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Green Energy Based Mobile Communication System

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Abstract: Day by day the number of mobile users and the network operators increasing precipitously which fallouts the demand in energy efficiency. Green radio technology prefers environment friendly approach towards the mobile communication. The mobile towers are increasing in an extraordinary manner thereby increasing the radiation of electromagnetic waves as well as the burning of coal to generate the power. The source for towers is based on the power requirement. In our project, depending upon the number of users the sub towers are activated. When enormous amount of power is produced and consumed, the emission of carbon dioxide, sulphur dioxide are increased which harms our environment. So to avoid the problems due to the mobile communication system, we proposed a model in which the power is saved and at the same time the power is produced using solar energy and wind energy which also saves our environment from the harmful effects. The whole thing in our project is monitored using IOT. This project is developed for modification in mobile infrastructure for energy conservation andCo2reduction (carbon credit).

Keywords: Co2 reduction, conservation of power, green radio, mobile users, IoT

I. INTRODUCTION

Now a day usage of power has been increased which thereby increases the burning of coal which pollute the environment by releasing the harmful gases such as carbon di oxide, sulphur dioxide etc. Mobile communication has the latent to make direct and indirect aid to reduce the environmental impacts. Here we implement the concept of reducing the power consumption by a sub tower that provide network for mobiles. As a result we conserve the energy as well as reduction of emission of such gases. There will be a control room consisting of the power amplifier to manage the usage of bandwidth from the tower. The power amplifier gets heated soon by enabling the towers one by one. So to protect the amplifier the control room is fixed with AC and usually a room consists of a light, fan etc. The operation of an AC is not needed during rainy season where the humidity matters. At that time we can reduce power consumption by using a blower. During the night time the number of users will be less compared to the day time, so there we can turn off the towers that is making the tower sleep mode thereby reducing the power consumption. Thus the main aim of this project is to reduce the power consumption and generation of power using a solar panel and wind mill and it can be used by utilising less power from power station. This also reduces the cost. By putting the tower in sleep mode in night time while the number of users is less, the power used for that tower is reduced, so power consumption is reduced. Saving 1Watt power in a single tower every day, saves a large amount of current in all the towers which saves the power usage of the tower.

II. RELATED WORK

Markus Gruber, Oliver Blume, Dieter Ferling, Dietrich Zeller, Muhammad Imran, Emilio Calvanese Strinati jointly presented EARTH-Energy aware radio and network technologies. The main technical objective of this project is to achieve the overall energy consumption of mobile broadband networks by 50%.EARTH regards both network aspects and the individual radio components. On the component level this project focuses on base station optimization as power amplifiers consumes the most energy in the system. Power efficient transceiver is developed to adapt changing of traffic load for an energy efficient operation in mobile radio communications. EARTH reduces the cost and carbon dioxide emission.

N. faruk, A.A. Ayeni, M.Y. Muhammad, L.A. Olawoyin, A. Abdulkarim, J.Agbakoba, M.O. Olufemi (2013) presented Techniques for minimizing power consumption of base transceiver station in mobile cellular system. This paper investigates power consumption of base transceivers stations (BTS) schemes that potentially decrease

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the power consumption and the potential of reusing the conserved power without compromising quality of service of network. MIMO (multiple input multiple output) technique is used, power is reserved and optimized and increase reserve power.

JieTang, Daniel k.c, Emad Alsusa, Khairi Ashour Hamdi, Arman Shojacifard (2015) introduces a Energy efficient optimization with interference alignment in multi-cell MIMO interfering broadcast channels. The important design of green wireless system is characterizing the fundamental energy efficiency (EE) performance of multiple input multiple output interfering broadcast channels (MIMO-IFBC). Here new network architecture proposition based on EE maximization for multi cell MIMO-IFBC within the context of interference alignment. Two schemes are proposed to optimize EE for different signal to noise ratio (SNR) region.

"Green Radio: Radio Techniques to Enable Energy-Efficient Wireless Networks" by Congzheng Hanetal., provides an in-depth overview of the ongoing Mobile VCE Green Radio project, which aims to establish novel approaches to reducing the energy consumption of wireless links, especially improving the design and operation of wireless base stations.

"Energy Consumption in Wired and Wireless Access Networks" by Jayant Baliga et al, Provides detailed analyses on the corresponding energy consumptions of digital subscriber line, hybrid fiber coax networks, PONs, fiber to the node, point-to-point optical systems, UMTS (WCDMA), and WiMAX. The authors conclude that PONs and point-to-point optical networks are the most energy-efficient access solutions at high access rates.

III. EXISTING SYSTEM

The towers are controlled by the control room by powering it according to the number of users. In some systems they have only generated power using solar panel without managing the tower. One more technology that have been used is the multiple input and multiple output to reserve the power and to use the reserved power. Various techniques and protocols are used to save the power consumed by the tower.

IV. PROPOSED SYSTEM

Here we propose a model using the green radio concept in terms of mobile communication, which reduces the harmful gases emission and make the efficient usage of bandwidth. And also the generation of power using solar and wind energy and it is consumed which reduces the intake from main power station. The towers of the subsystem are managed by means of wireless. We introduce a method of monitoring the status of the towers using Internet of things.

V. HARDWARE REQUIREMENTS

SINGLE BOARD COMPUTER

Single-board computer (SBC) is a complete computer built on a single circuit board with microprocessor, memory, input/output (I/O) and other features required of a functional computer. Single board computers were made for demo and development purpose, for educational systems, or for use as embedded computer controllers. Many types of home computers or portable computer integrate all their functions onto a single printed circuit board.

A single board computer is different from a personal computer by the way it is designed. A single board computer has all of the elements of a complete computer contained within one single circuit board. On a desktop computer, the processor, memory, storage, input and output devices and other basic components attach via sockets on the motherboard. On a single board design, everything is self-contained. Single board computers are also expanded in their capabilities differently than desktop computers. On a desktop computer, adding capability to the motherboard is typically accomplished by plugging a peripheral device into a slot on the motherboard. Single board computers come in a huge range of different capacities. Because some of them are used to control very simple processes, some single board computers are very slow and limited compared to the average desktop computer.

In many cases, single board computers are plugged into a backplane. The backplane allows for input and output devices to be attached to the computer. Single board computers are frequently used in rack systems, which allows for reliable and fast integration into a system.

Single board computers have all of the capacity required to perform most automation tasks and specialized designs are widely available. Single board computers are very small. This allows them to be embedded in devices where space is very limited. The computers are also very efficient, giving them an edge where saving on power is concerned. In addition to these advantages, single board computers are self-contained, making them very reliable under trying environmental conditions.

A single-board configuration reduces a system's overall cost, by reducing the number of circuit boards required, and by eliminating connectors and bus driver

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circuits that would otherwise be used. By putting all the functions on one board, a smaller overall system can be obtained, for example, as in notebook computers. Single board computers are most commonly used in industrial situations where they are used in rack mount format for process control or embedded within other devices to provide control and interfacing. There are different types of single board computer. Raspberry pi is the one which is used in this project.

The RaspberryPi is a credit-card-sized computer that plugs into your TV and a keyboard. It is a capable little computer which can be used in electronics projects, and for many of the things that your desktop PC does, like spreadsheets, word processing, browsing the internet, and playing games. The original Raspberry Pi is based on the BroadcomBCM2835 System on a Chip (SoC), which includes an ARM1176JZF-S 700 MHz processor, VideoCoreIVGPU, and was originally shipped with 256 megabytes of RAM, later upgraded (models B and B+) to 512 MB.

VI. BLOCK DIAGRAM

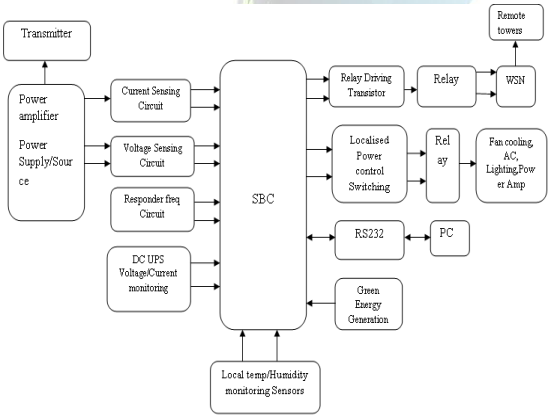

Fig: Block Diagram

VII. MODULES OF GREEN RADIO

There are different modules included in the concept of green radio. They are the following segments

1. Voltage sensing unit
2. Current sensing unit
3. Responder frequency
4. Light sensing unit
5. Temperature sensing unit
6. Humidity sensing unit

VOLTAGE SENSING UNIT

The voltage sensing circuit, which consists of potential transformer, potential divider, fullwaveprecision rectifier and filter. The potential transformer for sensing the voltage. Fullwave precision rectifier has an op-amp to produce an efficient output.

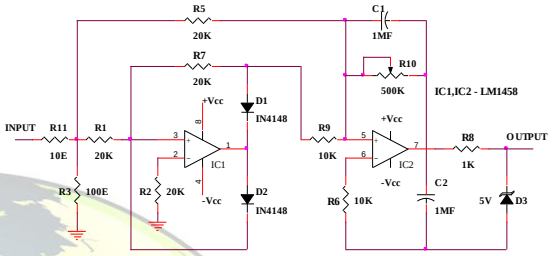

Fig: Circuit Diagram of Voltage Sensing Block

CURRENT SENSING UNIT

Current sensing circuit consists current transformer, shunt resistor, full wave precision rectifier and finally a filter. The secondary of the current transformer should not be left open if there is any current in the primary, the entire primary voltage become the induced voltage for the secondary. Operation is same as that of voltage sensing circuit except a shunt resistance is used to convert current to voltage

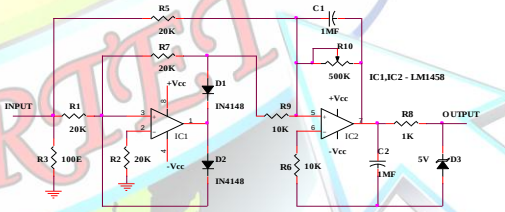

Fig: Circuit Diagram of Current Sensing Block

An integrator is used to find the exact number of users and to filter the noise. Zener diode acts as an voltage regulator here to output a 5V which is input to an SBC.

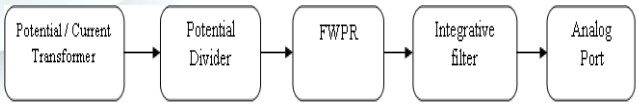

Fig: Block of Current and Voltage Sensing Circuit

Potential transformer is used in the voltage sensing unit to step down the input voltage and current transformer is used in the current sensing unit for maintaining the input voltage. Full wave precision rectifier and the integrative filter is common for both the voltage and current sensing unit. FWPR using op-amp is used and the Integrative filter gives the saw tooth waveform.

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RESPONDER FREQUENCY UNIT

The tower is powered with the help of responder frequency circuit. Here in this circuit an unknown frequency is converted into a known frequency. The unknown signal is generated by the astable multi vibrator. Responder frequency decides the type such as type of a wave which is decided by the Schmitt trigger, the amplitude of the signal and finally the duty cycle. Finally the frequency is converted into an equivalent voltage using the frequency to voltage converter circuit. Finally the responder frequency circuit consists of transistor coupler, Schmitt trigger, differentiator and an F2V converter

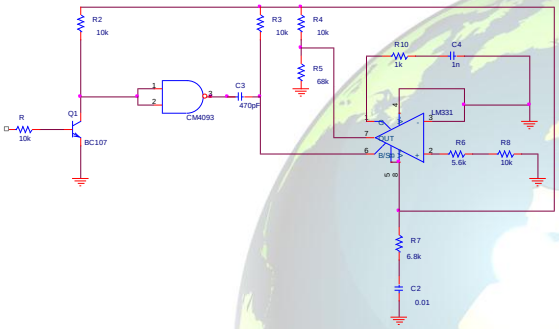

Fig: Responder frequency ciruit

Input is given by Function generator or astable multivibrator. Transistor BC107 is used to shape the incoming wave. CD4093 is used as Schmitt trigger.LM331 is used to convert frequency to voltage. The converted voltage is given to the analog port.

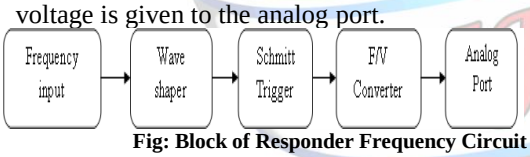

Fig: Block of Responder Frequency Circuit

TEMPERATURE SENSING UNIT

The temperature sensing unit consists of a potential divider and a thermistor. The thermistor is a temperature dependent resistor or a passive transducer. From the thermistor it is given to the low pass filter and then to the SBC through the analog port. This is used to sense the humidity based on which the power is managed for the control room as said before. Likewise during a seasonal change the tower problem will occur probably hence to avoid such uncomfort the humidity sensor will intimate the nearby tower to share its bandwidth so that the users are benefited and will not suffer from a signal problem.

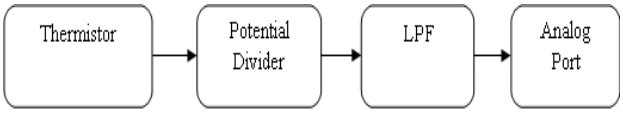

Fig: Block of Temperature Sensing Circuit

Thermistor is made up of Bismuth oxide -B type. From this we can also get the Humidity value. This will control A/C and cooling fan according to the temperature.

HUMIDITY SENSING UNIT

Humidity sensing unit also consists of thermistor as same as the temperature sensing which is used to sense the humidity based on which the power is managed for the control room as said before. Humidity is measured by measuring the temperature. Likewise during a seasonal change the tower problem will occur probably hence to avoid such uncomfort the humidity sensor will intimate the nearby tower to share its bandwidth so that the users are benefited and will not suffer from a signal problem.

LIGHT SENSING UNIT

Light sensing circuit uses a main component as a light dependent resistor and a potential divider .This unit is placed in the control room, used to control the power amplifier. This unit senses the light intensity, based on that it controls the switching of light inside the control room which saves the power consumption.

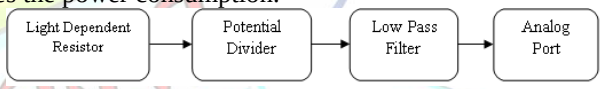

Fig: Block of Light Sensing Circuit

LDR is light dependent resistor which is used for light sensing. It is made up of solenoid. The luminance of light 10-10000 LUX will be sensed.

RELAY DRIVING UNIT

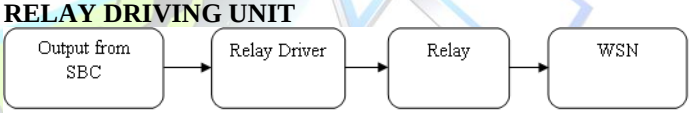

Fig: Block of Relay Driver Circuit

Output is obtained from the port of SBC that is raspberry pi. BC 107 is as relay driver. 4 relays are connected to each collector of transistor which controls the sub tower in wireless mode.

TRANSMITTER AND RECIEVER SECTION

In transmitter side we send responder frequency when power amplifier once reached 85% and during the rainy season based on the humidity the responder frequency is given when power amplifier reaches 70% which ensures the signal strength. This frequency is send at near BS based on priority. Responder frequency is received on the receiver side of the Base station. Then the BS instructs to switch ON it. Each BS having transmitter as well as receiver.

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The sub towers are powered on in means of wireless. The block diagram is as follows:

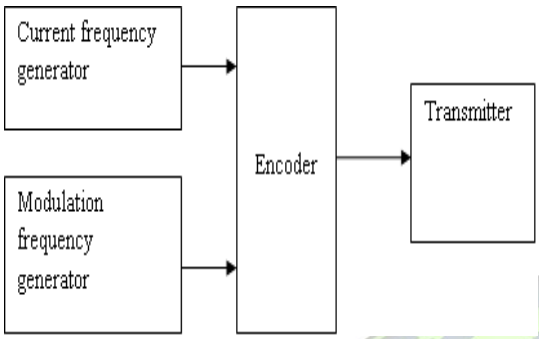

Fig: Tranmitter Section

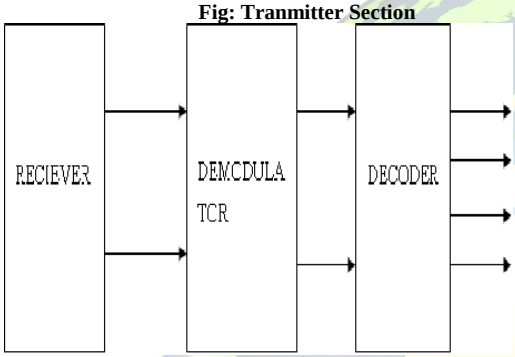

Fig: Receiver Section

In the transmitter side carrier frequency and the modulation frequency is given to the encoder, which encodes the signal and transmits to the receiver. In the receiver side, the demodulator demodulates the encoded signal and decodes the signal. In the receiver side up to four sub towers can be connected and can be powered on using the wireless transmitter.

VIII. SOFTWARE REQUIREMENTS

VISUAL BASIC

Visual Basic is Easy Programming language with Visual Basic you can develop Windows based applications and games Visual Basic is much easier to learn than other language (like Visual C++),and yet it's powerful programming language.Users are able to work in a graphically rich environment. This made application much easier to learn and use. It also facilitates the use of multiple windows on the screen enabling to run more than one program at a time.Things that may be difficult to program with other language can be done in Visual Basic very easily. Here the VB is used for the graphical representation of the tower responder frequency, controlling the lights fan AC etc are seen in the graphical format and also the voltage generated by the solar and the wind also shown in the visual basic screen.

TWO METHODS FOR GENERATING CURRENT

- Wind turbine
- Solar panel

Current is generated using the solar panel and the wind turbine. The produced power from these two are merged together to a battery and used when power is off or instead of the generator. Polarity control is used to block the reverse operation. From the wind energy and the solar energy, power is generated and stored in the battery and when the battery is fully charged it will reverse the current to the wind turbine or solar panel which works as motor or heater.so to avoid the reverse operation polarity control is used.

RESULTS

The final outcome of the hardware and software is as follows.

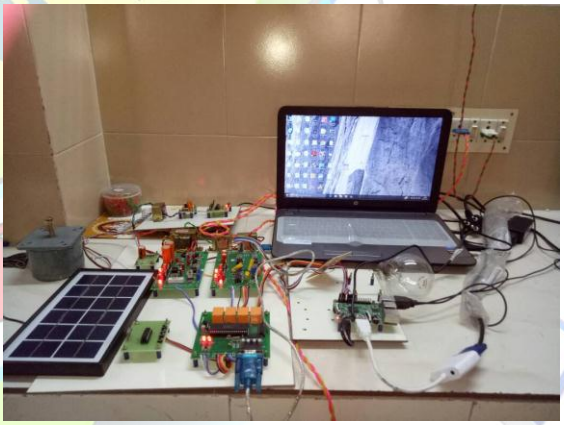

Fig: Hardware Outcome

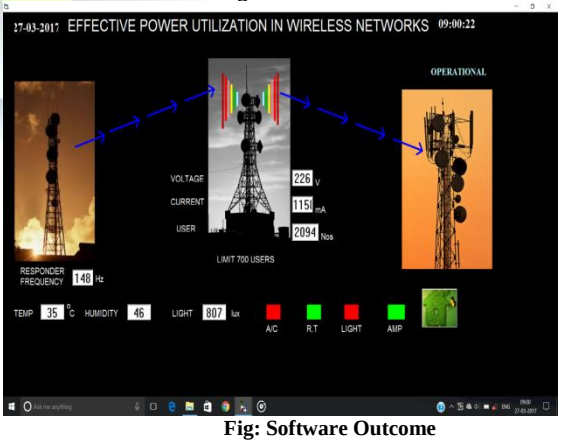

Fig: Software Outcome

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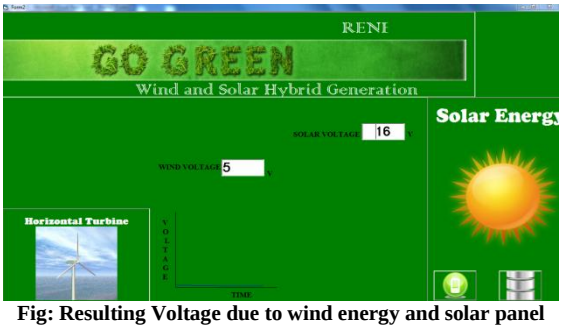

Fig: Resulting Voltage due to wind energy and solar panel

IX. CONCLUSION

Thus the green radio concept is implemented using the limited bandwidth according to the number of users. The power is generated by means of solar and wind energy thus reducing the burning of coal thereby reducing the CO2 emission. Our project proposes a comprehensive approach towards an energy efficient operation of next generation mobile communication. Green Radio includes efficient hardware and software platforms and careful integration into self organizing network functions. This technology is a key factor for operation expenditure reduction and endures an eco friendly.

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