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ALTERNATE ENERGY FROM BUSY ROAD FOR DEVELOPMENT OF SMART CITY USING IOT

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ABSTRACT

The world is facing energy crisis with the difference in demand and supply and limited number of natural resources. So, there is a need for saving energy and requirement an alternate energy source which is cheap and feasible. This paper attempts to concentrate on how electrical energy can be generated from busy road using speed breaker, stored and used. In large metro cities the amount of vehicles increases gradually. Another way to generate the power by tapping this energy is possible by replacing normal speed breaker with this simple mechanism. The energy generated is stored for lighting street lights and for use in rural areas. Also energy saving is aim of this paper, using microcontroller, some electronic peripheral (devices) and android application to switch on/off street light.

Keywords: Speed Breaker, Rotational Motion, GSM, Renesas microcontroller

1. INTRODUCTION

This project addresses both the issues of energy saving as well as energy generation using simple mechanism of a speed breaker on a busy road. Energy changes from one form to the other". When a vehicle moves over the speed breaker there are lot of energies involved in the process. Energy due to friction, potential energy, heat etc. are lost in the environment. The idea is to utilize and convert the potential energy due to the weight of the vehicle to electrical energy. A mechanical shaft with the dynamo is used and placed on the plane of the road. When a vehicle passes on this roller, due to friction, the roller rotates which in turn moves shaft of the dynamo. When the shaft rotates it generates the voltage based on Faraday's law. This voltage can in turn be stored in a battery which can be further used to light the street bulbs. "A vehicle weighing 1,000 kg going up a height of 10 cm on such a rumble strip produces approximately 0.98 kilowatt power. So one such speed-breaker on a busy highway, where about 100 vehicles pass every minute, about one kilo watt of electricity can be produced every single minute. The figure will be huge at the end of the day", the second concept is "Energy Saving". Many times the street lights are kept ON in broad daylight or when there is no traffic on the road at midnight [1,5]. Energy can be saved by switching ON the lights whenever and wherever necessary. Half of the lights can be switched OFF when there is no vehicle on the road and all can be switched OFF in broad daylight. LDR's are used to detect day and night and two infrared sensors are used at the two ends of the road to detect any activity the road. A Renesas microcontroller is used as a control unit along with the sensors [6].

Electricity is the most varied and widely used form of energy. An energy crisis is any excellent bottleneck (or charge rise) inside the supply of power sources to an economy. Energy disaster can develop due to Overconsumption, Overpopulation, Delay in Commissioning of Power Plants, Wastage of Energy. Sometimes bottlenecks at oil refineries and port centers limit fuel supply. An energy crisis can rise up because of over use

of the sources and wastage of energy generated. Another major problem, which is becoming the exiting topic for today is the pollution. Power stations and automobiles are the major pollution producing places. So non-conventional power source is needed to reduce this problem. We proposed a nonconventional power generating system based on speed breaker mechanism which generate electricity without using any commercial fossil fuels, which is not producing any polluting products This project addresses the issues of energy saving as well as technology and the usage of simple mechanism of a speed breaker on a busy street. Energy modifications from one form to the other". When a car actions over the speed breaker there are lot of energies involved in the process, energy due to friction, ability energy, heat and many others. Are lost to the surroundings. The idea is to utilize and convert the potential energy due to the weight of the vehicle to electrical energy. When the vehicle passes on this speed breaker it converts the linear motion to rotational motion by spring mechanism. The spring mechanism consists of spring and the gear system, when the speed breaker is pressed the spring compresses and inturn rotates the driver gear with the combination of gear system it rotates the shaft of the generator. The electricity generated by the generator is stored in the rechargeable battery. The second part of this paper is an efficient use of simple electronics. Many times the street lights are kept ON in broad daylight or when there is no traffic on the road at midnight. Energy can be saved by switching ON the lights whenever and wherever necessary. Half of the lights can be switched OFF when there is no vehicle on the road and all can be switched OFF in broad daylight. LDR's are used to detect day and night and two infrared sensors are used at the two ends of the road to detect any activity the road [7,10].

2. LITERATURE SURVEY

The idea was first implemented in South Africa due to their electrical energy crisis, which made them to light up small villages on the highways. The idea of basic physics to convert kinetic energy into electrical energy that goes waste when the vehicle runs over the speed break was used. Since then a lot has been done in this field.

Aniket Mishra - "Electricity generation from speed breaker". This paper explains the mechanism of electricity generation from speed breakers. The load of the vehicle is acted upon the speed breaker system is transmitted to the rack and the pinion arrangement**.** Rack and pinion can convert rotary to linear or from linear to rotary motion. Rack is a linear gear and pinion is a circular gear. Applied force on rack is converted to rotation by pinion. The mechanical force is converted into rotational force. This mechanism is more used than any other mechanisms, due to its high efficiency compared to other mechanism [2].

Prathibha Arun – "Eco-friendly electricity generation using scintillating piezo". This paper explains that the electricity is produced from the mechanical stress on the crystals due to Piezoelectric effect. The piezoelectric effect exists in two domains, the first is the direct piezoelectric effect and it describes the material's ability to transform mechanical strain into electrical charge. In second form it has the ability to convert an applied electrical potential into mechanical strain. Thus in this paper it generates the energy needed for charging batteries to light the street at night and also for the city consumption of electricity. It is very encouraging to get good voltage and current at such a low cost at the same time utilizing the waste energy [4].

Akshay Tank – "Eco-friendly energy generation through speed breaker". This paper emphasizes on the idea that the kinetic energy wasted while vehicle moves can be utilized to generate power using special arrangement of spring or piston assembly with water tank. As the vehicle runs on the speed breaker due to its weight the top portion of the speed breaker moves downwards hence moving the spring or piston arrangement,

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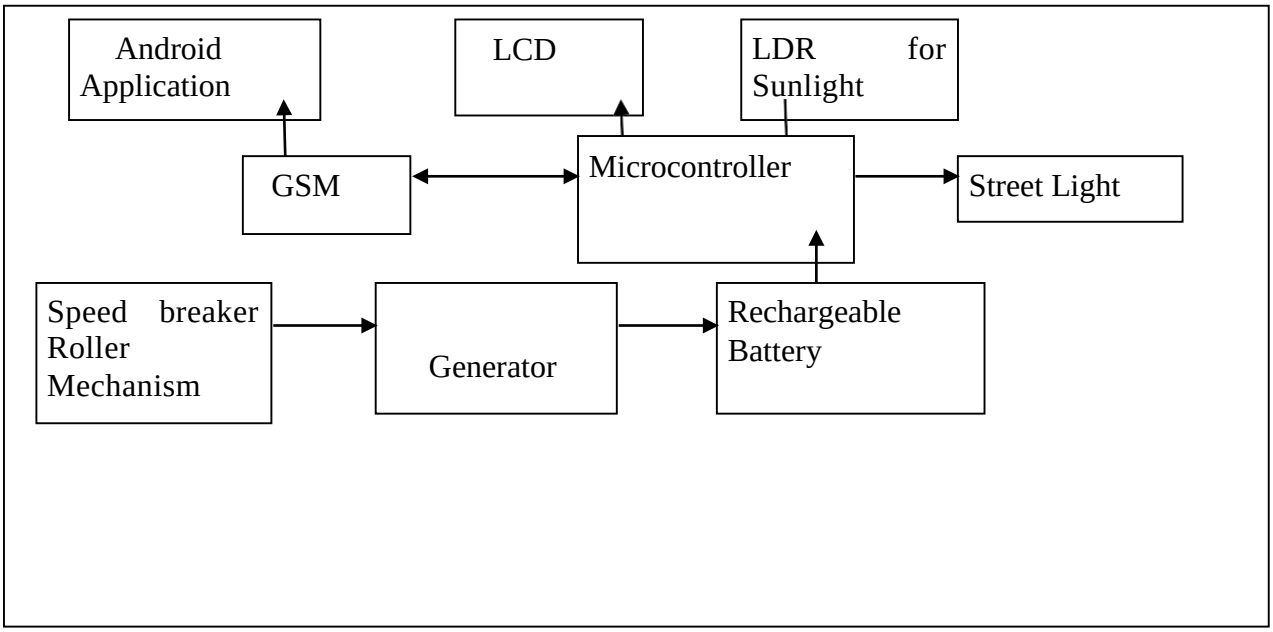
due to this force applied on the piston or spring mechanism in the water tank the water comes outside of the tank. This water is passed on rotor blade which rotates the chain belt which in turn rotates the generator [3].

3. METHODOLOGY

When the vehicle passes on the speed breaker the force is exerted vertically on the lever, then the force is transmitted to the pinion and to the rack arrangement which comprises of gear mechanism, by this arrangement (Fig.1) it converts linear motion to rotational motion. Generator shaft is rotated by the rotational motion of the gear and power is generated by the generator. Thus, power generated is stored in rechargeable battery. Hence the stored energy is used to light up the street-lights. Microcontroller along with an android application is used as a switching device and controlling device.

Voltage and current sensor are used to measure input and output voltage and currents. LCD is used to display the power generation, voltage and current. GSM technology is used to detect the fault such as generation fault, ground fault etc. LDR sensor is used to check the intensity of light, it turns on the street lights during night times. IR sensor consists of transmitter and receiver. It checks the activity on the road. Whenever the vehicle passes, it automatically switches on the street light with the control of microcontroller. We are using android application to control the street lights instead of using LDR. The android application is connected to the microcontroller with the help of GSM. Microcontroller takes the commands from the android application and takes the control over switching on and off of lights [9]



4a. GSM

GSM (**Global System for Mobile** Communications, originally **Groupe Special Mobile**) is a standard developed by the European Telecommunications Standards Institute (ETSI). SIM900 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz. SIM900

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features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4

You can use AT Command to get information in SIM card. The SIM interface supports the functionality of the GSM Phase 1 specification and also supports the functionality of the new GSM Phase 2+ specification for FAST 64 kbps SIM (intended for use with a SIM application Tool-kit). Both 1.8V and 3.0V SIM Cards are supported. The SIM interface is powered from an internal regulator in the module having nominal voltage 2.8V. All pins reset as outputs driving low.

4b. MOTOR DRIVER

The Device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays solenoids, DC and stepping motors) and switching power transistors. We have used this driver circuit (Fig2) too drive the motors of the robot. Each L293D is used to drive two motors [8].

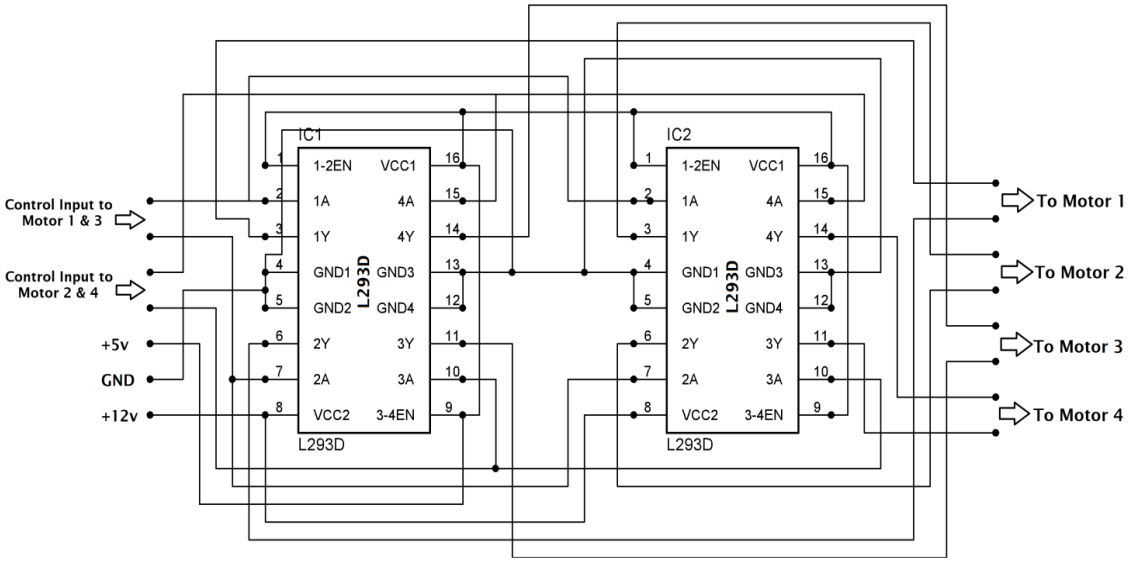

Fig.2: Motor circuit

4c. LCD DISPLAY

A **liquid crystal display** (**LCD**) is a flat panel display, electronic visual display, based on on Liquid Crystal Technology.A liquid crystal display consists of an array of tiny segments (called pixels) that can be manipulated to present information. Liquid crystals do not emit light directly instead they use light modulating techniques.LCDs are used in a wide range of applications, including computer monitors, television, instrument panels, aircraft cockpit displays, signage, etc. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones

4d. RENESAS MICROCONTROLLER

Renesas microcontroller surpasses its predecessor i.e. 8051 family of microcontrollers, with various in-built features.Renesas is a 16bit microcontroller and minimum instruction time can be changed from ultra-low speed (30.5us) to high speed (0.03125us) plus 16 to 512KB of ROM and 2 to 32KB of RAM are available depending

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upon the series and number of pins. On-chip high-speed (32 MHz to 1 MHz) as well a low-speed (15 KHz) oscillator is present. 10bit resolution A/D converter (6 to 26 channels depending upon the series). Totally 3 UART for Serial Interface. Totally 0-7 channels for timer with built in PWM features. Most of the pins of Renesas have multi-task features. Cost of Renesas microcontroller is comparatively less. Rigid body of microcontroller hence less prone to damages due to electrostatic charge. It operates with 5v power supply [11,13].

4e. LIGHT DEPENDENT RESISTOR

A photoresistor (or light-dependent **resistor**, **LDR**, or photo-conductive cell) is a light-controlled variable **resistor**. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photoresistor is made of a high resistance semiconductor [12,14].

5. RESULT

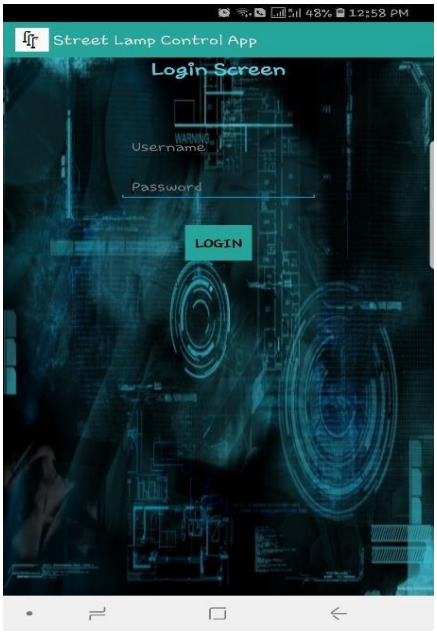

Fig.3: Login Screen

The first screen (fig.3) of the Application i.e. login screen which provide the interface to both the Operational user and Admin. The user have to put the login credentials that is the username and password which is given during the registration time. The pop up will show if the correct credential are entered. After the Successful login, the user can register their mobile number. The User have to put their ten digit mobile number in order to get the SMS status. Once the number is successfully registered, the pop-up will show that the number is registered successfully. Providing of ten digit mobile number. If the number entered is not of ten digits the pop up will suggest you to put the ten digit number. Pop up display that you should enter the ten digit mobile number to register. The pop up that the number is successfully registered. The street lamp can be controlled with the help of two specified modes which are the manual mode and the auto mode. It depends on the user through which mode he wants to access the lights. Once the mode is selected, the SMS will be sent to both the numbers i.e. the number which is used to register in the app and to the admin's number. The SMS "MM" is sent to the admin numbers as well to the registered user number which indicates the selection of manual

mode. The Picture (Fig.4) shows the SMS sent from the application user. The picture (Fig.5&6) shows the SMS received to Admin. The user gets the control to manually enable/disable the light. The message L11 for light 1 and L21 for light 2 will be sent by the user application to admin's application if the light is turned ON. The message L10 for light 1 and L20 for light 2 will be sent by the user application to admin's application if the light is turned OFF.

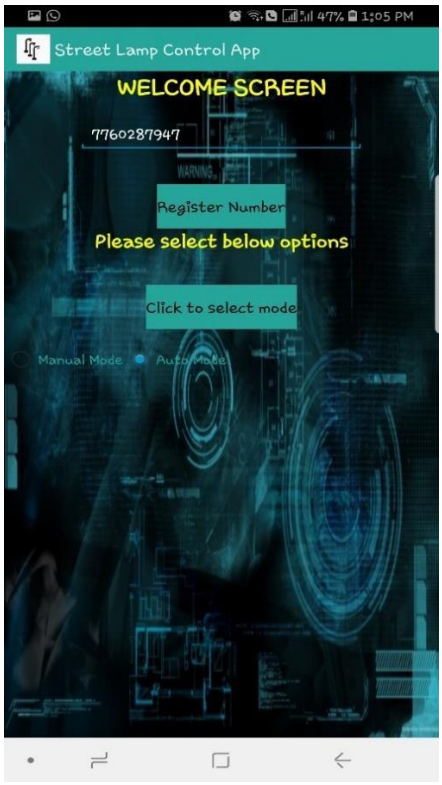

Fig.4

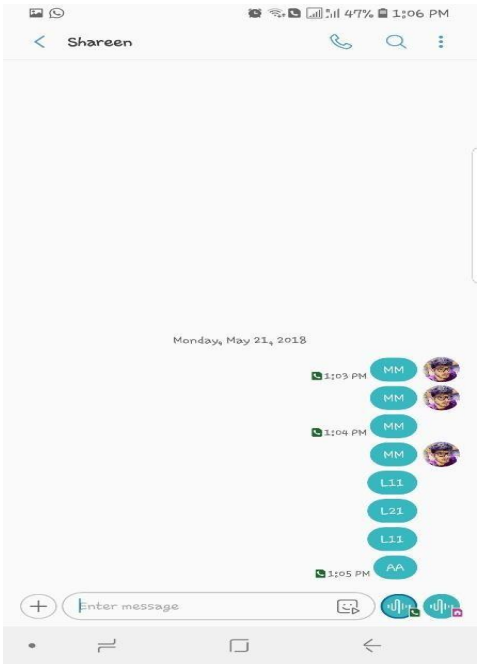

Fig.5: User's SMS Screen

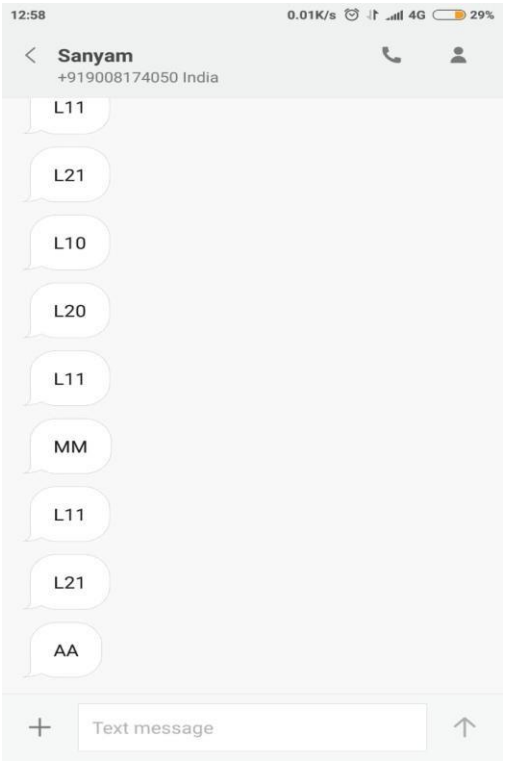

Fig.6: Admin's SMS Screen

If the user selects the automatic mode, then the lights control will be switched to automatic. The lights will be then enable/disable based on the. And the SMS "AA" will be send by the application user and to the admin.

CONCLUSION

The existing source of energy such as coal, oil etc. may not be adequate to meet the ever increasing energy demands. These Conventional sources of energy are also depleting and may be exhausted. These are some non-conventional methods of producing energy. This project is a step to path of exploring the possibilities of energy from several non-conventional energy sources. The rollers used in this project can be intended/ upgraded for heavy vehicles large amount of potential energy generated on the busy road can be converted into electrical energy which can be utilized to light the street lights. This alternative source of energy can be used to provide an aid to the conventional energy sources thus improving the economy of the smart metro cities. "Energy saved is energy generated". This project also saves the power by utilizing it optimally during night and only if there is any activity on the road. Advantage of this system is it has not utilize any external source. Now the time has come to put forward this type of new ideas, and also researches should think to upgrade its proposal.

FUTURE SCOPE

Such Speed breakers can be designed for heavy vehicles, thus increasing the input torque and eventually output of generator can also be increased. Output can be further increased by using of multiple transmission system. In future, if the flywheel speed control device and voltage protection devices can be added with large generation process, it would be a model all over the world.

After some regulation of the intended project, the power generation of the system can be increased by increasing the capacity of the generator and applying more weight.

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