ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 5, May 2016

A Novel Idea to Conserve Rain Water and Generate Electrical Energy-A New Perspective

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ABSTRACT: In this paper an effort is made on harvesting the rainwater for generating an electrical energy. Main objective of this work is to overcome the water and power problems in urban areas especially in factories, multiplexes, apartments and hospitals etc., The space between the two skyscrapers can be utilized to install a trolley balanced by a counter weight, such that it is initially held at the top of the building. When there is a rainfall the trolley gets filled up with the rain water. Once the weight of the trolley exceeds the counter weight the trolley starts to descend. When descending a special pulley arrangement driven by chain is designed. The pulley is coupled to a generator which generates electricity. At the ground level a wedge is provided that causes the trolley to empty the water in to the sump. When the water is completely drained the trolley automatically ascends up to its original position during ascending also electricity is produced. In this work power is generated through gear mechanism system by using Traction drive and Geared DC generator. Generated power can also stored using rechargeable battery which is used as backup during any interruption occurs. An illumination control is also designed with a comparator and microcontroller chip. In this work saving of energy and effective utilization of power are the important outcome factors.

KEYWORDS: Traction drive, Electricity, Illumination, skyscraper, servomotor.

I.INTRODUCTION

Energy is a major input for all socio-economic development of any society. Hydel energy is the fastest growing conventional energy. Hydel technology has improved significantly over the past two decades, and energy has become increasingly competitive with other power generation options. Hydropower plants are installed in more than150 countries, over 32% of hydro power is generating in Asia-Pacific region only. China is leading country in the generation of hydro electric power (approximately 721 terawatt hours). Micro Hydroelectricity is the term referring to electricity generated through rain water harvesting concept. The electrical power can be generated by using gravitational force which is present in the falling water. It is the most widely used form of renewable energy, accounting for 16 percent of global electricity generation more than 3,427 terawatt-hours of electricity production till 2015, and is expected to increase about 3.1% each year for the next 25 years.

In hydroelectric power generation, water is the main source hydraulic energy is converting in to mechanical energy this in turn converts into electrical energy by using alternator (AC Generator). The production of Electricity depends on the flow of water from zenith sources. One of the latest energy harvesting techniques is converting the mechanical energy from falling rain drops in to electricity that can be used to power sensors and electronic devices. The system works with rain drop ranging in diameter from 1-5mm and simulation show that its possible to recover up to 12milli-watts from one of the larger “down pour” drops. When a rain drop impacts a surface, it produces a perfectly in elastic shock. The amount of energy generated by the impact can then be estimated using a mechanical electric model.

II. METHODOLOGY

The methodology follows with various sections in step by step as shown in Fig.1. The main components of block diagram are Traction drive, Geared DC Generator, unidirectional/bidirectional current controller, rechargeable battery and illumination Control unit.

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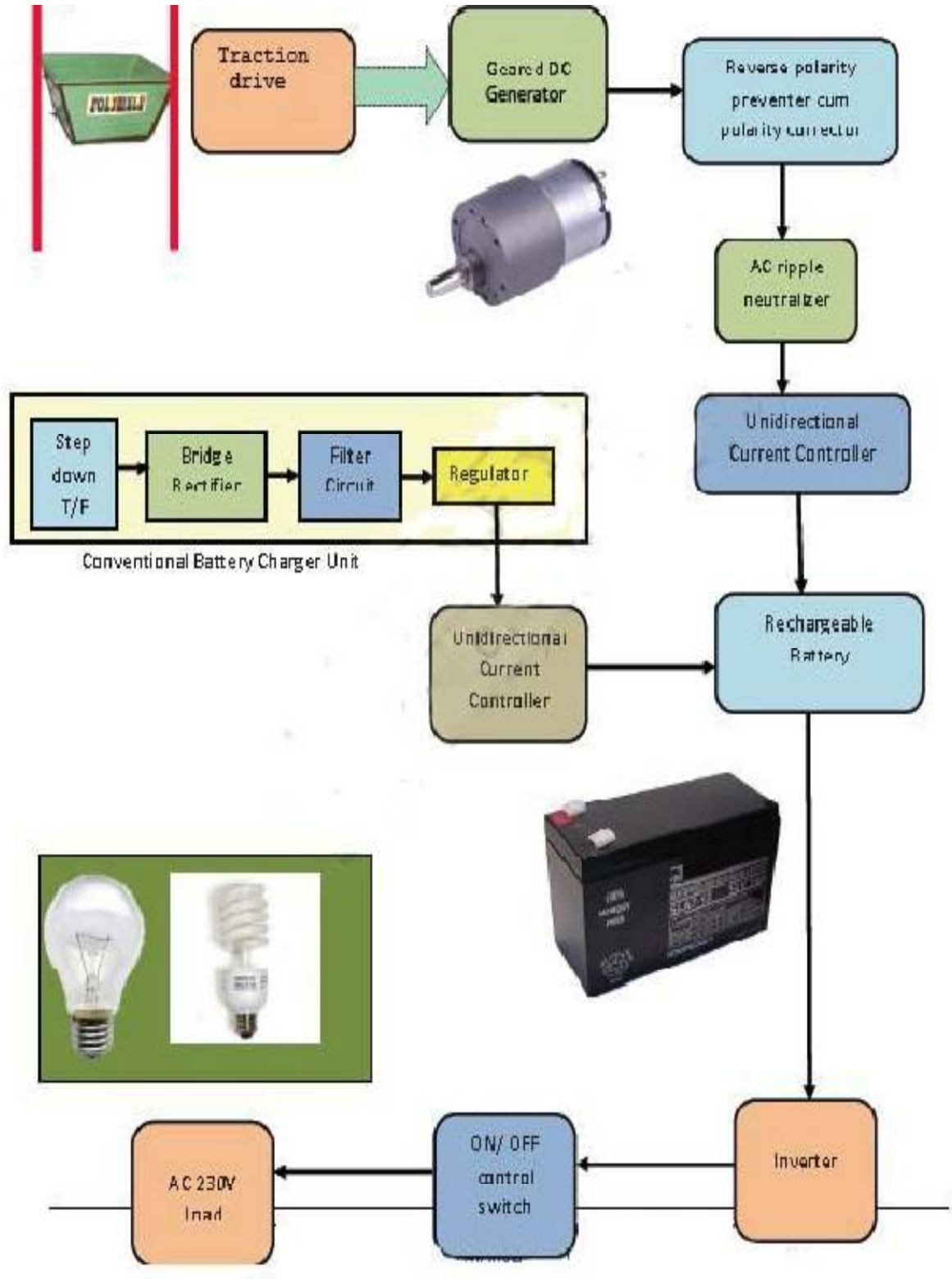

Fig.1 Block diagram of implementation of rain water harvesting and power generation.

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III. TRACTION MOTORS

The motor chosen in this work is very small typically used in a toy

Fig.2 Dissected motor

Fig.2 shows a small motor outer most part is steel frame which gives protection and mechanical support to the field system. There is an axle, a nylon end cap and two battery leads. The leads from the armature of the motor are connected to a flashlight battery, the axle will rotate in clockwise. If polarities of the leads are reversed, then it will rotate in counter clockwise direction. Here two other views of the same motor are shown.

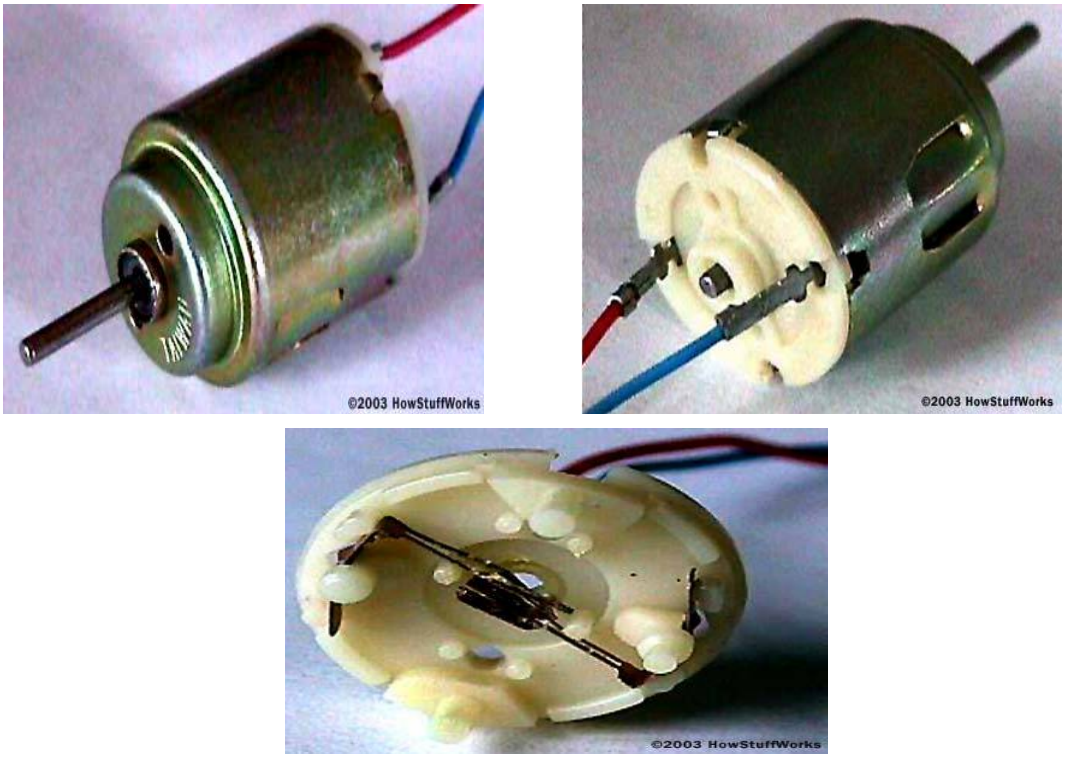

Fig.3 Nylon end caps

Geared DC motor is used for vertical to and fro motion of elevator. It collects PWM pulses from the microcontroller and accordingly maintains speed of the elevator.

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Fig.4 Geared DC Motor

Technical specifications: Rated Voltage 12V, Operating Voltage Range 3V-12V, Current at no load 50mA, Current at full load 500mA, Gear ratio is 50:1, Motor Shaft Speed: 100 RPM, Torque 2.7 Kg-cm.

SERVO MOTOR BLOCK DIAGRAM

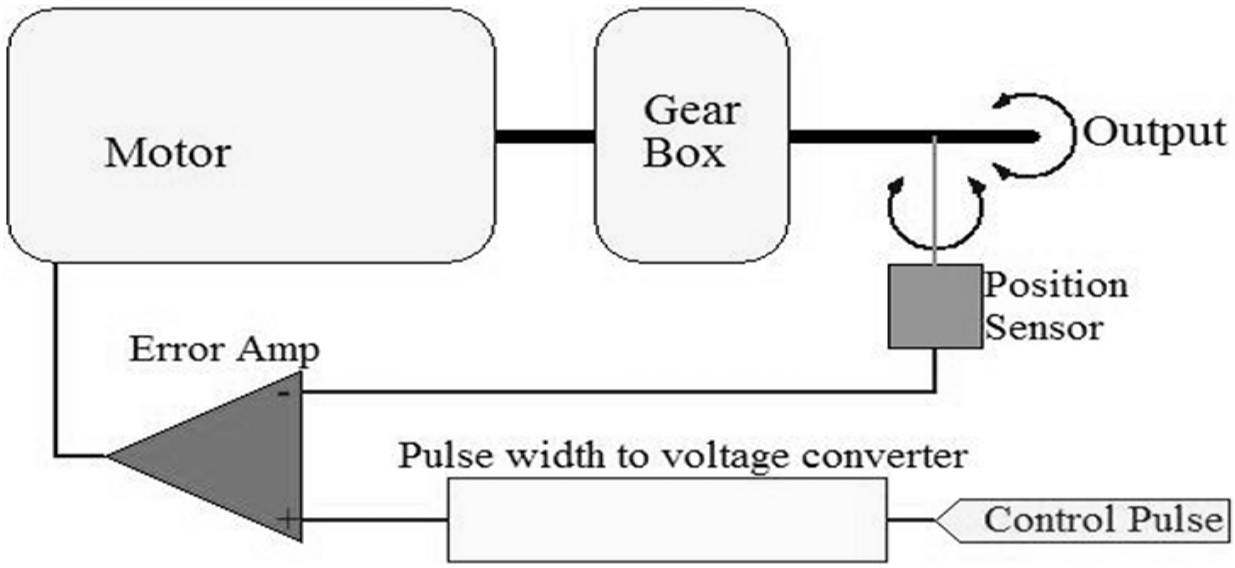

Fig.5 Servo Motor Block Diagram

The Brake actuators comprises of Precision servo motor operating at 5V and a brake mechanism. Electrical control unit (ECU) applies brake by providing PWM pulses to Servo motor. Servo motor angle can be defined by using PWM signals. The advantage of servo motor is precision braking by applying appropriate pressure to brake pads. Servo is a small device that has an output shaft, which can be positioned to specific angular positions by sending the servo coded signal. As long as the coded signal exists on the input line, the servo will maintain the angular position of the shaft. As the coded signal changes, the angular position of the shaft changes.
Technical specifications: Operating Voltage 5V, Operating Current 500mA max. Speed 60 RPM, Torque 5Kg-cm, Weight 120 grams.

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IV. ILLUMINATION CONTROL

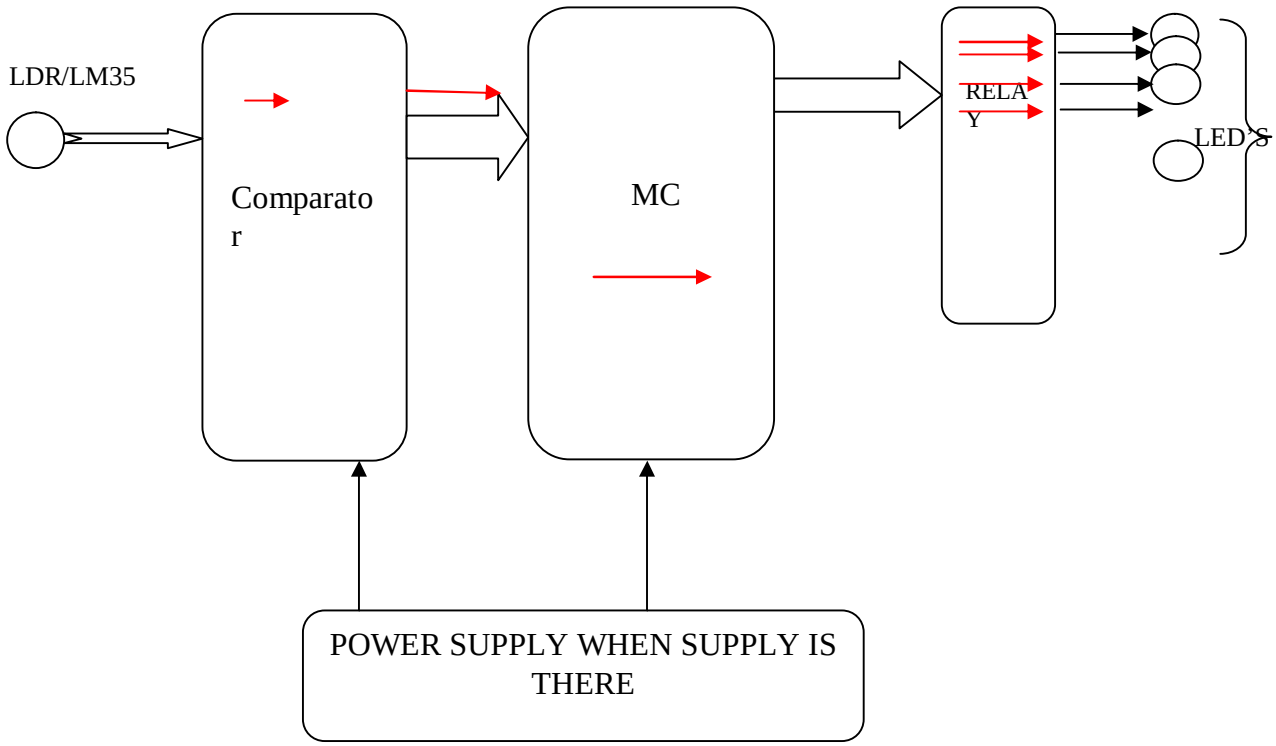
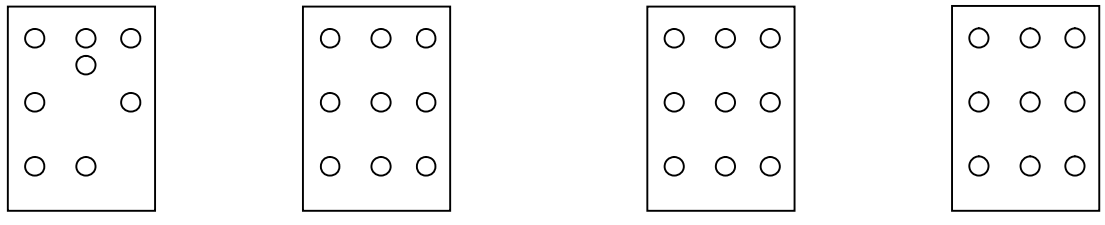


Fig.6

In our daily life knowingly or unknowingly many times we forget to switch off the lights, fan and other appliances, which lead to a lot of power wastage. In order to overcome from above disadvantage we have developed illumination control unit. In this stage the natural light enters into the room or office with the help of LDR/LM35, the intensity is measured and given to the COMPARATOR, the output of comparator converts into digital signals at the output pin. These signals are fed to microcontroller 89C51, to maintain the room/office required number of LED's were chosen. Depending on the natural light intensity number of LED should be switched ON and OFF.



Depending on the natural light intensity, these array should be controlled. If intensity of natural light is minimum then intensity of the light will be high (9 LED's), in the absence of natural light then only 4 LED's will glow. Incase if there is a continuous variation in natural light intensity then depending up on the condition either single or double or all LED arrays may be switched ON and OFF.

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ROOM TEMPERATURE CONDITIONER

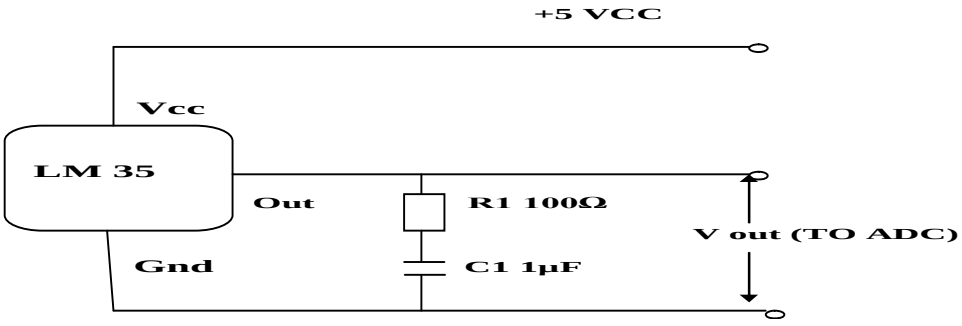

Fig.7

Triac is a variable a.c. power control device which is used as bidirectional switch. This circuit can operate for the resistive load up to1kW. At higher power levels (i.e. 150W plus) the Triac will require a heat sink. The present circuit shows a phase-triggered AC motor controller. Input from Counter & relay section and C1 are wired together as a combined variable potential divider and variable phase shift network. The Diac is used as a simple trigger device that fires when the C1 voltage rises to roughly 35 V [in either polarity] and then partially discharges C1 into the Triac gate, thus triggering the Triac on. The Diac turns off automatically when the C1 voltage falls below 30 V or so on.

PIN DISCRIPTION AND ARCHITECTURE OF 8051:

Introducing the Intel's Microcontroller 89C51

FEATURES:

4KB of In-System Reprogrammable Flash Memory, Endurance: 1,000 Write/Erase Cycles, Fully Static Operation: 0 Hz to 24 MHz, 128x 8-bit Internal RAM.

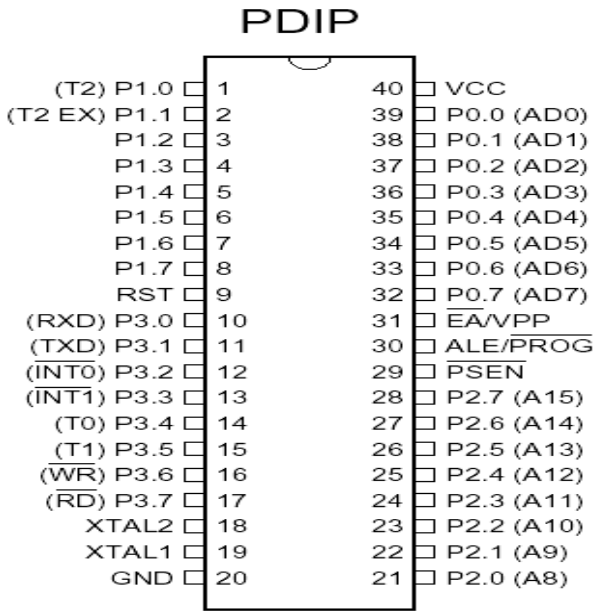

Fig.8

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The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4KB of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density nonvolatile memory technology and is Compatible with the industry-standard 80C51 and 80C52 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer.

V. RESULT AND DISCUSSION

Figure 9.a and 9.b shows the generated voltage obtained at the output after conversion from gear mechanical energy into electrical energy is about 3V. This generated voltage is stepped up to12V by using Buck-boost regulator and LM317IC which is shown in fig.9.a. Then this regulated voltage is stored in a rechargeable battery. This stored energy can be used in emergency.

Fig.9a).Sky scrapers with gear mechanism

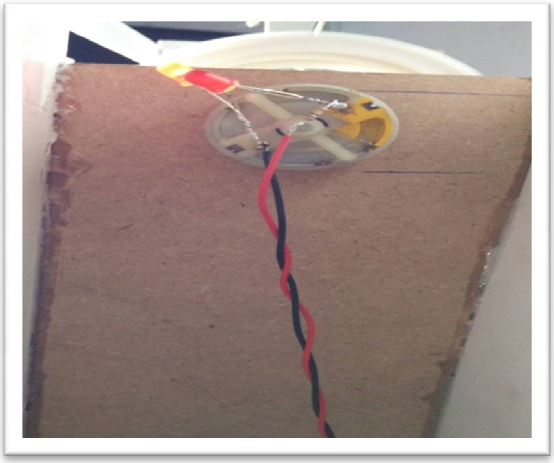
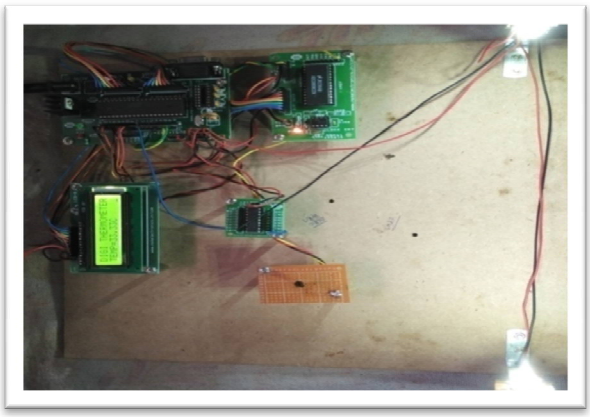


Fig.9b) Generated electrical power

Figure 10. Shows the illumination control units in which it senses the room temperature if its value is less than reference value (45 degree Celsius) then all array of LED's will be switched ON. Incase if it increases beyond reference value then array of LED's will be automatically switched ON according to the illumination requirement.



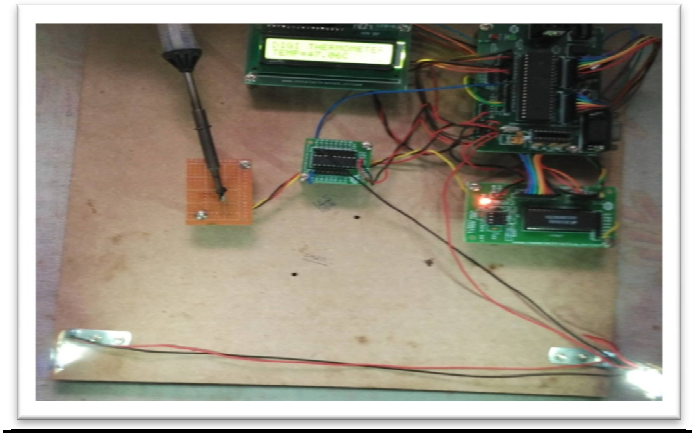


Fig.10 Illumination Control units

Figure.11 depicts overall project circuit which includes two sky scrapers in between a container is placed to which a counter weight is attached. When over flow occurs from over head tank also during rain fall the water gets collected in container and moves downwards. When this container reaches certain instant the entire water is made to tilt and stored

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in underground sump. During this process the gear mechanical energy is converted in to electrical energy. Along with this an illumination control unit is shown.

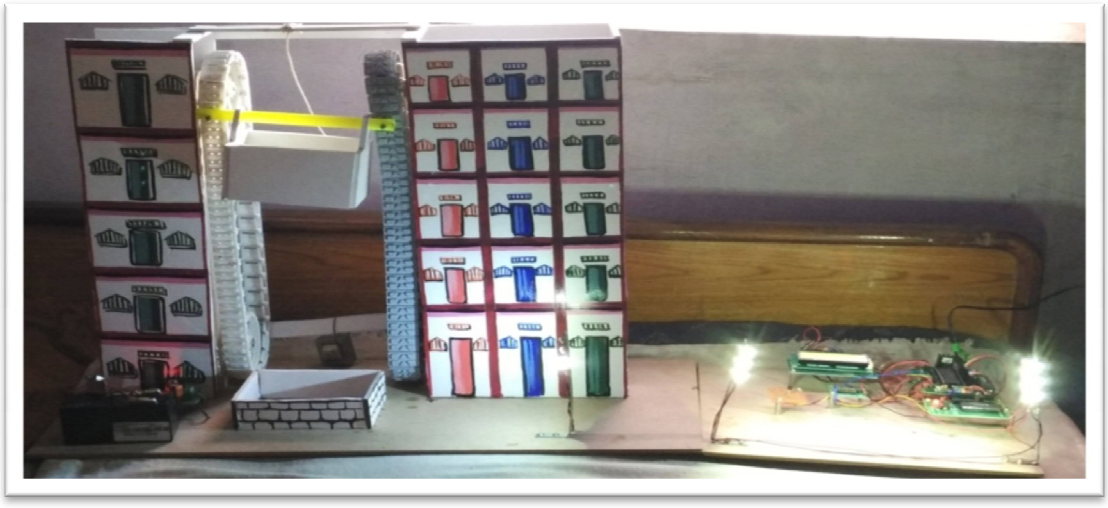

Fig.11 overall project circuit

VI.CONCLUSION

It is completely a GO-GREEN project & eco-friendly without any pollution. This technique helps to increase the underground water level. This work can be developed in urban areas wherever tall buildings are available and also in between hillocks. It is flexible, low power costs, reduced CO_2 emissions.

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