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ENERGY CONTROL ANALYSIS, USING THE INTERNET AS A TOOL TO MINIMIZE THEFT IMPACTS

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Abstract - *Maintenance planning and control, more specifically preventive maintenance, has become a critical tool for companies that want to incorporate cost reduction strategies into their facilities. This tool has made significant advances and its application is increasingly evident in the industry. There are several types of methods used to perform maintenance and most companies use the unplanned corrective maintenance method to solve any problems, which is very disadvantageous in view of the losses related to long downtime. the execution of equipment changes, in addition, the periodicity of failures that occur in the equipment are much greater in corrective maintenance systems, because there is no study that enables the prevention of these failures. In this context, this paper approaches the model of a preventive maintenance plan in a river vessel electrical system, using reliability data for the planning of the steps and choosing the periodicity of stopping to perform the tasks.*

Key Words: Electricity, Control and Theft Impacts, technological tools.

1. INTRODUCTION

Maintenance is essential for any company to achieve its in the last years with the lack of financial investment in various sectors by the federal government, set up a financial crisis in several companies across the country. With this part of the population began to use it is a maneuver already known by the electric utilities and the national electricity agency (ANEEL), known technically as economic losses for theft of energy and popularly known as "cat".

"cat" is an act that consist in to cheat the electricity bill using illicit and clandestine connections, on your meter or not to take ownership of electricity in order not to record the energy for your electricity meter.

Because of the clandestine and fraud occurring in all regions of Brazil and in all walks of life calls, these types of activities are usually used by part of the population, caused by the ease of practice the act, thus becoming one cultural feature.

Due to the variations in unemployment that increase each year, given the economic conditions that the country has been going through since mid-2014, in contrast to the value of the electricity tariff and problematizing the socioeconomic situation [1]

To execute such the act of meter infringement (resgistration) requires just few minutes to be able to observe a saving result in a particular consumer unit. However, for the concessionaires, the results for this type of activity are considered irreversible and not immediately presented.

Tales of Miletus noted through one of his experiments in the sixth century B.C. that amber became highly magnetic after friction giving the amber the power to attract small pieces of straw. After this observation the magnetic electric field became, where it was discovered a small peculiarity or characteristics of some stones able to attract metal without needing to receive friction.

According to [1], with the discovery of the power of magnetic attraction of the stones in the region of Magnesia called Magnetites, Arabs and Chinese began to use such properties turning them into compasses for their orientation at sea. Such an application consisted of a piece of magnetite floating in a container with water no matter the direction in which the vessel was going because the stone always indicated the south of the region second [5]. In these descovery, note that importance of energy and its availability, regardless of the model. Thus in 2001, the first energy crisis in Brazil occurred, the blackout crisis, due to the lack of water in Brazilian hydroelectric plants, which according to [7] led millions of Brazilians to the rational use of electricity.

With the lack of rain, reservoir levels have dropped dramatically, leading Brazil to an unprecedented energy crisis. This problem was associated with the lack of investments in the generation, transmission and distribution sectors.

With the large number of watersheds, Brazil started to use electricity from hydroelectric dams, however few studies have been developed since the rivers have a period of drought throughout the year.

In 2015, the lack of water in the hydroelectric plants gave

rise to the second major energy crisis in Brazil. Since the large Brazilian hydroelectric plants did not have enough water within their limits for the generation of electricity [1].

In this context, the national interconnected system was created shortly after the 2001 energy crisis in order to perform maneuvers involving electricity, with the objective of coordinating, controlling and maneuvering to transport electricity from one region to another without prejudice in order to avoid blackouts in any region, currently the national interconnected system serves 98% of the national territory [7].

The "Luz para todos" program was created by the federal government in 2003, and its had as main activity to carry out the social inclusion of all Brazilian localities by developing the socioeconomic side through electric energy [9]. From that moment on, all Brazilian localities that suffered from the lack of electricity could enjoy the benefits of having quality electric energy even living in regions considered difficult to reach [1].

Corroborating with [8], the transmission lines started to have a great prominence in the Brazilian commercial scenario due to their great function in respect to the transportation of high voltage electric energy throughout the Brazilian territory, which energy that allowed the social inclusion in all Brazilian regions, where the electric power transmission lines present their electric power transmitted to the entire Brazilian territory through the transmission towers that travel throughout the national territory [4].

Electricity transmission towers have metal structures, reinforced metal conductors, lightning conductors, ceramic insulators and other insulating materials. In Brazil we have some types of transmission lines and can be classified according to their transmitted voltage level: supply voltage equal to or greater than 230 Kv, supply voltage from 88 kV to 138 kV and supply voltage of 69 kV. In Brazil there are some types of electrical distribution with conventional air distribution network, compact air distribution network, isolated air distribution network and underground distribution network [9].

The predominant type of electricity distribution in Brazil is the aerial distribution system, because this type of system has several advantages compared to other types of destruction second only to visual aesthetics.

For the electrical maintenance of the distribution system, aerial type is used qualified teams, equipped and trained for the occurrences of daily life and for situations in which it is necessary to not disconnect the power supply of a certain region is used line teams live [8].

Even so, the practice of energy theft is a very widespread activity throughout the Brazilian territory [8]. Regardless of social class and then there is no direct link between the "cat" and the low-income social class.

The illicit practice is also practiced by middle and upper class families, therefore, encompassing all social classes and sectors, whether residential, commercial or industrial. Actually, there are several ways and types of "cat" to be performed and that may even be listed as [4]: bypass on input branch, bypass on connetion branch, isolated neutral, open calibration switch, terminal of open test (1, 2 and 3), meter destroyed, meter with perforated cover, meter off, bridge between phases in terminal block, and backlighting by default.

There are numerous possibilities to make an irregular connection whether it is made directly on the counter or not. The clandestine power connections for energy are considered huge losses for electric utilities [3], due to the existence of a large difference between the energy delivered and the energy charged [5].

According to Cardoso [2], theft of electricity, also called non-technical losses, are considered to be a retardation forsociety, because all energy theft has only the offender himself as beneficiary and not the society.

With the evolution of the existing financial crisis, a portion of the Brazilian population began to use illicit means to appropriate electricity. The preventing theft of energy in some Brazilian locations is considered a high-risk activity in some locations, as electrical installations have entered communities that are protected by the power of local trafficking which inhibits the action of maintenance teams. The electrical installations did not keep up with the growing evolution of communities throughout the Brazilian territory, favoring and enabling irregular connections [3]. Thus, the use of technology to prevent and combat non-technical losses. The Arduino has become one of the best tools for combating fraud and diversion due to its market value, size and reliability, besides being usablein various sectors [6].

The arduino platform was developed in the 2000s by a team of students whose purpose was to facilitate the creation of electronic projects. Arduino is a technological innovation that allowed the introduction of sensors of various purposes and can be resistive, capacitive, inductive, approximation among other types [1].

The aim of this study is to minimize the impacts of eletric energy theft using internet associated with technological tools that can perform the control of the electric current and the connection of the electric energy meter. If necessary adjust an arduino simulator to capture the current informing in real time to the concessionaire of energy regarding any power theft.

2. MATERIAL AND METHOD

The research aims to bring information about the types of energy diversion in areas where the practice is more developed, bringing a possible solution to such social problem that is not restricted to only one social class, associating a microcontroller with the meter of the consumer unit, for recording the current consumed and the connectivity of meter for the concessionaire of energy system.

This article proposes the control of the amperage current of a consumer unit through real time controller boards, taking the first Amperage reading at the input branch of the consumer unit and finally inside the local measuring box where it is located the electricity meter.

For the realization of the physical part it is necessary to use 100 ampere non-invasive current sensors (SCT-013), Arduinos uno, 830 point protoboards, bluetooth, LCD display, pin bar, resistors, capacitors, jumpers, parallel wires, shields for connecting to the internet, computer for all programming, 9v power supply, specific wiring for protoboard connection, soldering and soldering iron. The controller board has 15 measuring units.

3. RESULTS AND DISCUSSION

With the advancement of new technologies and the emergence of arduino, several studies began to be carried out, feeding a market oriented to new technogy that using the programming language.

The programming is the way that the arduino can receive information, process and send a signal in response to the received, the programming language is the standardized method for executing pre-programmed instructions on the arduino platform through a computer that allows it to be performed of the programming.

Arduino was used, one of the best technological tools developed, due to its size, value in the commercial market and finally its ability to process various information giving answers to information inputs in a timely manner.

Thus, the development of the amperage controller board is proposed, with the purpose of minimizing power theft using the evolution of technological tools as the main ally, following the technological evolution projecting to a wide market taking into account the lack technologies developed for the area of inspection of consumer units and monitoring.

In the installation of the controller board is expected to perform without error the amperage control of a consumer unit since all items necessary for its construction have been carefully thought out minimizing any possibility of failure.

For the installation of the amperage controller boards, is required the presence of a qualified electrical or electronic professional, since the installation of the amperage controller board will require direct contact with electricity. Ampere controller boards 1 and 2 are small, easy to handle and easy to move, so they can be installed in hard to reach places, since your main sensor only needs the connection branch of consumer unit to start the data collection after it is installed and turned on.

Before being installed the amperage controller board is turned on, taking a partial reading of its own system and checking the status of all its electronic components informing on its LCD display its perfect operation allowing the performer to be installed at the input branch or connerction branch.

Installing the amperage controller board, it will make immediate contact with the other amperage controller board, finally informing the data to the concessionaire of energy as scheduled closing a whole cycle.

The amperage controller board will have direct contact with the concessionaire of energy through an internet shields informing in real time when possible power thefts occur, becoming a new tool assisting the surveillance teams in the fight against power theft.

Considering their operating mode, the Amperage controller boards will be able to tell which area of the city has the most non-technical losses taking into account the number of drives the Concessionaires of energy has.

As previously stated, the electrical distribution facilities and the supervision of consumer units have not been monitored by the concessonaires of energy throughout Brazil allowing the dissemination of practices such as large-scale power theft.

With the Amperage controller board the consumer units will have their energy consumption controlled in real time reducing the possibilities of power theft.

Based on the installation principle, Amperage controller board 1 will be installed on the pole while Amperage controller board 2 will be installed inside the measuring box.

Using Protoboards, arduinos, sensors, internet and other items, the Amperage controller board is developed with the ability to interpret the reading of the electrical current of a consumer unit made by the non-invasive current meter sensor 100A STC-013.

The amperage controller boards will have as main tool the constant exchange of information and real time of the amperage reading between them.

The Arduino, in addition to a development board, is an open-source platform created in 2005 by Italian Massimo

Banzi, contributing the learning of the electronics for students of design. The main objective was to create a low cost platform so that students could develop their designs and prototypes at the lowest possible cost.

The on-board microcontroller is programmed with the Arduino programming language, based on the C++ language, and the Arduino development environment, based on the Processing environment. The Arduino can be standalone or can communicate with a computer to accomplish the task using specific software.

All this occurs from the moment the power goes out of the transformer, destined for the consumer unit controlled by sensors, which associated with technological devices, exchanging real-time information via Bluetooth with the concessionaire of energy via the internet.

In the event of disconnection of the meter or current difference between the sensor located on the pole and the sensor located on the meter, the central unit of information will be informed that something other than the programmed one is happening.

The concessonaires of energy, in reply, sends one of its teams to the site to perform a meter inspection of the consumer unit thus avoiding daily expenses.

When it comes to initiatives and news in the energy sector, an extremely important issue not addressed in most studies that is the market implementation of the device studied. It's amazing how many inventions could definitely change the world, but few are really available to the consumer. It was found that reading the electricity consumption in real time actually generates greater knowledge for users, arousing their curiosity and consequently their awareness.

For the accomplishment of the study, in order to follow the energy deviation according to [13], eletrical energy is present in all human activities and, as it is not directly available in nature - being obtained through natural resource transformations - its adequate consumption manifests itself as one of the essential requirements. For building a sustainable development model [14] argues that the pursuit of energy efficiency should be a conscious part of all actions of the modern human being.

The Internet is probably the largest engineering system ever created by the humanity, with hundreds of millions of connected computers, communication links and switches, billions of users connecting through laptops and tablets, and a host of devices like sensors, webcams, game consoles, picture frames and even washing machines being connected [10].

In the conception of [11], the fast popularization of the Internet and its access from mobile devices can be pointed as the most visible part of the transformations that the media landscape goes through, especially in the last decades. This promising scenario is favorable for the expression of ideas, the emergence of concepts and theories, as well as the proliferation of new technologies. In a broader definition, the Internet relates to the ability of networked objects to provide information about their operation. Such technology, infer [12], has the purpose of providing intelligence for objects, in order to allow their control and notification of changes in their state.

From 2015 [16], energy bills had an additional metric resource, the Tariff Flags. The system complements the current method of charging electricity consumption and consists of three flags: green, yellow and red. They indicate whether energy is more expensive or cheaper depending on the conditions of electricity generation.

According to [16], with the flags, the electricity bill becomes more transparent to the consumer and encourages them to use it more consciously. Following the logic - green flag: favorable conditions for power generation. The fare is not increased at all; yellow flag: less favorable generation conditions. The tariff increases by R$ 0,025 for each kilowatt hour (kWh) consumed; red flag: more costly conditions of generation. The tariff increases by R$ 0,055 for each kilowatt hour kWh consumed.

The first devices that measured the consumption of electricity were based on lamps, as the voltage and current in these lamps were constant and that all lamps were connected to only one switch, it was necessary to measure only the time these lamps were lit so that it had the final consumption at that time was created the lamp-hour unit and the arduino today [15].

4. CONCLUSIONS

As for the aspects inherent to “energy efficiency”, it is evident the dependence of the human being for electricity, which is fundamental for economic, social and well-being development. It is shown pressing, adopting methods of generating clean, less polluting and harmful to the environment, based on renewable sources. Like these measures, the modification of the consumption habits of the population and the increase of new technologies are relevant to achieve sustainable results in the use of energy. Therefore, the difference in amperage reading between the controller boards will trigger the concessionaire of energy via the internet indicating a change in electricity consumption.

In view of the above, and aiming at maximizing the control of non-technical losses and consequently the minimization of electric thefts, with the use of the controller board, the concessionaire of energy would be fighting their own expenses related to their teams of combat and surveillance of theft of electricity daily.

There is no doubt the possibility of reducing costs even by the power utility with its inspection teams, since the inspection teams would only to the location specified when the concessionaires of energy were triggered by the controller board electricity.

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