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Implementation of Internet of Things for Electrical Energy Harvesting System of a High Tension Transmission Line

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***Abstract*--High voltage overhead lines play a major role in high power transmission, as they possess low power loss, high efficiency and can be transmitted at less cost. But increase in temperature, gradual aging of the transmission line conductors, ice coating surrounding the conductors will increase the sag of the line. This will further restrict the operability of the transmission system. If the ice coating increases on the conductor or vibration due to air increases on the conductor may tends to break the conductor. The operating condition or the state of the transmission line can be monitored and necessary action can be taken before actual damage occurs in the system. With rapid increase in the power industry and urbanization, loop network and cable routing has to do in a proper way. So underground power supply has carried out in many thickly populated areas. Even though underground power supply looks convenient, it cannot be applied for long power transmission system. In this paper we have done monitoring of the various devices which are directly mounted on the transmission line conductor. Protection of electronic equipments from strong electric fields, feasibility of powering devices, wireless data transmission system and also the operating condition of the system in the presence of strong magnetic field which appears due to heavy currents and transient signals.**

Key words: Aurdino, PIR sensor, ultrasonic sensor,GSM modem, GPS modem.

I. INTRODUCTION:

Icing of transmission lines puts additional weight on the conductors and causes increase in the sag level of the system. The vibration of the conductor can be minimised and longer life time can be provided by having the knowledge of the Eigen frequency of the conductor. From already existing environmental sources, many technologies have been developed for harnessing the useful electrical energy. Based on electromagnetic induction an improved approach an improved approach has been introduced to take the energy from 10kv three core cables which will gets generated from strong electromagnetic fields around the conductor. This system consists mainly three units viz, energy gaining coils, energy storage unit and exact Regulated output. The proposed system can able to collect the energy from strong electromagnetic fields of a three core cable [1]. By using a capacitor, the energy of electric field around a power cable can be stored by a conductor plate which will be placed very near to vicinity of the over head high voltage power lines. Here, results show that the repetitive pulse rate is linear function of the line voltage [2]. In order to make the power line communication to be energy efficient, a relaying technique has installed with the system for energy harvesting. A relay which exploits high noise through PLC and enhances the energy efficiency, it will use dual loop decode and forward broadband [3]. By wounding a coil on magnetic core energy harvesting can be done easily done from the power lines by making the magnetic core to operate in non saturation region. The energy is extracted from the highly permeable core cables and operating coil near saturation region [4]. A system consisting of dual transmission lines appeared with matching networks which have high reliability, compactness and efficiency up to 40% has used a rectenna

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operates on a frequency of 2.4 GHz. the proposed method is very flexible and harvested power is up to 57%[5]. A wifi operated rectifier capability of the lines can be used. The harvested power level can be increased by 27% by adding a switch to short circuit the consists of radio frequency design tapped with network has used to harvest the energy. The sckotty diode's impedance is transferred into input impedance of the system by tapered network through communication lines [6]. The energy efficiency can be increased in local small grids, wireless data communications through internet of things with the implementation of energy harvesting technology. Wireless dual hop system makes use of energy harvesting strategic technology, with the help of this, harvesting efficiency of wireless communication; high voltage transmission lines can be improved [7]. A 0 dmn power harvesting can be achieved can be achieved by designed a proper radio frequency and a differential rectifier. Here size of radio frequency module has improved and efficiency also improved. The highest conversions of energy of the module are reached up to 57.7% [8]. The power which is required to to remove the ice which is coated on the transmission lines, and also to remove he snow from the lines can be determined along with by improving the energy harvesting efficiency. In order to do this, three different core cables which is made up of three different core cables like crystalline, silicon steel and nickel steel , has merged into a single core three phase cable [9]. To improve the reliability and capability of the battery which can be used for best energy harvester individual battery cells has arranged in series to achieve the objective [10].

II.PROBLEM STSATEMENT

Study and implementation of magnetic energy harvesting technology by around power cables. Deploying more numbers of sensors, will enable to measure the various parameters economically to reduce the size of the harvester. This method is also able to avoid the problems associated with insulation problems of the system such corona and partial discharge from the system. The problems caused by the power source for monitoring the transmission lines are introduced and for realization of self power, two viable devices are introduced. Based on the simulation results, the power conditioning design constraints are derived. So for an high voltage transmission line system, electrical energy harvesting has needed and in this paper an efficient technology has introduced.

III. HARDWARE COMPONENTS

3.1 ARDUINO IDE: It is based on ATmega32u4 and Autheros AR9331, consists of micro controller board. Based on open work linino which supports distribution board of linex. It has an inbuilt Ethernet support feature, wifi supporter, 16 MHz crystal oscillator and a connection for micro USB. An over view of this device and its parts is as shown in figure 1 and figure 2 respectively.

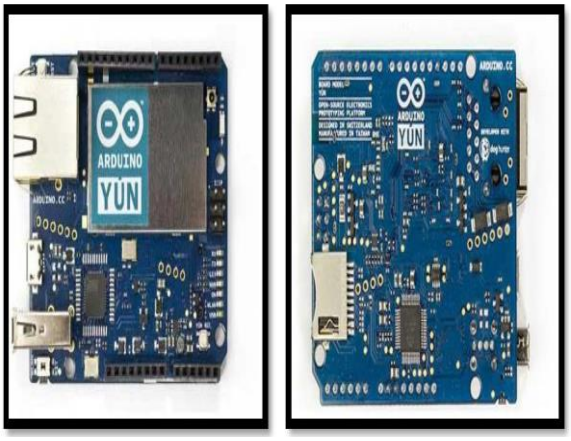

Figure 3.0: Arduino

The flash memory of the device is 16MB and power capability is at 50 milli amperes and 3.3 volts.

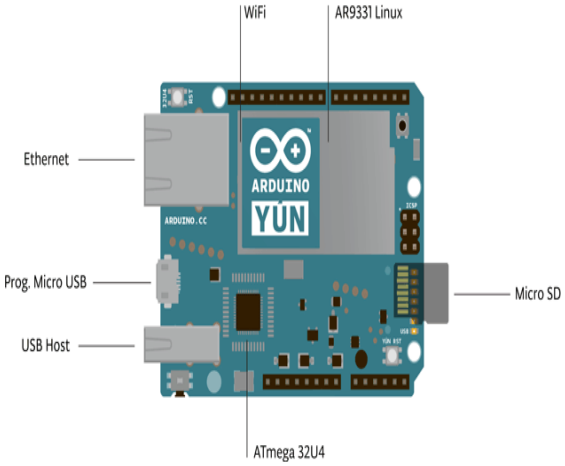

Figure 3.1: Parts of Arduino

3.2. LINUX MICROPROCESSOR

The board of this device gets power from 5V DC supply through a micro USB connection. If we want to supply the power through vin pin, then we must use a regulated 5V DC supply. Inside the processor the memory on AR9331 has not embedded. As all the input lines are tied up with 32U4 it is not possible to access inputs of atheors AR9331. It has an inbuilt LED system which is connected to pin number 13. The pin diagram of Arduino is as shown in figure

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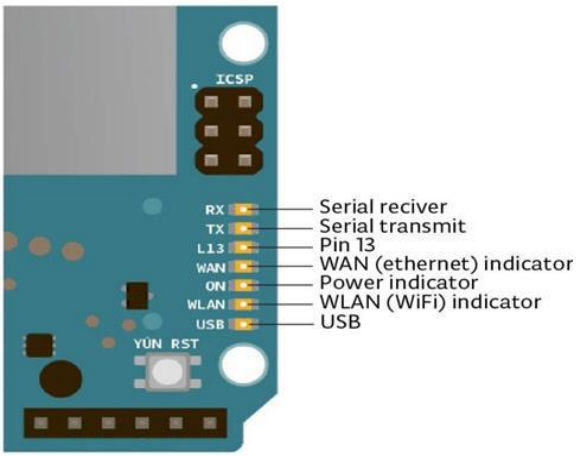

Figure 3.2: Pin Diagram of Arduino

3.3. PIR SENSOR

The motion of an element can be detected by sensing the infrared radiant heat can be done by a PIR sensor. By checking the sudden pattern of IR, this motion can be detected easily. The PIR sensor shows high value of output signal at its output port, when actual motion is detected. The PIR sensor and pin diagram is as shown in figure 4.

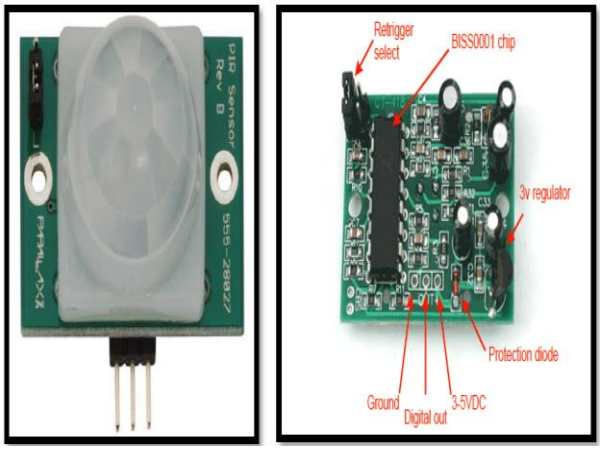

Figure 3.3: PIR sensor and pin diagram

3.4. TEMPARATURE SENSOR

: In this sensor, its output voltage is linearly proportional to temperature in Celsius. LM 35 type sensors have many advantages over classical sensors which gives temperatures directly in Kelvin. Figure of temperature sensor is as shown in figure 5 below.

Figure 3.4: Temperature sensor

Understanding the linear scale factor plays a major role in understanding working principle of a temperature sensor. As per its manufacture specifications, by increasing in every 10 volt at its output pin, the value of temperature is increased by one. In data sheet it has mentioned like 10 milli volts per degree centigrade. This sensor has used in two different types of configuration circuits. One is used to measure the positive temperature from 2 degree centigrade to 150 degree centigrade. In second type of configuration it can be used to measure the temperature from -55 degree centigrade to 150 degree centigrade. A detailed circuit configuration of temperature sensor and trigger signal representation is as shown in figure 6 and 7 respectively

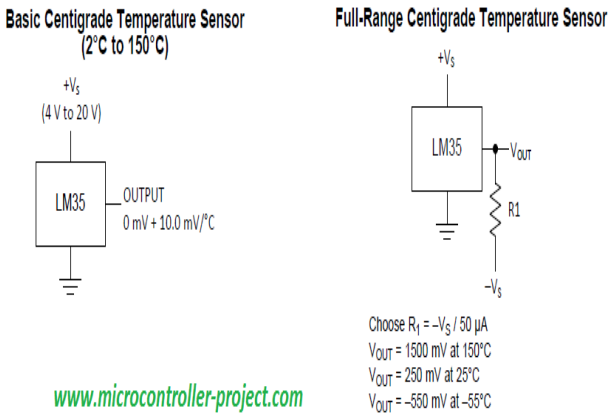

Figure 3.6: Temperature sensor circuit configuration

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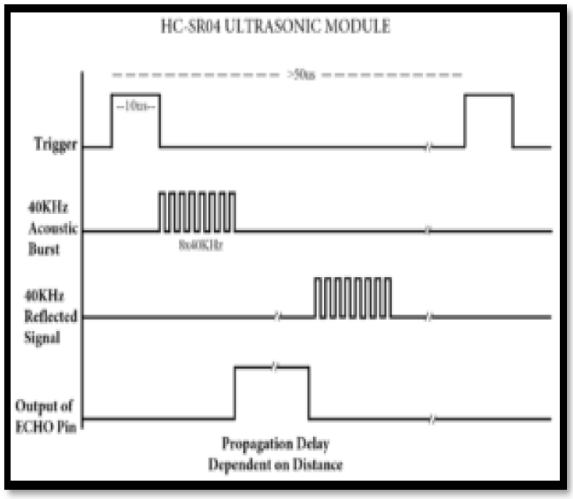

Figure 3.7: Representation of trigger signal, acoustic bursts, reflected signal and output of echo pin.

The time signal is converted into distance by a microcontroller by using following equation.

$$\text{Distance in centimetre} = \frac{\text{Echo Pulse width in(us)}}{58}$$

$$\text{Distance in inch} = \frac{\text{Echo Pulse width in(us)}}{148}$$

$$\text{Distance} = \frac{\text{Time taken} * \text{speed of sound}}{2}$$

IV. METHODOLOGY

In this project, Arduino is the heart of the is centre of working era which is used to control, observe and monitor the parameters like voltage, current, distance and motion in a smooth manner. A voltage divider is a device we have used here to scale the dc voltage which is output of rectifier, rectifier will get input from a step down transformer. Current transformer is used to measure the current and gets converted into DC with the help of rectifier and used to be feed the Arduino pin. The complete operation and performance of the proposed system is as showed in figure

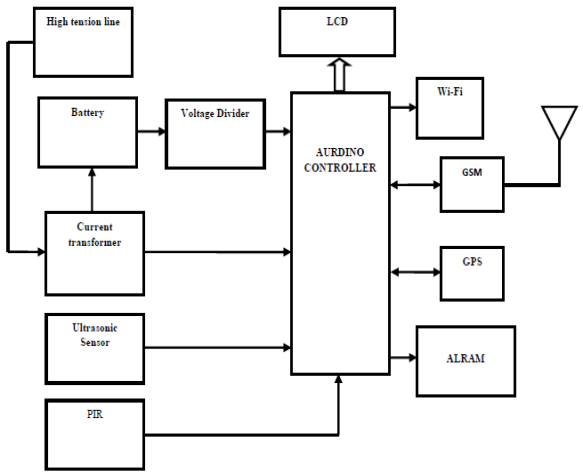

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Figure 4.1: Block diagram for energy harvesting system of a high tension line

V. IMPLEMENTATION

The implementation of this project has already explained in methodology section. An ultrasonic is having two inputs like input and output, and a trigger pin is used to transmit the ultrasonic signal which will used to detect the either an object is there or not. Finally, an authorised person will get an intimating message through GSM by using AT commands and the location has traced by using GPS. The project making picture is as shown in figure 10.

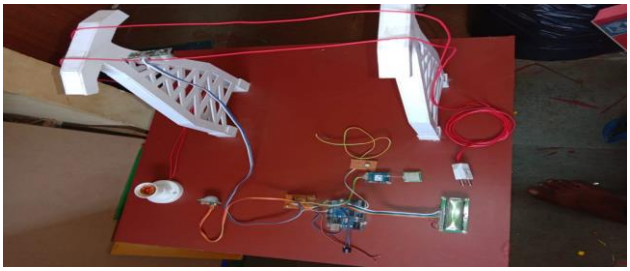

Figure 5.1: Project making picture

VI. RESULT

The sagging of the transmission line is can be detected by attaching an ultrasonic sensor to the pole. An unauthorised person can be detected by attaching a PIR sensor on the pole. The control room will get signal though GSM if a line get sag and the LCD will display it and also LCD will display the detection of unauthorised person.

VII. CONCLUSION

The prototype model, its design and fabrication has projected in this paper and is carried out for a 230 v ac supply. In order to enable the deployment of more sensors, the study of electrical energy harvesting is very essential. As this study is still in initial stage, a lot of research work ahs to carry out on this. In order to make this project more

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economical, its size has to be reduced and is very challenging. It also helps in avoiding the insulation problems like corona loss, partial discharge etc.

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