International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

Smart Electrical Operator Using Geo-Tagging

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Abstract: ***Idea: To minimize the accidents (the risk of death of the operator/electrician on the power transmission lines) in electricity board. In the field of electricity board, hundreds of electricians work on the power transmission lines everyday. There is a high risk factor to their lives. Even though the engineer ensures that there is no power supply in the line on which the work has to be done, still there are chances that a live wire exists because of: 1) Other village or town electricty board might have laid a new line through the same pole. 2) The operator at the substation might have turned off the other line because of disturbance in the phone call.. etc. As the power transmission lines carry heavy voltages hence, working on these lines without proper information about the power supply (i.e., on/off) can be dangerous. We are proposing an idea to develop a device or an app which shows the entire electricity network (this can be accessed shortly through the central government project called geo-tagging), with the location and pole numbers etc. The engineer can check the information about the various lines passing through a particular pole and the status of the power in the lines. After the line or load clearance is given at the concerned sub-station, the engineer can refresh the page and can check the status of the supply in the lines. The status of the supply in the lines can be obtained with the help of sensors and a wifi module present at that location. Here, IoT is being used to maintain up-to-date information.***

Keywords: IoT, Geo-Tagging, Power transmission lines, Sensors

1. INTRODUCTION

The electrical networks in any part of the world is a huge network connecting the generation stations, sub stations and consumer buildings. In India, the flow of current from generation station to consumer building is as follows: From Generation Station **763kv, 400kv, 220kv** is transmitted EHT(Extra High Tension) lines to a regional station, where that extra high voltage is step-down to **132kv/33kv** and transmitted through HT (High Tension) lines to the local sub-stations, where it is further step-down to **11kv** and will be transmitted to industries, and at the distribution end 11kv is further step-down to LT (Low Tension) and transmitted to houses and other buildings either as 3-phase supply (**440v,50hz** phase to phase) or single phase supply (**230v,50hz**).[1][2]

Recently, the Indian Government took up a project on Geo-tagging the entire electrical network in India. All the electric poles will be Geo-tagged (providing geographical identification information) to help the officials in connecting the poles with fibre cable. Till date in few states like Andhra Pradesh and Telangana, the information about the **33kv** feeders between the two sub-stations and the information about the **11kv** feeders and the agricultural transformers is updated.[3]

Thus, with the help of this Geo-tagging network it is easy to get the information about the location of poles in an area and the feeders through that pole. This information can be used to know the status of supply in the transmission lines before the electrician start working on the line; thus, eliminating the risk of accident.

Hence, the further sections deals with the implementation and working of the idea.

2. Working

At every electric pole a step-down transformer is used to reduce the high tension voltage to a low tension voltage, and the directional sensors are used to get the information about the status of power in the lines. As the electric poles also carry optical fiber cables of internet soon according to the Government project information, we can utilize that facility and send the power status information/data on to the software application.

By designing a software application the person can get the information about lines passing and can view the status of power supply in various lines passing through that pole.

Directional sensors were investigated to spatially isolate the electromagnetic field from a particular power line where two or more power lines are in close proximity (referred to in this project as a “high line density” situation).A three-axis magnetic field sensor was integrated within the power line monitor and tested on AC and DC transmission power lines.

2.1 Tri-axial (or directional) magnetic field sensors

A 3-axis sensor is used to distinguishing electromagnetic fields produced from the lines in close proximity. Mathematical modeling of various line configurations (Figure 2-1) and simulations of power lines were used to optimize sensor placement and determine signal processing techniques required to identify and filter out magnetic field contributions from specific lines of interest. The electromagnetic fields from adjacent power lines are superimposed on each other and variations in the resultant angle of the superimposed magnetic field vector was designed. In the example shown in Figure 2-1 below, two lines are separated by a distance of 60 feet. The magnetic sensor is placed at 45 feet from left line and 15 feet from the right line.[4]

The magnetic vector angles are calculated for 3 cases:
1) Power flow only in right line
2) Power flow only in left line
3) Equal power flow on both lines

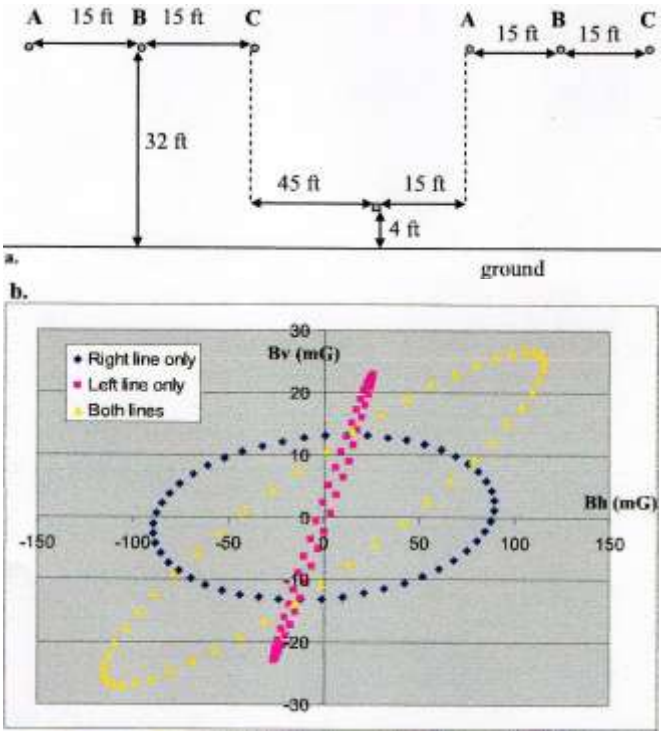
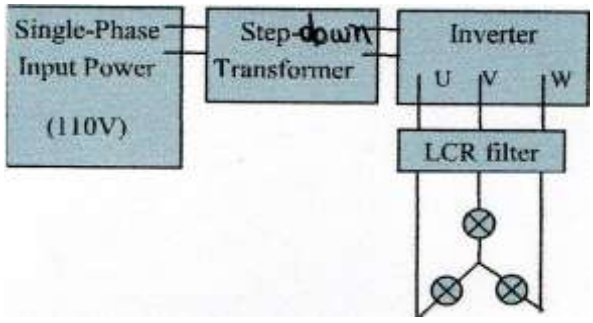


Figure 2.1: a) example for two transmission lines separated by a distance of 60 feet. Sensor is positioned at 45 feet from left line and 15 feet from the right line. b) The resultant magnetic field vector for three different power lnes (power flow on right line only, power flow on left line only and equal power flow on both lines).

Acoording to the model there is a variation in the angle of vector rotation for the three cases. A laboratory power line simulation was developed as shown in Figure 2-2(a) to test the modeling results presented above. [4]. An inverter is used to deliver 3 phase power along 3 parallel conductors. An LCR filter is used to generate a 60 Hz sine wave output. Initial results shows that the axis of rotation of the magnetic field vector varies with distance from the line as shown in Figure 2-3. Various line positions and power distribution configurations were tested as shown in Figure 2-2(b). The agreement between the simulation and experiment suggests that acquisition of data acquired on the full magnetic field vector using the 3-axis sensor can distinguish varying power levels on transmission lines in adjacent to each other.



(a)

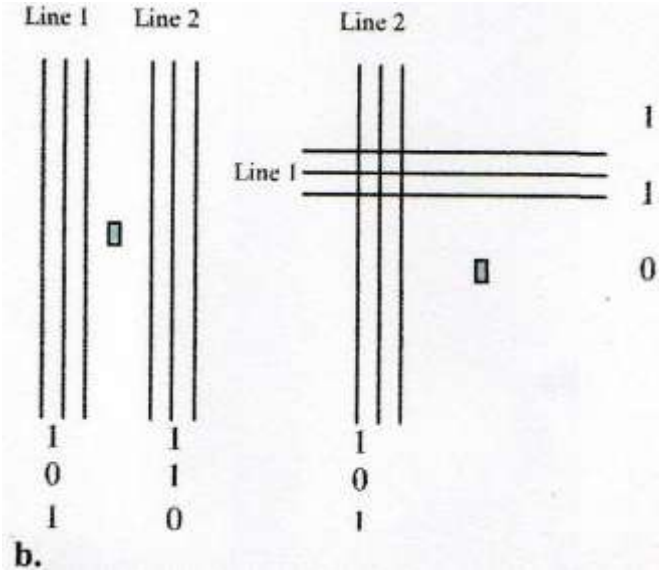


Figure 2.2: a. Circuit design for simulated power line electromagnetic field testing in the laboratory. b. Line configurations and power distributions tested using the laboratory simulation.[4]

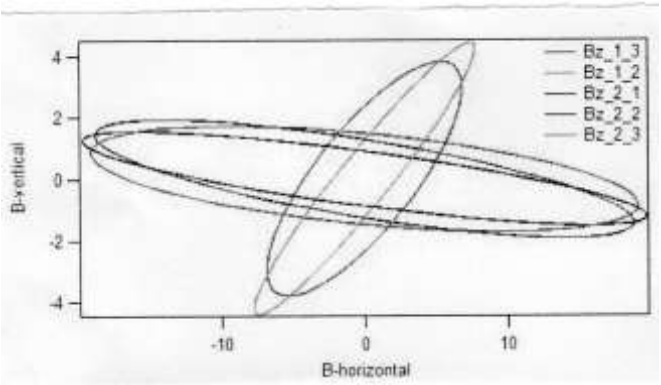


Figure 2.3: Comparison between the angle of vector rotation under the model line (Bz_2 mG) and 4cm from the model line (Bz_1 mG)

Software applications are existing already to enable data reception, data storage, data processing, geospatial event processing and event alert delivery using data from the power line monitoring network..[5]

3. Conclusion

Thus, with the help of software application the person before starting the work on the line can make sure whether the line carries power or not. The user can select the location and the pole at which the work has to be carried out, in the software application.(This can be made accessible by linking the Geo-tagging project based server/ application to our software application). With the help of Geo-tagging operator, if we can make sure the status of supply even after getting the line clear from the sub-station, we can avoid the accidents to some extent and can save a persons life and family.

4. Acknowledgement

This project would have been impossible if it wasn't for a few people who stuck with us and guided us through. First and foremost, we would like to thank our parents for being our

backbone, as without their support and encouragement, nothing would have been possible. I would also like to thank our guide Dr.Bajarangbali, who has been the backbone and driving force ensuring successful results without losing his patience. Last but not the least, we would like to thank PESSE, BSC for giving us this opportunity to display our work and talent.

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