

Harvesting of Piezo Electric Energy for the Application of Traffic Signal Control

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ABSTRACT: Energy is generated by using piezoelectric materials. Energy in terms of pressure, stress is converted to electrical energy. The output of the piezoelectric material is not steady and requires charging circuit. The control of traffic in urban streets is difficult due to the usage of two, four wheeler which leads to more number of accidents. An intelligent traffic violation detection and traffic flow analysis system to monitor and measure red light jumping is constructed and the system is based upon Radio Frequency Identification (RFID) technology for identification of vehicles on the road. The main objective is to generate energy from the piezo electric transducers and to increase its energy level generation the obtained energy is used for the traffic lights glowing and also to control the signal.

KEYWORDS: Radio frequency identification (RFID), Global system for mobile communication (GSM), Piezo-electric disc's, Super capacitor, LED

I. INTRODUCTION

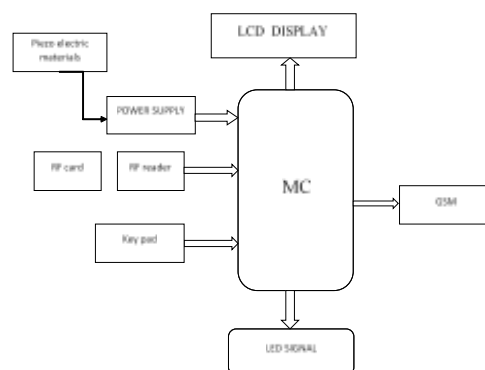
With increasing concern of global warming and the depletion of fossil fuel reserves, sustainable energy solutions to preserve the earth for the future generations is the main concern. Using piezoelectric material converts the pressure applied to it into electrical energy is one of the techniques. Traffic enforcement authorities can deal with the challenge of regulating the traffic and enforcing rules caused by the huge number of vehicles on the road and the indiscipline of the motorists by applying modern technology. Here designed in a such a way that if the person jump the Red signal with the help of RF card reader it is located in the vehicle, ones its jump the red signal the message will be sent to the owner through GSM.

The energy harvested from Piezo-electric discs converted which that energy generated is used for the application of street lights and traffic lights, and also to control the traffic signal violation. Using piezoelectric material, the pressure

applied on it is converted into electrical energy is one of the techniques. Travel is an important part of today's fast paced life as everyone has to move around for their day-to-day work. Road transport is the most commonly used mode of travel due to its ease, low cost and availability to common man.

The most common problem with all the existing systems is that the density of the traffic is measured by means of IR sensors and video capturing technology is used to track the information of the vehicles. This technique is not effective and not cost effective. The piezoelectric disc are used for energy generation. Which are implemented on the road. The movement of the vehicles on these PZD will create a stress where PZT convert this stress into electrical energy, instead the energy is not allowed to get wasted thereby generated energy is simultaneously stored into the batteries. Generated electricity we can use the lightning of lamp or traffic lights.

Block diagram of piezo electric energy used for traffic signal application and signal jump identification is shown below



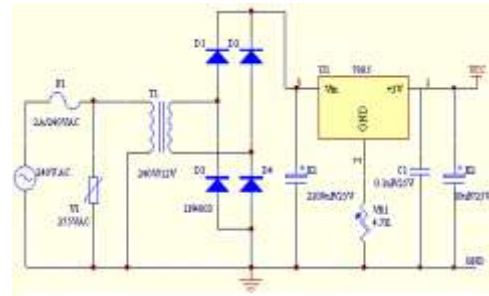
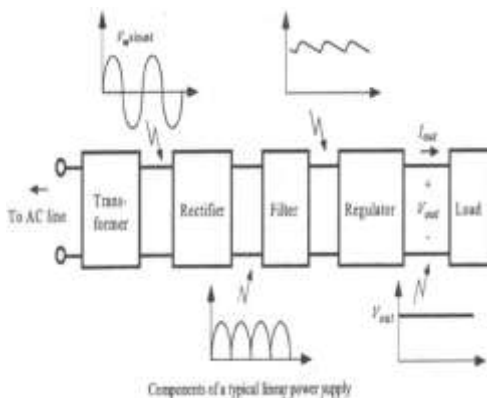
The PZT work on the principle of piezoelectric effect. When mechanical stress or force are applied to some material along certain planes, they produce electric voltage. This electric voltage can be measured easily by the voltage measuring instrument. The microcontroller is used

to manipulate the serial operation based on the program present in it and the output is taken from one of the four ports. Main building block of any electronic system is the power supply to provide required power for their operation. The electronic devices are very sensitive to the fluctuations in the power fed to them. This problem can be solved by using regulated power supply for them. GSM is a standard set which is used to describe the protocols for digital cellular networks. If anyone violates the traffic rules, GSM is used to send SMS to a mobile device which indirectly controls traffic. A lithium-ion battery or Li-ion battery is a type rechargeable battery. It uses an intercalated lithium compound as one electrode material, compared to the metallic lithium used in a non-rechargeable battery. The batteries have a high energy density, no memory effect and low self-discharge. Energy density: 250-693 W-h/L, Specific energy: 100-265W-h/kg.

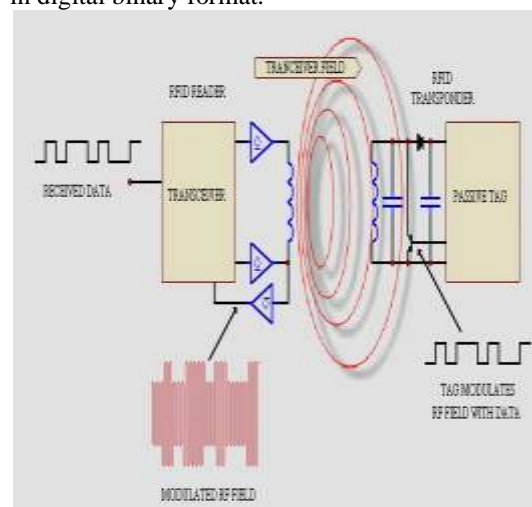
II. WORKING PRINCIPLE

Piezoelectric material converts the mechanical pressure applied on it into electrical energy. The source of pressure can be either from the weight of the moving vehicles or from the weight of the people walking over it. The output of the piezoelectric material is connected to charging circuit. The generated energy is used in the signals for traffic controlling LED lights. In today's life it is difficult to handle the traffic rules. Everyone is busy in their own life. But if anyone brakes the traffic rules there is a chance of accident occurs due to this in order to overcome this problem the hardware is designed in a such a way that if the person jumps the Red signal with the help of RF card reader it is located in the vehicle once it jumps the red signal the message will be sent to the controller office and also the owner of the vehicle through GSM.

Block diagram and circuit diagram is as shown below



The power supply given out is well regulated +5V output and output current capability of 100 mA is obtained. The electronic devices are very sensitive to the fluctuations in the power fed to them. This problem can be solved by using regulated power supply for them. This project about power supply circuit is equipped with an adjustable voltage regulator to adjust the output in accordance with the requirement. Adjustable voltage regulators have both line and load regulation which is better than standard fixed regulators. The circuit is made using following active and passive electronic components: Bridge Rectifier, Resistors, Capacitors, Variable Resistors, Linear Voltage Regulator IC. The micro controller and other devices get power supply from AC to DC adapter through voltage regulator. The adapter output voltage will be 12V DC non-regulated. The 7805 voltage regulators are used to convert 12 V to 5VDC. Shown below is a typical RFID system. In every RFID system the transponder Tags contain information. This information can be as little as a single binary bit, or be a large array of bits representing such things as an identity code, personal medical information, or literally any type of information that can be stored in digital binary format.



Typical RFID system

Figure shown is a RFID transceiver that communicates with a passive tag. Passive tags have no power source of their own and instead derive power from the incident electromagnetic field. Commonly the heart of each tag is a microchip. When the Tag enters the generated RF field it is able to draw enough power from the field to access its internal memory and transmit its stored information.

When the transponder Tag draws power in this way the resultant interaction of the RF fields causes the voltage at the transceiver antenna to drop in value. This effect is utilized by the Tag to communicate its information to the reader. The Tag is able to traffic control the amount of power drawn from the field and by doing so it can modulate the voltage sensed at the Transceiver according to the bit pattern it wishes to transmit.

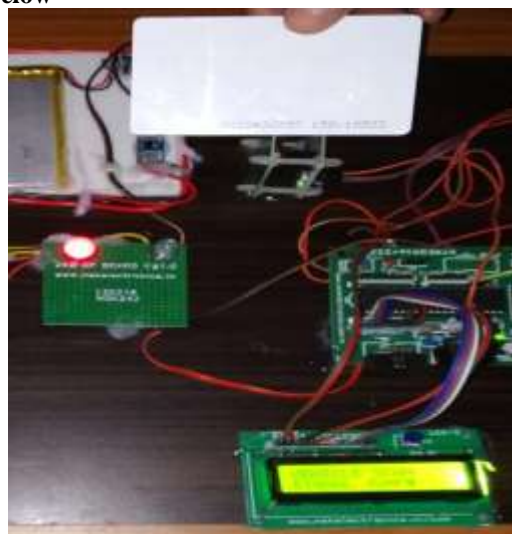
RFID FEATURES:

Frequency	: 125 kHz
ReadRange	: up to 8 cm
Power supply	: 5V DC (± 5 %)
Current consumption max.	: 60 mA
Operating temperature	: -20 ... +65° C
Storing temperature	: -40 ... +75° C
Interface	: RS232 (TTL), Weygand and others (on Demand)
Dimensions (l x w x h)	: 36 x 18 x 10 mm
Serial Interface Format	: 9600Baud, No Parity, 8 Data bits, 1 Stop bit

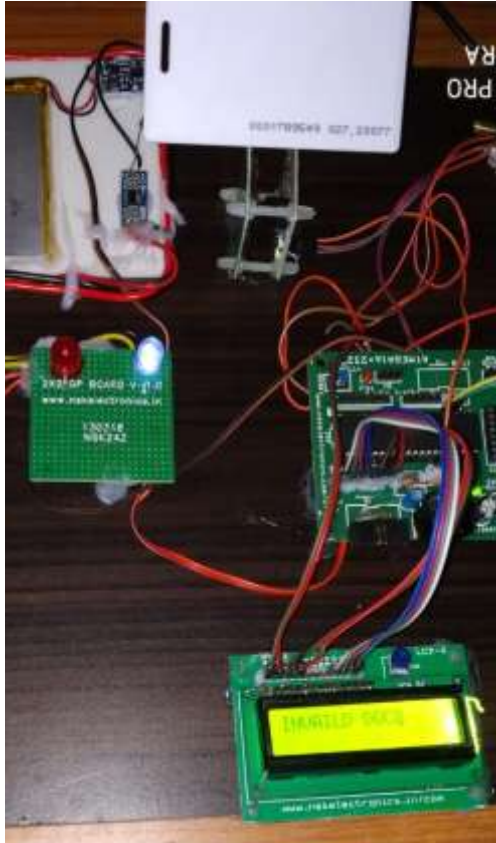
RFID Introduction:

RFID (Radio Frequency Identification) allows an item, for example a library book, to be tracked and communicated with by radio waves. This technology is similar in concept to a cell phone. RFID is a broad term for technologies that use radio waves to automatically identify people or objects. There are several methods of identification, but the most common is to store a serial number that identifies a person or object, and perhaps other information, on a microchip that is attached to an antenna (the chip and the antenna together are called an RFID transponder or an RFID tag). The antenna enables the chip to transmit the identification information to a reader. The reader converts the radio waves reflected back from the RFID tag into digital information that can then be passed on to computers that can make use of it. The heart of the system is the RFID tag, which can be fixed inside a book's back cover or directly onto CDs and videos. This tag is equipped with a programmable chip and an antenna. Each paper-thin tag contains an engraved antenna and a microchip with a capacity of at least 64 bits. The main components of RFID is as follows: RFID tags that are electronically programmed with unique information, Readers or sensors to query the tags, Antenna, Server on which the software that interfaces with the integrated library software is loaded.

Operation of the micro controller when the vehicle jumps during the RED signal is shown below



Operation of the micro controller when an invalid document is detected is shown below



III HARDWARE SETUP

The hardware is designed and configured for practical use. Energy generated from the piezoelectric transducer by the vehicle pressure. The output of the piezoelectric material is connected to charging circuit. This energy can be used in traffic signal applications. The different parameters are shown below

If the vehicles cross the red signal, then the RF card reader reads the RF tag and sends the violation message to the card holder.



If there are no vehicles at the traffic signal it displays “NO VEHICLES” in the LCD screen.



The Piezo electric transducer used for controlling traffic signal as advantages as follows

- Utilization of existing foot energy.
- Less cost and more reliable.
- Identification of signal jumping easily.
- Circuit design is simple and easy.

The Piezo electric transducer used for controlling traffic signal as disadvantages as follows

- Installation Cost is high.
- Possibilities of circuit damages by heavy weight.
- Time required is more to scan the vehicle.

IV RESULTS & CONCLUSION

The developed system for automatic detection and penalty management of signal violation which will in turn help to decrease the number of accidents. The system also analyzes the traffic flow on a given road at a given time according to the circumstances of the road. The implemented architecture is portable, accurate and can be installed at a reasonable cost. The system alleviates the need for traffic police at every signal to manually identify the violations. The system shows promising results on automatic detection, since the detection of the tag identification is more precise, reliable and efficient in active RFID, leading to implement corrective actions. Piezoelectricity should be targeted as an alternative energy source of the future. To maximize the power output of the system, bridge rectifier followed by step down dc to dc converter should be used along with the filter circuit. The charge levels in battery must be continuously monitored to estimate the traffic passing per cycle of traffic light switching. Ultra-capacitors should be used for

better storage capacity. It can be enhanced by implementing combining of solar wind along with piezoelectric materials for generation of more energy. In future data base can be improved and data will be updating in server for further study. Remainder message will be sent if not paid amount in time.

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