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EFFICIENT POWER UTILIZATION IN COMMUNICATION TOWERS

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Abstract *–In this modern era, due to the rapid growth of technology, the usage of mobile has become wide which leads to implementation of enormous communication towers. The source input for the cellular towers depending on the power requirement in the developing countries are always greater than the generated. Hereby our idea is to reduce the energy usage and emission of CO2 into the environment by Green Radio Technology, which prefers environment friendly approach towards the mobile communication. The methodology in Green Radio Technology is dynamic switch over of towers. The dynamic switch over is based on the frequency handling of a tower. Based on this, a tower may remain either in an active state or idle state.*

Keywords— PIC Microcontroller - 16F877A, Cellular tower, Relay driver&Relay-12V, Solar voltaic cell.

1. INTRODUCTION

Cellular phones first become widely available in 1990's and the corresponding usage of cellular phones also increased in parallel. This parallel increase in usage of cellular phones has lead to implementation of communication towers called base stations.. The base stations comprises of electronic equipment and antennas that receive and transmit radio frequency signals. Effective energy management is the essential requirement for successful operation of mobile communication networks. Energy saving is one of the important parameter for mobile operators because directly and indirectly mobile operators are creating huge loss to the society by wasting power. As a part of energy management, reduction of energy consumption by the towers is achieved by Green Radio Technology.

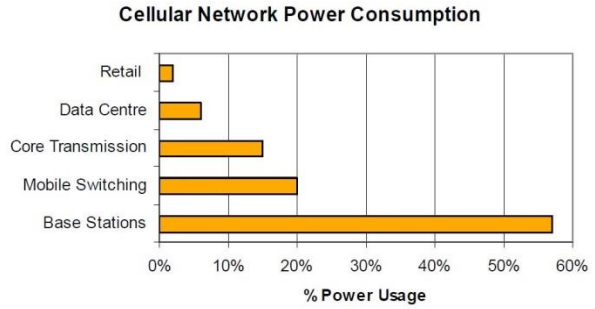


Fig-1.Cellular Network Power consumption

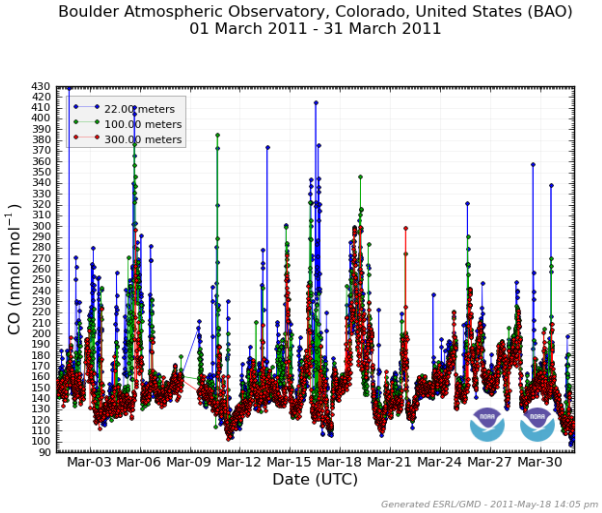


Fig-2.CO2 emission from base station (observed at various distance in atmosphere)

The FIG1 clearly demonstrates that, the base stations alone consume more power than other parameters in cellular networks. The FIG2 shows the CO2 emissions in atmosphere by subscribers from base stations. The impact due to several million towers installed in a country is unimaginable.

Moreover, in communication towers, power is not only used for the signal transmission process but also running the cooling unit of generator and light indicator along with lighting arrestor. These cooling unit operates throughout the day irrespective of the temperature and environmental change. So by turning off the cooling unit at unnecessary condition will reduce considerable amount of power usage.

Green Radio Technology prefers the use of renewable energy sources like solar and wind in the place of conventional source (diesel). *In* general, all the towers *remains* on working state irrespective of the traffic (number of users) which leads to the wastage of power. In order to overcome this, our project proposes a comprehensive approach towards an energy efficient operation of communication towers during less traffic *(less number of users)* by keeping only one mobile tower on working state to take up all communications while the remaining towers stay in idle mode. Hereby our objective is to reduce the energy

consumption in the base stations and reduce the amount of CO2 emission.

2. LITERATURE REVIEW

"Green Radio: Radio Techniques to Enable Energy-Efficient Wireless Networks" by Congzheng Hanetal.

Gives an overview of the ongoing Mobile VCE Green radio project, that aims in reducing the energy consumption of wireless links. By the project, it has been shown that solar based stations can have very high operational energy budgets than mobile networks, therefore to reduce the energy consumption of mobile communication system, appropriate designing of energy consumption of base stations is important.

"Toward Dynamic Energy-Efficient Operation of Cellular Network Infrastructure" by Eunsung oh.

Provides the dynamic operation of mobile base stations in which low traffic base stations remains in idle state which limits the wastage of power .Based on real cellular traffic and information, the authors discuss the first order approximation of the power saving that can be expected by turning off base station during low traffic periods while maintaining coverage and inter operator coordination.

"A Significant Scheme of Distributed Generation

System using Wind-solar-diesel Applying in Island" by Jie Shu, Xianyong Zhang, Changhong Wu, YuLiang Shen/IEEE.

Provides the design of wind-solar-diesel hybrid power supply system that can make fully use of the local wind and solar resource which results in the reduction of co2 emission in the atmosphere. By the project, the use of conventional resource is reduced and exploitation of renewable resource is increased.

"Isolated Micro-Grids With Renewable Hybrid Generation :The Case of Lencois Island" by Luiz Antonio de Souza Ribeiro, Osvaldo Ronald Saavedra, Shigeaki Leite de Lima, and Jose Gomes de Matos/IEEE.

Proposed the specification on, design and development of a standalone micro-grid supplied by a hybrid wind solar power supply system .The author discusses about the families in Island have not been connected to an electricity grid yet ,due to their remoteness .By the project, the above problem is resolved.

"Solar power generation :International Journal of Photoenergy" by K.S.Reddy, T.K.Mallick and D.Chemisana.

In this Journal, the importance of solar power generation technologies in contributing a major share of the renewable energy needed in the future is proposed. Furthermore, the generation of solar power by photovoltaic (PV) and concentrating solar power (CSP) systems is explained in detail.

"Power Consumption: Base Stations of Telecommunication in Sahel Zone of Cameroon: Typology based on the power consumption-Model and Energy savings"

By Albert Ayang, Paul-Salomon Ngohe-Ekam, Bossou Videme and Jean Temga.

This paper consists of categorizing telecommunication base stations (BTS) for the Sahel area of Cameroon according to their power consumption per month .It also mentioned that the mismanagement of lightning systems ,air-conditioning systems were also the cause for increased power consumption of the base station.

"Energy efficiency enhancements in radio access networks" by T.Edler, S.Lundberg.

The author strongly believes that energy consumption in the usage phase of the radio access networks is the most critical factor relating to impact on the environment .He also attempted to develop solutions that reduce operating costs and effects on the environment.

"Power Consumption and Optimization of Energy Consumption in telecom towers in India" by Eisha Akanksha and Y.P.Singh.

This paper consists of categorizing telecommunication Base Stations (BTS) for India and their power consumption. He also proposes some parameters for saving energy that clears the congestion effectively and improves the quality of life that provides the cleaner environment.

"Green and Sustainable cellular base stations: An overview and future research directions" by Jin Hong Kim, Jeong Kim, Mohammed H.Alsharif.

This study presents an overview of sustainable and green cellular base stations which account for most of the energy consumed in cellular networks .It then summarise the trends in green cellular network research over the past decade and it also highlights the ruses of renewable energy in cellular communication.

3. EXISTING SYSTEM

The architectural operation of presence scenario is not energy efficient. On an average, a typical diesel generator that is used for supplying power for communication towers consumes seven million of diesel per day. This results in emission of 85 kilogram of carbon per day into the atmosphere. On the other hand, irrespective of the user frequency (number of users) all the towers in an area are turned on. This leads to the considerable wastage in power.

4. PROPOSED SYSTEM

In order to overcome the disadvantages we have proposed a technique Green Radio Technology. This technique limits the usage of power and reduce the CO2 emission. Solar photo voltaic based power generation is believed to be a solution for reduction of carbon dioxide emission. The other disadvantage is overcome by activating the tower based on the user strength that is in accordance with the user strength in a region, the towers in the particular region is turned on/off.

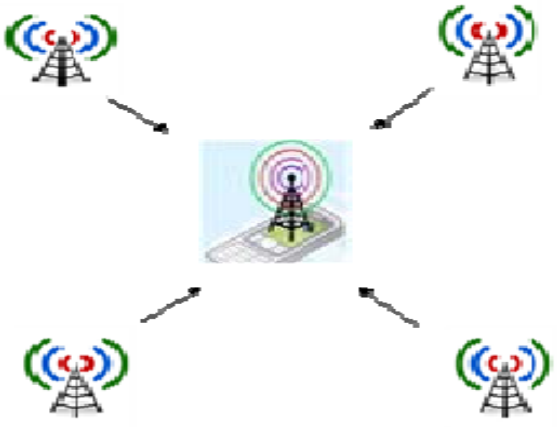


Fig. 3.2.1. Current configuration

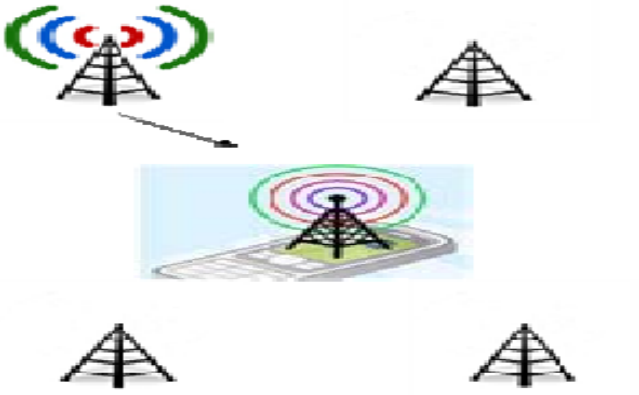
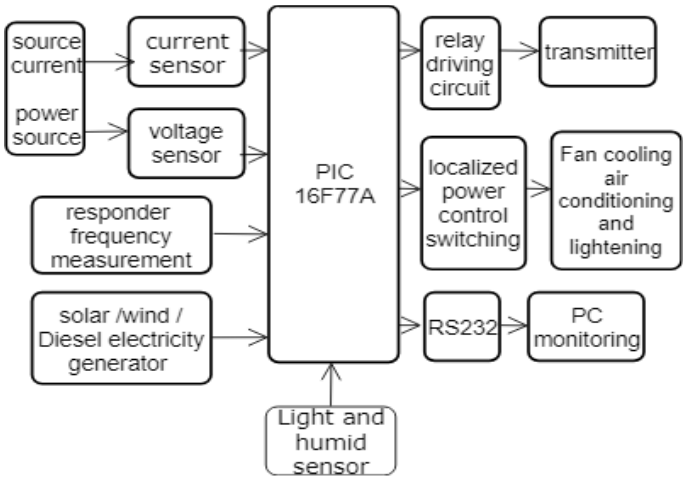


Fig. 3.2.2. Proposed configuration

5. BLOCK DIAGRAM



In this block diagram, the current and voltage sensing circuit helps to sense the power and give the corresponding output to monitoring system. The responder frequency which will be received from the main server will help microcontroller to decide whether tower should activate or not ,this is achieved by setting predefined threshold frequency and that corresponding received value can be displayed in PC. Local temperature and humidity monitoring sensor senses the temperature and humidity level of the environment and controls A/C and cooling fan according to the temperature. If the current and voltage sensing output is zero, it indicates that the number of users is zero in that instant of time .Similarly if number of users using the cell phone tower get increased then relay will activate neighbouring towers

6. SOFTWARE IMPLEMENTATION

The tool which we are going to use is Visual Basic. Visual Basic is Windows based application which is easy to learn. It is one of the language to support programming which especially suited to graphical user interface(GPI).Visual Basic is ease to use which makes us to work in dialog boxes etc and they required only less lines of programming to control.

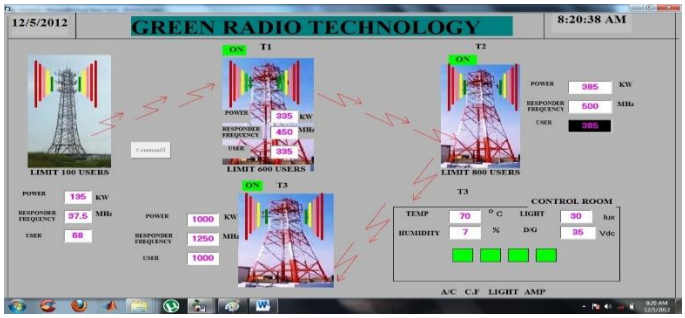


Fig-3.Software Implementation

The first window is to monitor the renewable energy harnessing on the rooftop of the tower

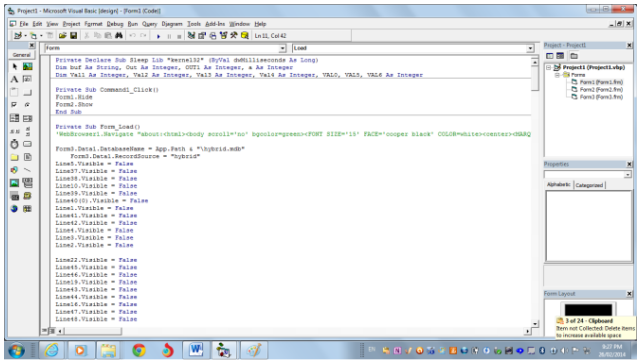


Fig-4. Software Implementation (Window 1)

The second window for viewing the database which is used for storing all details about voltage, power and current of renewable energy

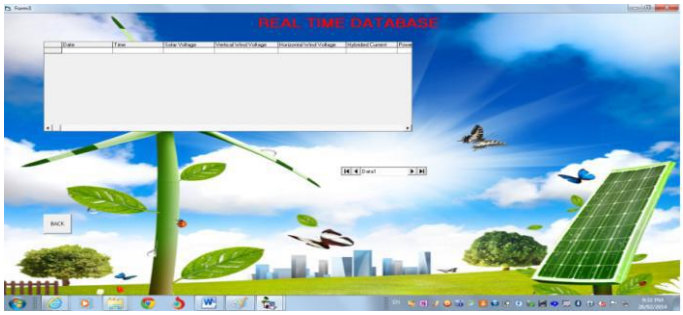


Fig-5.Software Implementation (window 2)

7. METHODOLOGY

A. GREEN RADIO TECHNOLOGY

Power consumption in communication towers is reduced by adapting the network capacity to the actual demand at a given time. The cellular tower working will be based on the peak and off peak hours. In current scenario, even at the time of less traffic(less number of users) condition in a particular region ,all the towers were made to work. This results in wastage of power. Our idea is to propose a new methodology to reduce this power wastage. The methodology is dynamic switch over of towers. It is as follows. Based on the survey conducted, the time zone of less traffic condition is extracted .During that interval, only one tower (primary tower) is made to be active and the remaining towers were set to remain in idle state. When the frequency handling of primary tower is exhausted, the other tower (secondary tower) is activated. Consequently, if the number of users count decreases again, the secondary tower is made idle and the primary tower alone is capable of handling the users.

B. RENEWABLE ENERGY SOURCE

On an average, each tower consumes 28 litres of diesel per day which results in emission of 85 kg of carbon in atmosphere .The total CO2 emission rate by millions of towers in country is unimaginable. In order to reduce CO2 emission, the power used by the base station is reduced. This is achieved by controlling different parameters within the base station. Communication towers, in addition to signal transmission and reception , consumes power for cooling unit that consists of air-conditioner ,cooling fan ,lightning arrester along with a light indicator. By controlling these parameters based on their need, the reduction of considerable amount of power consumption is achieved .Also by using renewable resources like solar power, wind energy in place of conventional diesel source, the emission of green house gases is reduced.

8. CONCLUSION

In this paper, a framework for efficient power utilization in cellular towers is proposed. Thus by introducing Green Radio Technology, energy usage by base stations will be limited as much as possible and hence the emission of harmful green house gases (carbon dioxide) will be reduced. This leads to an environmental friendly approach towards wireless communication.

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