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Implementing an Embedded based Smart Street Light Controlling System through Piezo Electric Effect

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Abstract: *electricity has become one of the major need of present day civilization and its demand is increasing quickly. Therefore we'd like a non-conventional method of power generation. This paper focuses on the need of automated street light system and therefore the peculiar way of implementation with embedded system tools. Here we are generating electricity by using piezoelectric material. Every time when a vehicle passed over the road, large amount of potential energy is wasted due to friction. In this project we have a tendency for generating electrical power in a non-conventional method by simply running the vehicle on the piezo electric device, by using microcontroller we are able to glow the lights supported vehicle position, by using piezo electric impact piezo electric device converts that energy into current and we are storing that electrical energy in rechargeable battery, by using ldr we can control the street light on day times without human beings.*

Key words: *Piezo electric transducer, light dependent resistor, street light, microcontroller, rechargeable battery.*

I. INTRODUCTION

Embedded systems are getting used extensively for observation and controlling various physical parameters. Embedded systems are reactive that they respond to changes taking place within the external surroundings. The majority electronic gadgets (which include digital cameras, washing machines...etc.) getting used these days are unit fitted with an embedded system. Embedded systems are used currently as computing nodes connected on to net, forming into internet of things.

Many specialised applications such as automobile systems need interconnecting individual embedded systems for controlling brakes, doors, mirrors, rear and front object indicators, engine temperature, wheel speed, tyre pressure, Optical disc management control...etc. and to produce data into a display unit that is fitted into a splash board. The individual embedded systems are usually heterogeneous in nature as they're designed around completely different technologies. Generally the networking should be achieved through connecting the individual embedded systems that are placed in different layers, each layer catering for a specific communication speed.

II. PROBLEM DEFINITION

Now days, energy is a necessary want for human life and for the development in all sectors of economy. Generation of electricity are often done by totally different varieties of techniques. The main aim of this project is to generate electricity by non-conventional method through piezo transducer. In recent days electricity shortage is the main issue faced by the government. The only solution of this problem is the reduced usage of power. According to this paper we can reduce the wastage of power. Every time when vehicle passed over the road, large amount of potential energy is wasted due to friction. In this project by exploitation piezo electrical result we are able to turn out electricity, once vehicle passes on road pressure is applied on roads, by exploitation piezo electrical result we'll convert that mechanical energy to voltage by using rechargeable battery we are able to store that energy in to the battery. In streets the lamps are glowing endlessly throughout the night. Large amount of power is wasted by unwanted use of power. This wastage of power is reduced by the implementation of this project. By using piezo transducer we can sense the vehicle movement and based on that movement we can glow street lights by using programming in microcontroller.

III. LITERATURE SURVEY

Many contributions have been presented related to the problem area; most of them concentrated around the implementation of energy savings through different technologies like IR sensors & by using Piezo transducers to be used as a standard which is generally achieved through converting from one form of energy to the other.

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A. Senthilkumar

Had developed a power saving material for street lights control system using piezo electric material. In this paper piezoelectric transducer is used to save the energy and IR pairs are used for detecting the movements of the vehicles/pedestrians across the street lights. LDR is used to measure the light signal. ADC is used for converting analog signals from LDR and converted it to digital and then it sends to the controller. Here the lights are control LED by the PWM signals which will be sending by the controller.

B. Akshay Balachandran, Murali Siva

Have developed a automated street light system based on the LDR's and Piezo knock sensors. Here they used MSP430 as microcontroller which is used as the brain to control the entire systems involved to it. LED's are used as the street lights due to its special low power consumption and for cost effective nature. The best advantage of this technique is that the piezo sensors act independently with none external sources and there'll not be the radiation exposure to the vehicles.

C. Gauri Sahoo, Nikhil Divekar, Ruchita Rao

Have implemented a new technology for the controlling of street lights. The main concept of this paper is to make the use of energy generated as the result of movement of vehicles and pedestrians on the road to control the street lighting and thereby increasing the efficiency and automating the entire process. Here they used energy harvesting and boost circuit for the rectification of energy and boosted to become the use of practical purpose.

D. Chithra Pradeep, Devika S, Davood K K.

Have enforced the automated light-weight and street light control system by generating electricity through piezo sensors .the major need of present day civilization is electricity. Here the electricity is generated by using vibration energy that's generated by vehicle movements on road converted to electrical energy by piezoelectric effect. during this I even have ascertained an extra factor that, rather than considering traffic as a drag we will take it as a chance to supply energy and also the generated energy effectively used for the automated management of light weight and street light.

The desire to use self-powered devices drives to achieve enormous growth in the field of energy harvesting. With the few limitations such as low amount of power generated using the power harvesters, the researchers are working towards generating new methods. These methods would help in placing the energy harvesters as one of the best sources to power portable devices in the field of wireless technology.

IV. PRINCIPLE OF WORKING

The basic principle that we have a tendency to use to come up with electricity is the piezoelectric effect ^{[6][7]}. A piezoelectric material is one that converts mechanical energy or vibration energy into electrical energy that is experienced on it, to a charge which can be stored.

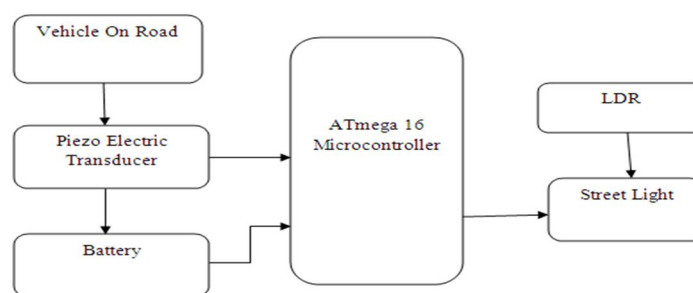


Fig: Block Diagram

Once a force or pressure is exerted on the elastic piezoelectric crystal material, the crystal gets unshapely and this causes it to develop charge between them and therefore the crystal goes back to its original state. This charge flow is converted to a voltage that can be stored in a battery. Since the power obtained from a couple of them will be in a very small amount, we have a tendency to use voltage amplifying circuits here. As the size and the number of piezoelectric crystals increases, the energy obtained from them also increases.

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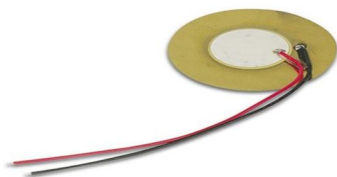


Fig: Piezo Electric Transducer

The Power from this source is effectively supplied for the functioning of street lights. The street lights are automatically control lights. We are connecting the LDR in the street light circuit by using bc547. When the sun light falls on it the resistance value will be increased, due to this high resistance the light will be turned off, until the sunlight passes away from LDR



Fig: Light Depended Resistance

In this prototype we used the LED^[5] in the place of street light, the LED is known as light emitting diode, as like diode it having anode and cathode terminals, the operating voltage of the LED is 1.8V to 3.5V, by using transistor we connected the LED and LDR to the rechargeable battery.

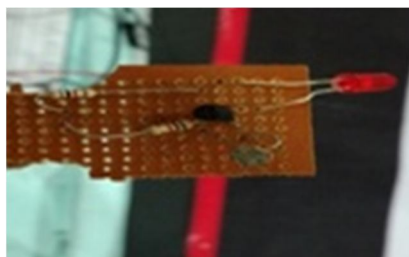


Fig : LDR with LED circuit

The heart of this proto type is microcontroller, here we used Atmega16 microcontroller, as a master device for controlling the entire application. When the transducer vibrates the signal will pass to microcontroller, then the controller will operate the actuator (street light).

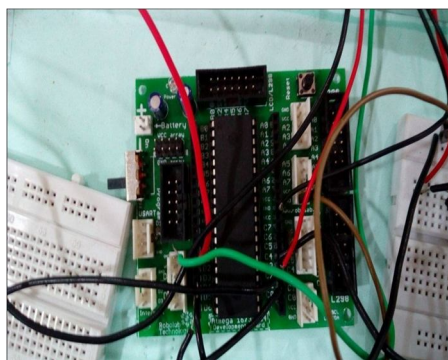


Fig: atmega16 development board

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V. RESULTS AND CONCLUSION

Experiment's have been conducted using LDR, Piezo Transducers and LEDs the results are:

- A. When the vehicle passes on the road the piezo sensor detect's the vehicle then the corresponding light will glow due to this we can save the power.
- B. The Pressure applied by the vehicle will generate the power by using Piezo Electric effect, thus we can store this power in the form of battery.
- C. By using LDR we can stop the light on day times, By this we can reduce the man power and operates the lights automatically.

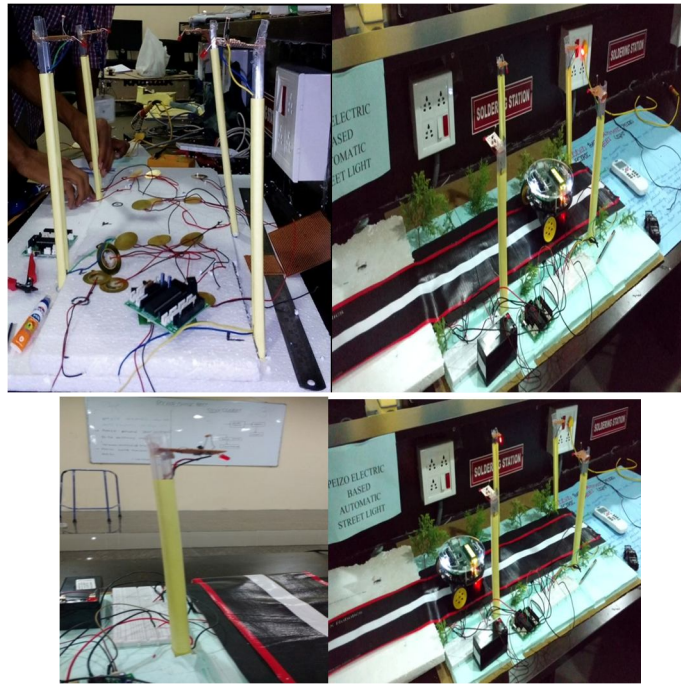


Fig: Experimental Results

VI. FUTURE SCOPE

- A. Implementing GSM as well as GPRS for getting the data to the mobiles and sending the information to the web (IOT).
- B. Implementation of camera along with the street lights for the security purpose.

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