the traction network.

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