GENERATION OF ELECTRICAL ENERGY BY EXERCISE CYCLE

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Abstract: Many parts of India don't have electricity. The existing power plants are not able to meet the current power demands. So we have made a project that generates electricity by pedaling and stores in a battery. This energy can be used anywhere to operate chargers, bulbs, fans etc. Further cycling keeps oneself fit, so there is a LCD screen which shows calories burned, kilometers cycled and watts generated. So the person can track how much calories he has burned. This research paper presents a prototype of the said model.

IndexTerms **– DC motor, voltage regulator, inverter, Lead acid battery.**

I. INTRODUCTION

There are many energy sources in the world. One such source is the muscle power. A person can generate approximate 75W of power in an hour. This energy is not used in the proper way. So we thought of making a battery charger using cycle, so that the muscle power can charge the battery and this battery could be used for other electrical equipments like charger, LED bulb, table fan etc.

1.1 MOTIVATION BEHIND THE PROJECT

About one third of villages in India don't have electricity. The existing electricity generation power plants are inadequate in providing the required amount of electricity. Moreover, the existing fossil fuels are going to be extinct in future years and other non conventional sources like solar energy, wind energy, hydro energy etc need an expensive infrastructure and high skilled labour.

So the energy generated by cycling is free of cost and can generate decent amount of electricity in a short time. The person can stay fit too as cycling burns around 100 calories in an hour.

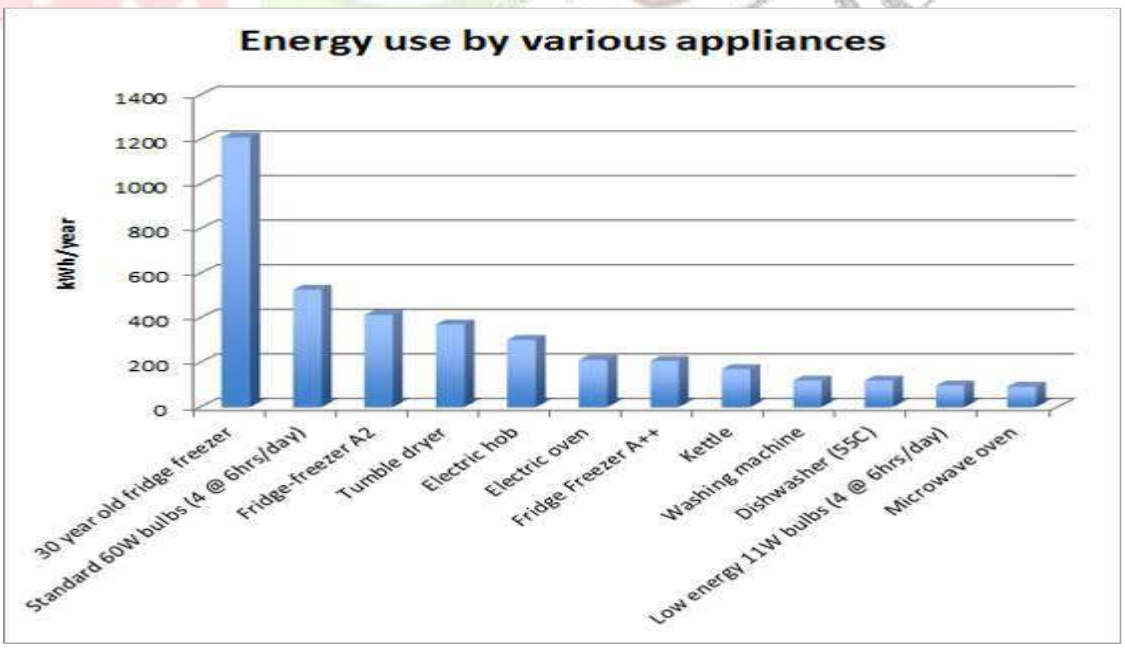

Fig 1: electricity usage by various appliances

1.2 BLOCK DIAGRAM

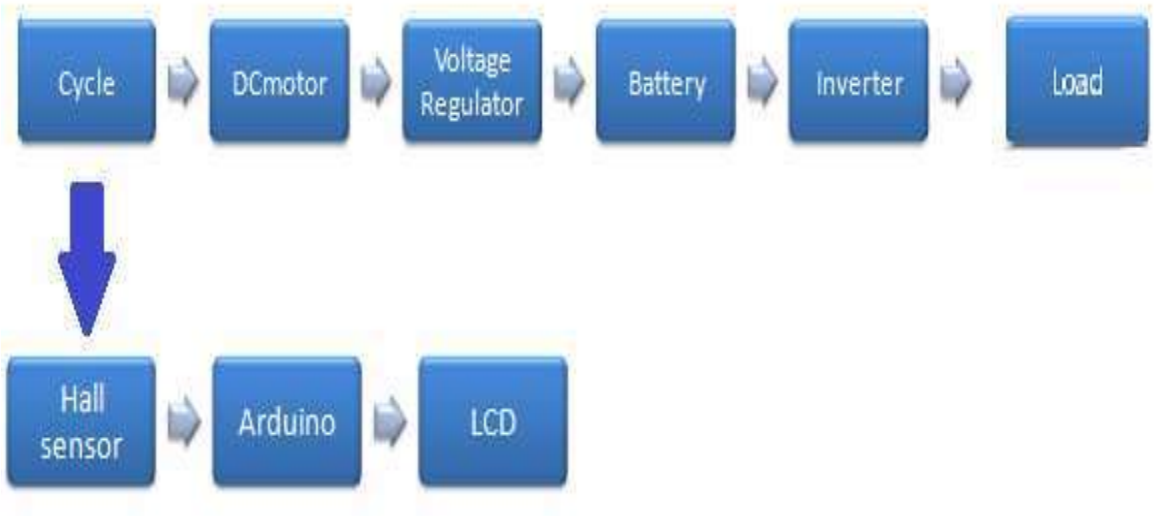

Fig 2: Block Diagram of the Project

The block diagram of the project is given above. The person will start to cycle. This mechanical energy will turn on the DC motor. This will start to produce electricity in high voltage ranges. Then it is fed to the voltage regulator, it will bring down voltage to 15v, which will charge the 12v battery. The battery will give energy to the inverter. It will convert dc to the ac and will be connected to the load. The hall sensor module is installed on the wheel along with a magnet. Whenever the hall sensor module is in direction of the magnet, it will sense the current and will give the signal to the arduino. The arduino will display the rpm, kilometers cycled, calories burnt and watts generated.

Table 1: Required Components

Sr no	Name	Specifications
1	Dc motor	Permanent Magnet, 24V,1000rpm
2	Battery	Lead acid, 12V, 7.2Ah
3	Voltage regulator	Converts 80-120v into 15V
4	Inverter	60W, converts DC to AC
5	Arduino Uno	Atmega 328PU
6	Transformer	230/12V step down,centre tapped
7	Hall effect sensor	-
8	LCD Screen	16x2

1.3 THEORETICAL LOAD CALCULATION

Table 2: load calculations

Watts generated	Hours	Fan(70W)	Light(35W)	Charger(5W)
37.5	0.5	0.5h	1h	7.5h
75	1	1h	2h	15h

112.5	1.5	1.5h	3h	22.5h
150	2	2h	4h	30h

II HARDWARE ANALYSES

2.1 Permanent Magnet DC motor: Permanent generator is the best suited one for this mechanism. PMDC generators are a major source of commercial electrical energy, they are mostly used to convert mechanical input from wind turbines to electrical energy.
A permanent magnet generator is a generator where the excitation field is provided by the permanent magnet instead of a coil here the rotor contains the magnet and the stator is a stationary armature connected to load. Magnetic field is generated through a shaft mounted permanent magnet mechanism and current is induced into armature. The magnitude of the voltage depends on the magnetic field strength and rotational speed of generator. The PMDC used in the system is 24V RO motor.

Fig 3: PMDC motor

2.2 VOLTAGE REGULATOR: A voltage regulator is used to regulate voltage level. When a steady, reliable voltage is needed, then voltage regulator is preferred It generates a fixed output voltage that remains constant for any changes in an input voltage or load conditions. It acts as a buffer for protecting components from damages. A voltage regulator is a device with a simple feed- forward design and it uses negative feedback control loops. The voltage regulator used in the system had 7815 voltage regulator IC. It would convert high dc voltage in the range of 80-120V into 15V, which is sufficient to charge the 12V battery.

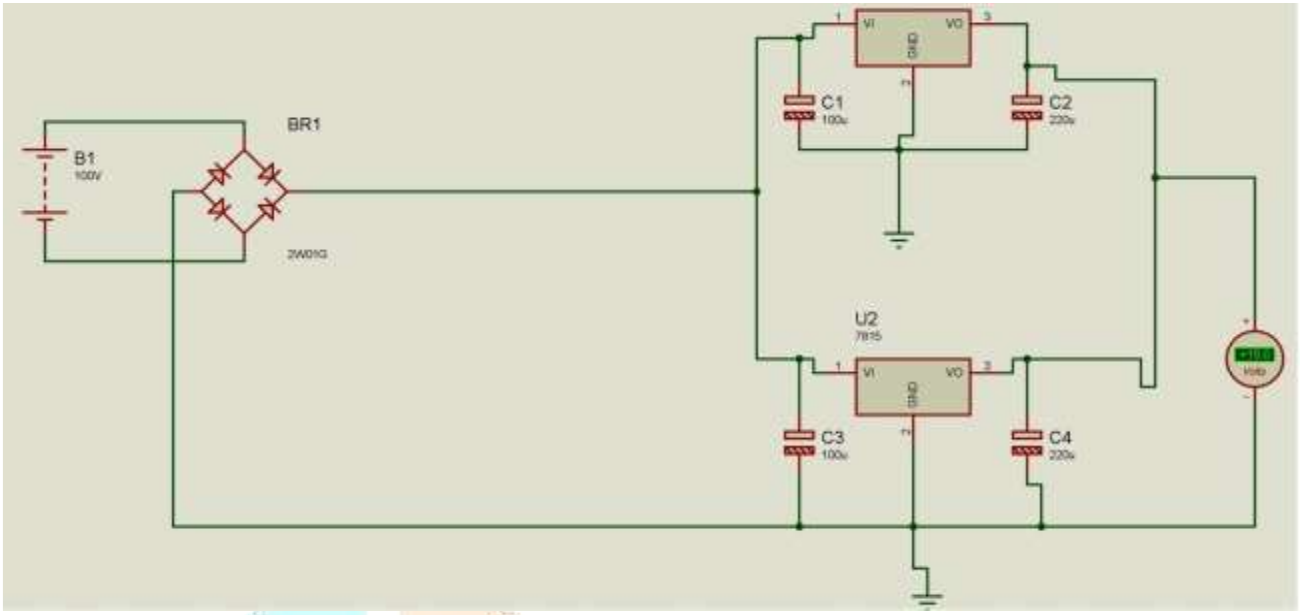

Figure 4: voltage regulator circuit

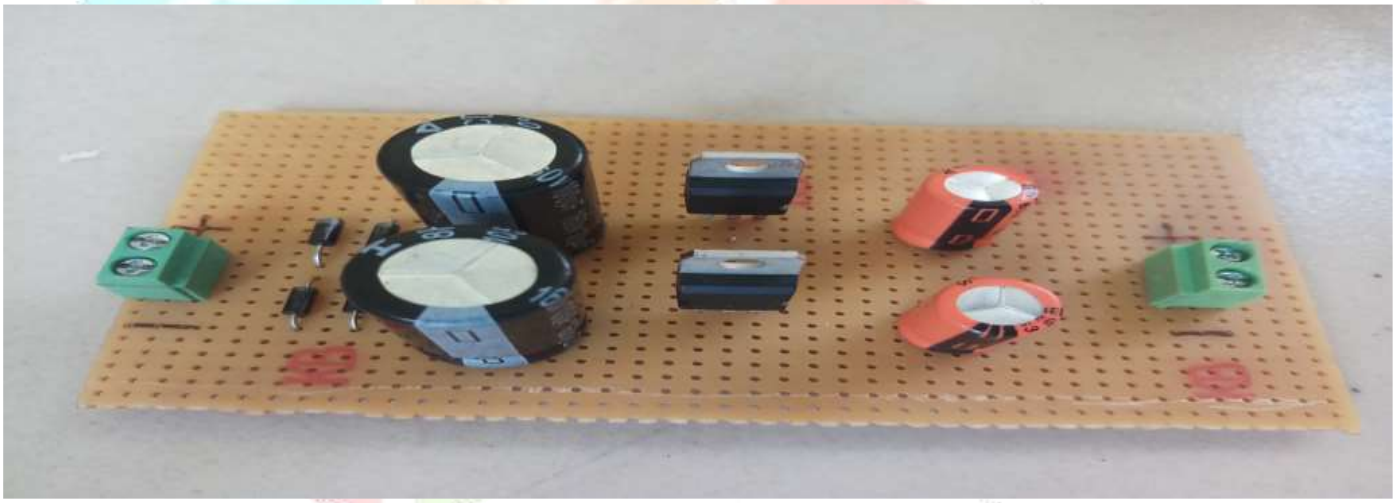

Fig 5: hardware model of voltage regulator circuit

2.3 INVERTER: An inverter is used to convert dc into ac supply. In the system, 60 watt inverter was used. In the design some basic electronic components are employed. In generating frequency of 50 Hz an integrated circuit.
CD4047 in conjunction with resistors and capacitors was used to achieve an astable multivibrator circuit. The selection of resistors is to generate a high current from the IC. Capacitors are carefully selected considering the frequency of pulse in question.
CD4047 is a monolithic integrated circuit that includes all of the control circuits necessary for a pulse width modulating regulator.

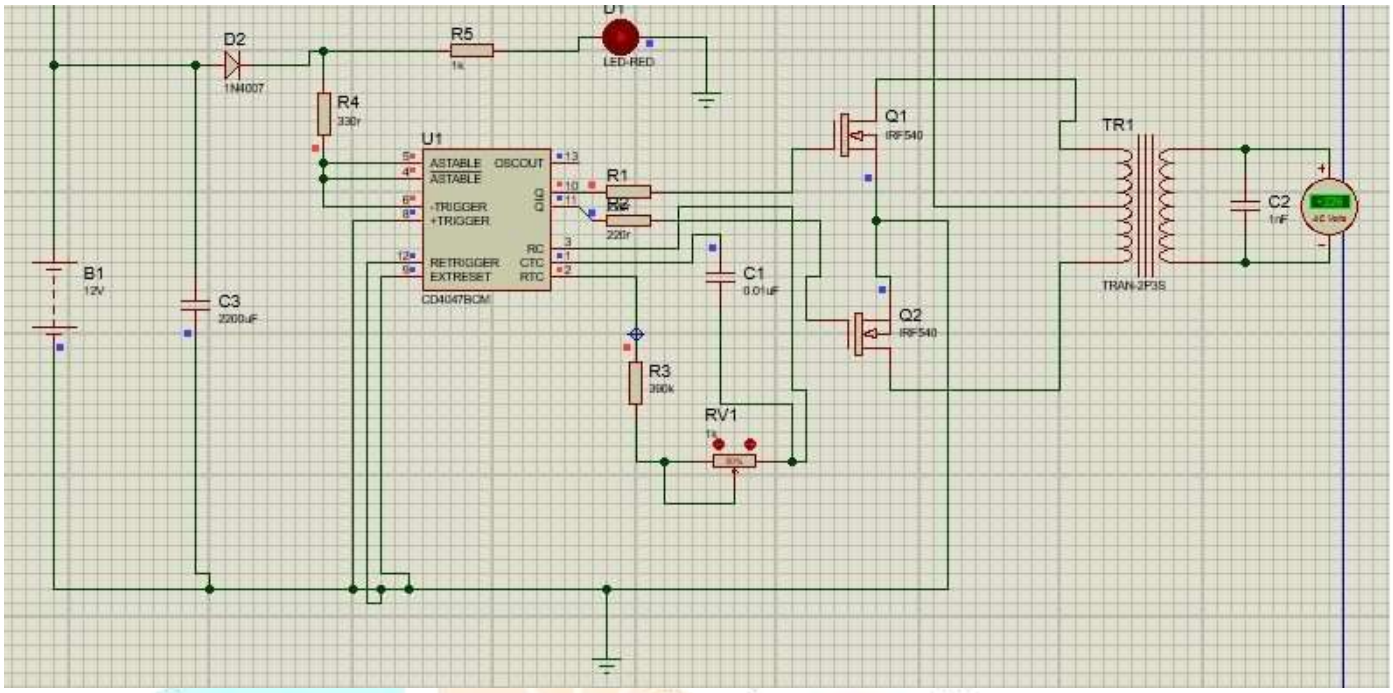

Fig 6: circuit diagram of inverter

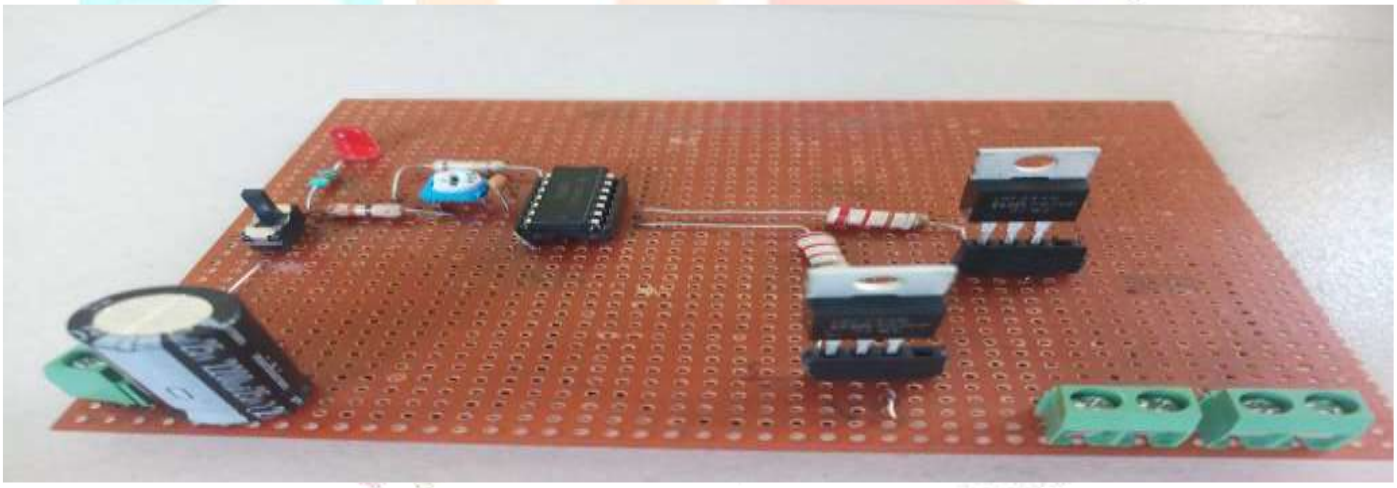

Fig 7: hardware model of inverter circuit

2.4 HALL EFFECT SENSOR: The Hall Effect Magnetic and Proximity Sensor Module can be used to detect the presence of nearby objects such as magnets. This sensor accepts a GND and +5V supply, and has a single digital output which goes low (GND) when a magnetic field is detected.

When we bring the magnet close to sensor the sensor changes its state. This change is sensed by the interrupt pin which will call the toggle function inside which we change the variable "state" from 0 to 1. Hence the LED will turn on. Now, when we move the magnet away from the sensor, again the output of sensor will change. This change is again noticed by our interrupt statement and hence the variable "state" will be changed from 1 to 0. Thus the LED if Turned off. The same repeats every time you bring a magnet close to the sensor.

Fig 8 : hall effect sensor

III RESULT ANALYSES

Fig 8: complete model

With different speed of motor, current and voltage are measured

Table 3: rpm vs voltage/current

Sr No	RPM of the motor	Current(A)	Voltage(V)
1	200	0.6	45
2	300	0.83	63
3	400	1.02	77
4	500	1.21	89
5	600	1.41	103
6	700	1.68	125

Table 4: Battery charging observations

Sr no	Current	Time in hours
1	1	7.2
2	1.5	4.8
3	1.68	4

Table 5: Load observations

Sr No	Load	Hours it can run
1	7	12
2	18	4.8
3	35	2.4

Fig 9 : working bulb

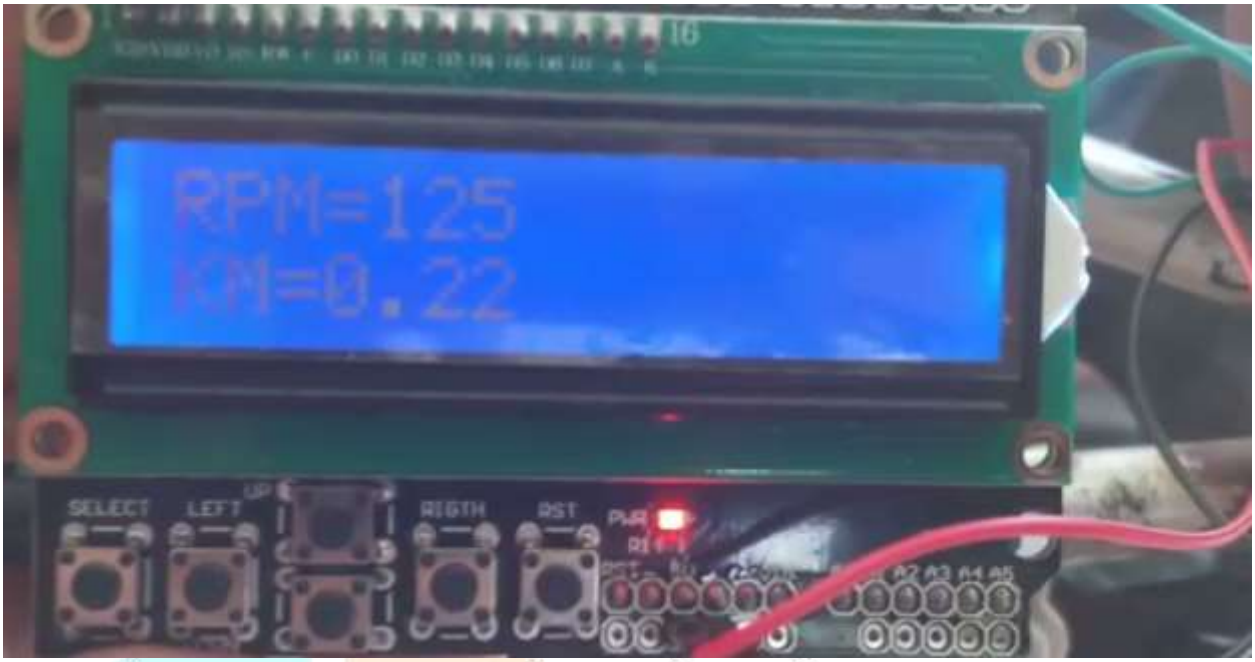

Fig 10: Lcd screen showing rpm and kilometers cycled

Fig 11 : Lcd screen showing calories burnt and power generated

IV CONCLUSION:

As we all know, the demand for power is going to get increased day by day and fossil fuels are inadequate to cater to the new power demands. So the simple cycle can be used to generate electricity so that it can charge the battery and the battery can be used to for small appliances. With this the human power does not get wasted and is utilized for something fruitful. Moreover , riding bicycle helps to keep someone fit. It burns a lot of calories and the person can see on the lcd about how much calories he has burnt, kilometers cycled, power generated and rpm.

4.1 ADVANTAGES AND LIMITATIONS

Advantages:

1. It does not affect the environment.
2. Easy to install
3. It is maintenance free.

4. It is cost effective
5. It gives good exercise to the body.
6. Simple design.
7. Can be used in any terrain.

Limitations:

1. The efficiency is poor – around 70% of energy is used.
2. The battery is small- it can power the appliances for less time.
3. The pulley gets damaged after heavy usage.

4.2 FUTURE SCOPE

1. It can be put in gym, so all the cycles are connected to a single power source.
2. It can be put in the common garden, so that people can exercise in the free time andhelp in producing electricity. This electricity can be transferred to the grid.
3. This can serve as employment to unemployed people, they can earn money by just cycling, which will generate electricity.
4. The motor and pulley can be improved to increase the efficiency.

V ACKNOWLEDGEMENT:

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