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Electricity Produce from the Waste Energy of a Running Vehicle –A New Approach to Reduce the Load of National Grid

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Abstract*-Crisis of electric power is a common scenario in a developing country. Day by day it's become serious issue due to various factors, such as increasing demand, lower production capacity and transmission losses, etc. For those reasons Instantaneous Power Supply System (IPS) is able to attract the focus of many consumer, especially for house hold purposes. The authors of this paper have been trying to propose a new method to store waste energy of a running vehicle into a battery and then it will use in IPS. We know when an automobile is running or even in breaking position for entry of passenger or stopping by traffic jam, always fly wheel is rotating up to stopping of engine. We are planning to connect the fly wheel to dynamo by suitable belt or pulley system. When a vehicle is stop in a traffic jam, our proposed system works automatically by help of a sensor. In that case fly wheel and dynamo is engaged and produce electricity, which is store in a battery. If the vehicle is start to running then sensor disconnect the connection between dynamo and fly wheel. That is engine power is fully used for vehicle acceleration. In this way when the automobile is finally stopped after end of journey, we remove the battery and use it in IPS system. Thus we can utilize the waste energy of IC engine and producing electricity reduces the load of national grid.*

Keywords: Fly wheel, PWM, Alternator, Sensor, Battery**.**

1. Introduction

Electricity is a common crisis in the world as well as our country. Many new form of electricity production is looking for day by day in our country. Energy conversion is not an old idea. But we have to ensure that any energy which is easily available must not waste away. We have to use this converted energy. Such wastage energy is in vehicle like bus, truck etc.

In our country traffic jam is a very common phenomenon. In traffic jam a lot of vehicle is stood standstill without shutting the engine. Also, vehicle in braking position for the purpose of entry or leaving of passengers engine also keep in running condition. During this time while engine is in running condition flywheel continuously rotates. In this paper, we are showing a new concept to use this rotational characteristic of flywheel while engine is running but the vehicle remains in still position.

2. Working Principle of vehicle's internal structure:

2.1 Flywheel:

A flywheel is a rotating mechanical device that is used to store rotational energy. Flywheels have a significant moment of inertia and thus resist changes in rotational speed. The amount of energy stored in a flywheel is proportional to the square of its rotational speed. Energy is transferred to a flywheel by applying torque to it, thereby increasing its rotational speed, and hence its stored energy. Conversely, a flywheel releases stored energy by applying torque to a mechanical load, thereby decreasing its rotational speed.

Three common uses of a flywheel include:

- They provide continuous energy when the energy source is discontinuous. For example, flywheels are used in reciprocating engines because the energy source, torque from the engine, is intermittent.
- They deliver energy at rates beyond the ability of a continuous energy source. This is achieved by collecting energy in the flywheel over time and then releasing the energy quickly, at rates that exceed the abilities of the energy source.
- They control the orientation of a mechanical system. In such applications, the angular momentum of a flywheel is purposely transferred to a load when energy is transferred to or from the flywheel.

Flywheels are typically made of steel and rotate on conventional bearings; these are generally limited to a revolution rate of a few thousand RPM. [1]

2.2 Alternator:

An alternator is a machine used to convert mechanical energy into electrical energy. When it is driven by the engine it produces electricity for running all the electrical circuits of the automobile and keeps the battery in charged condition. This is the function of alternator. [2]

The main component in the charging system is the alternator. The alternator is a generator that produces Alternating Current (AC), similar to the electrical current in home. This current is immediately converted to Direct Current (DC) inside the alternator. This is because all modern automobiles have a 12 volt, DC electrical system. A voltage regulator regulates the charging voltage that the alternator produces, keeping it between 13.5 and 14.5 volts to protect the electrical components throughout the vehicle. [3]

2.3 Battery:

It is an important component of electrical system. The battery supplies the necessary current to the primary winding of ignition coil which is converted into high voltage current to produce spark. It also supplied current to run the starting motor when engine is cranked for starting. A battery stores energy in the form of chemical energy and supplies it for running lights and other accessories of an automobile. Lead-acid battery is commonly used in most of the automobiles. [2]

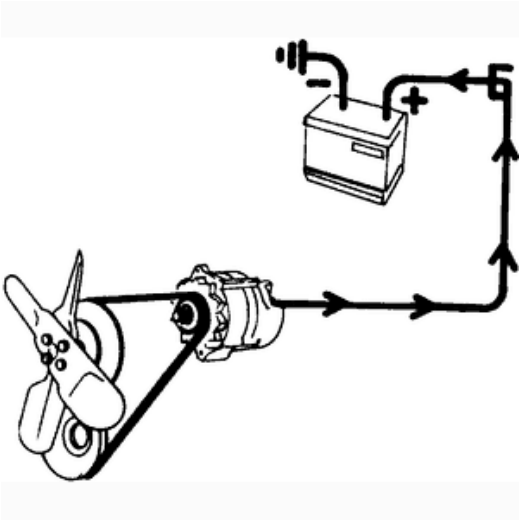

Figure 1: Flywheel, dynamo & battery connected in a vehicle.

3. Theoretical Model:

In a vehicle flywheel always rotate even at an idle position of the vehicle. Flywheel rotation converts into electrical energy by using alternator. Most alternators that are charging properly produce a voltage of about 13.8 to 14.2 volts at idle with the lights and accessories off. [4] The voltage regulator of the charge system does not measure the relative currents charging the battery and for powering the cars loads. The charge system essentially provides a fixed voltage of typically 13.8 to 14.4 V (Volt), adjusted to ambient temperature, unless the alternator is at its current limit. A discharged battery draws a high charge current of typically 20 to 40 A (Ampere). As the battery gets charged the charge current typically decreases to 2—5 A. A high load is when multiple high-power systems such as ignition, radiator fan, heater blowers, lights and other musical systems are running at the same time. In older vehicles (80's and earlier) the battery voltage may decrease unless the engine is running at a higher than idle rpm and the alternator/generator is delivering at least enough current to power the load. This is not an issue for modern vehicles where alternators provide enough amperage for all consumers and a regulator keeps charging rate in check, so faster rpm has no effect. In such cars rpm has basically no influence on the recharging voltage - tests show a good recharging voltage regardless of the AC / headlights / music / fan / defrosting / other electrical consumers even at idle rpm.[5]

If we run lead acid battery to below about 10 volts, we will damage the battery and it'll need to be replaced anyway. So, there we have to always keep charging the battery. When a vehicle at idle, a good rechargeable voltage is continued supply is continued. A battery which we supply the required ignition voltage it is defined as a primary. When vehicle is covering a long distance the primary battery is charged up in a certain time. This time we can find by the following formula:

Charging time (hrs) = 1.3 * (Battery capacity in Ah) / (CC mode charging current) (1)

Where, Ah= Ampere-hour, CC= Constant Current. [6]

So, after full charge the battery need only a little amount of charging voltage for not being discharge. On the contrary, the electricity produced by alternator remains unused. So, there we can use another battery which can store this electricity.

In our country, traffic jam is a common scenario. Many large vehicles like bus, truck etc. stacked in jam for a long time. This long time many vehicles engine keep on. A sensor can be used to sense this idle condition & can be switched to secondary battery to charge most of the available time. We develop a circuit based on PWM method to provide charging voltage both the battery so that primary battery must not discharge & secondary battery saves some electrical energy from being wasted.

4. A brief of some electrical components of our design circuit:

4.1 Transistor*:*

Specification:

TR1=TR2=880 (NPN)

*Working principle of Transistor***:** Transistor is device which is P-N junction a transistor is a specialized electronic component with three electrodes called the Emitter, Collector and Base. Transistor is made with semiconductor materials such as silicon, germanium, or selenium. Transistor can be used in various purposes such as electric key, amplifier etc. In our project it is used to amplify the voltage .For N-P-N transistor

emitter and base has forward bias condition .As a result emitter negative electron is passing through the positive base and collector and base junction is reversed biased .For this reason collector region is more negative and negative electron of emitter is more affected to collector and collector is collected negative electron. [7]

Figure 2: Transistor

4.2 Electro-mechanical Relay :

Working Principle of Electro-mechanical Relay: Electro-mechanical relays work on the principle of a mechanical force generated due to the current flow in a coil wound on a magnetic core. This force results in the operation of a contact arrangement which is used for relaying the operated condition to the desired circuit in order to achieve the required function. Since the mechanical force is generated due to an electric current flow, the term 'electromechanical relay' is used.

The mechanical movement of the operating mechanism is imparted to a contact assembly to open or to close the contacts. When the relay operates, it changes the state of its contacts, i.e. from Open to Close or from Close to Open. A majority of the relays are provided with a 'control spring' or are re-strained by gravity, so that they assume a given position when in a de-energized state. The contacts which are closed in this condition are termed as 'normally closed' and the ones which are open are termed as 'normally open'. [9]

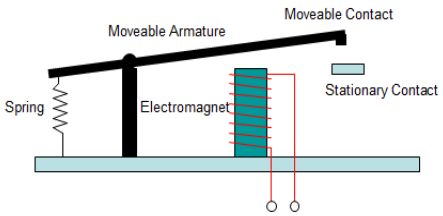

Figure 3: Electro-mechanical Relay [8]

4.3 Pulse Width Modulation:

It is a method of creating variable output which can be used that require far fewer bits of information and are much more efficient for microprocessors. This technique is called pulse width modulation. In the PWM method, many voltage levels can be achieved with one single-level input voltage, namely, the high voltage (say, 5 volts) and one output bit. To do this, the voltage on the output port of the processor is turned on and off; the average effective voltage will vary. In other words, as shown in Figure 4, as t_1 vs. t changes, the average voltage changes accordingly [10].

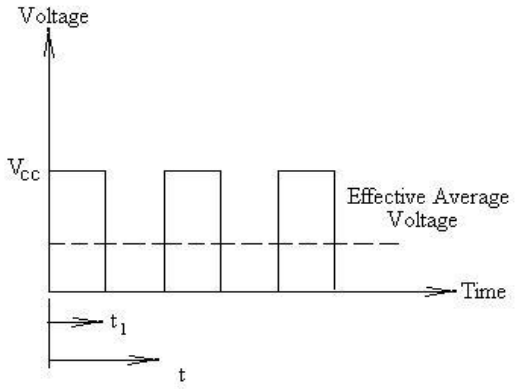

Figure 4: PWM timing [10].

In this work we use such kind of PWM signal by using microcontroller. A simple on and off signal is being produced in this control system.

5. Circuit Diagram:

Control circuit consists of a microcontroller PIC16F877A, a crystal 8 MHz, voltage regulator 7805, electrolytic capacitor 1μF, 100μF, power transistor BD135, Resistors 1K Ω (0.25 watt), LED and 12V power supply. Figure 5 shows the schematic of the control board.

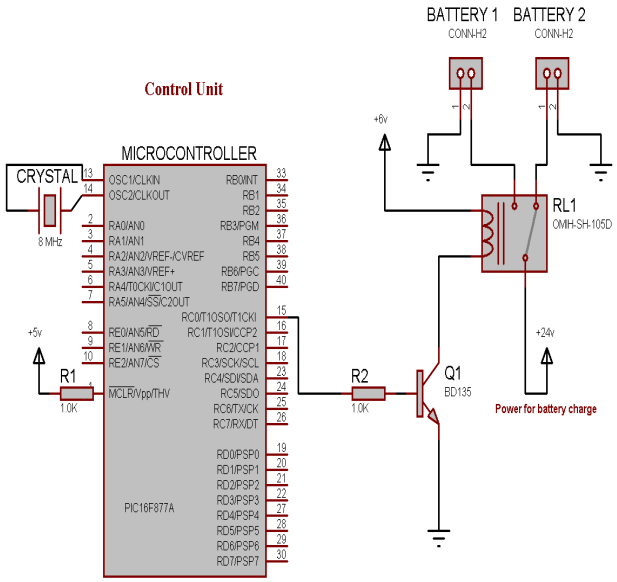

Figure 5: Circuit diagram of the control system

Pin RC0 is connected to the transistor for the PWM signal usage. The relay is connected with the two batteries. The PWM signal control battery charging system through the transistor.

6. Conclusion:

Electricity is a crisis in this modern age. Load shedding & traffic jam, two major problems we face in our country regularly. These two problems we cannot change abruptly. But we have to utilize some advantages from it. Such utilization is the energy storage in running vehicle in traffic jam. This storage energy we can use in our daily purpose like Instantaneous Power Supply System (IPS), vehicles using battery etc. So, we can reduce some load from the national grid.

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