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, Special Issue 3, March 2016*

National Conference on Recent Advances in Electrical & Electronics Engineering (NCREEE'16)

Organized by

Dept. of EEE, Mar Baselios Institute of Technology & Science (MBITS), Kothamangalam, Kerala-686693, India

On 17th & 18th March 2016

Off Grid Vending Machine

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ABSTRACT: Solar vending has created a completely independent, off-grid vending machine that powers its vending mechanisms with solar power. A vending machine is a machine that dispenses product when a customer deposits a sufficient amount of money into a money slot. The money is accepted by a currency/coin validator. It is a machine that provides water, mobile charging unit to customers. It is equipped with a battery and a GSM module. Battery able to stores energy which sufficient enough for the machine to use it back whenever it does not receives any sunlight. GSM module notifies the responsible person that the coin is almost full and the selling products are running empty.

KEYWORDS: solar energy, vending, renewable, coin accepting.

I.INTRODUCTION

Solar energy is the universally available source of renewable energy. It is the cleanest and inexhaustible source of energy .It has got wide range of applications like solar powered vehicles, satellite systems etc. It is that source of energy which has wide scope for many applications in future. One such important application is in solar vending machine. Solar vending has created a completely independent, off-grid vending machine that powers its vending mechanisms with solar power. A vending machine is a machine that dispenses product when a customer deposits a sufficient amount of money into a money slot. The money is accepted by a coin validator. The solar vending machine can be used to give any desired item also it's a mobile vending machine.

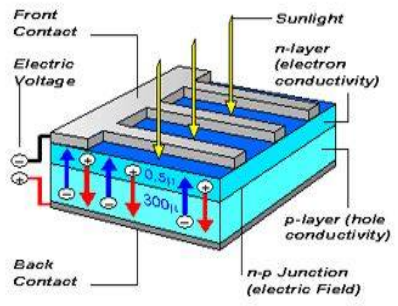

Fig 1. Solar cell

Fig 1. Shows the animated picture of a solar cell. Top layer of cell is manufactured by n-type material and bottom layer is made with p-type material. PV cell is exposed to this sunlight and absorbed by solar cell. When enough photons are absorbed by negative layer of PV cell, electrons are freed from the negative semiconductor material. These freed electron naturally migrate to the positive layer creating a voltage differential. Each individual cells produce only 1-2 watts.

II.WORKING AND BLOCK DIAGRAM DESCRIPTION

Fig2 shows the block diagram of solar operated vending machine. Solar panel convert solar energy directly to electrical energy. Electrical energy from the solar panel store in the battery & output fed to the voltage regulator. Voltage regulator regulate 12v DC input to 5v fixed DC output voltage. Voltage regulator IC, it powered the micro

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controller and other equipment's. When a coin is inserted it will measure the weight & width of coin.Then select the product required (pen, mobile charger, water).

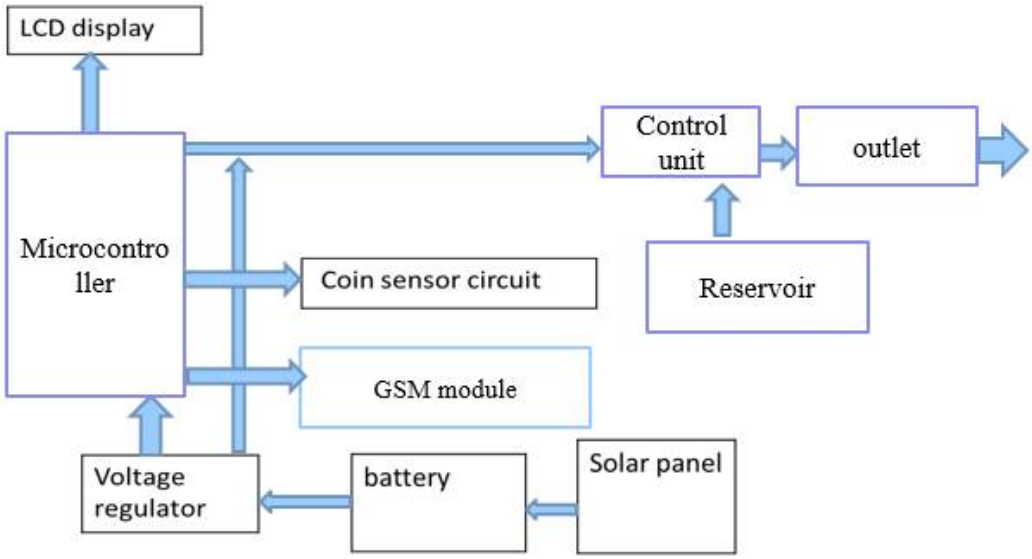

Fig2. Block diagram

In this machine mainly three operations has been done.

a) Water dispenser
b) Mobile charger
c) Pen dispenser

a) Water dispenser: A fixed amount of water will be given in glass, using a solenoid valve (150ml). Solenoid valve is an electro mechanical equipment. Transistor energise the coil using supply get from the microcontroller. When coil energise it will attract the valve for a 3 second, after 3 second coil will reenergise and valve will be closed.

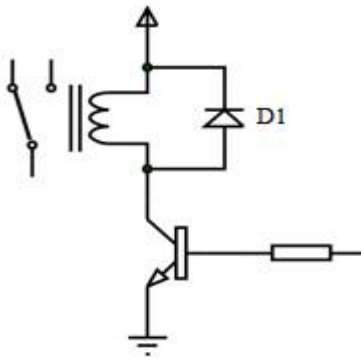

Fig 3.Water control unit

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b) Mobile charger: If mobile charger is selected, for a 30 minutes time charging point will be activated by activating the 13th pin of micro controller.

c) Pen: If pen is required, the mechanical set up will created. A square shaped box will be filled with pen. Provide a small gap in the bottom portion of the box which is sufficient for falling only a pen. Pen is falling in to a tray .The pen is pulled with a motor in to slope output tray

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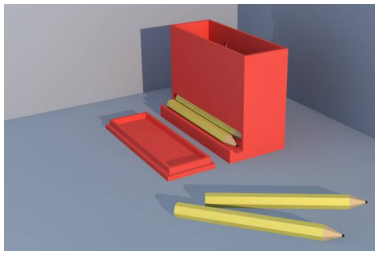

Fig4. Pen reservoir

GSM module notifies the responsible person that the coin is almost full and the selling products are running empty. By receiving the message responsible person can collect the coin or refill the product.

III. FLOWCHART

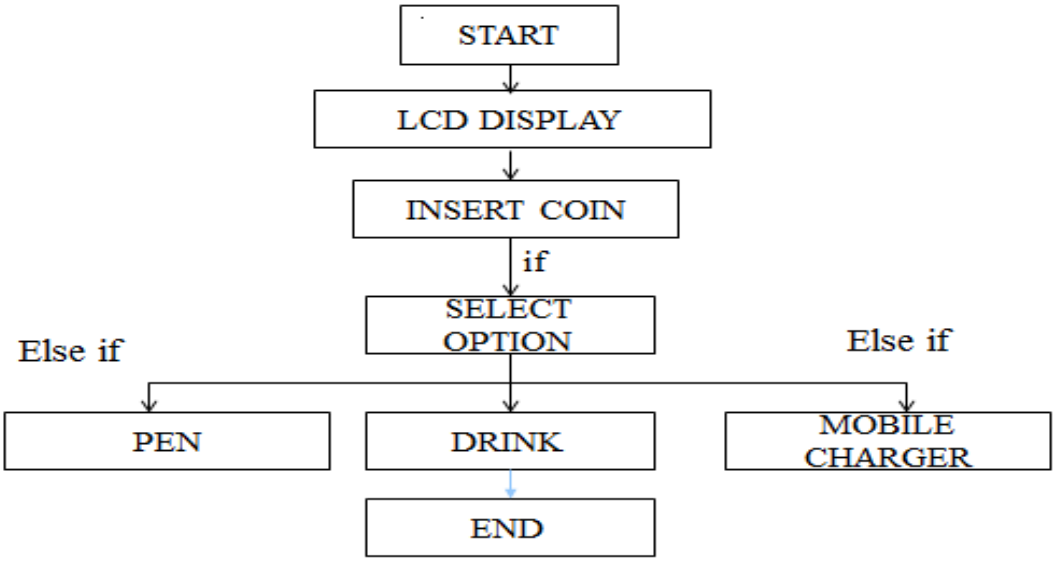

Fig 5. Flowchart

IV. MAIN HARDWARE PARTS

1. SOLAR PANEL: Fig5. Shows solar panel. Solar panel [2] convert solar energy directly into electrical energy. Solar panel consist of number of solar cells. The PV cell is exposed to this sunlight and absorbed by solar cell. When enough photons are absorbed by negative layer of PV cell, electrons are freed from the negative semiconductor material. These freed electron naturally migrate to the positive layer creating a voltage differential. Each individual cells produce only 1-2 watts. Rated power-is 20W, nominal voltage is 12V and Warranty about90% power output over 12 years

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Fig6. Solar panel

2. BATTERY: 12V, 7AH Lead acid reachable battery is used. Fig 6shows battery. Battery store energy get from solar panel for operating the vending machine in night times and intensity of solar cell is low.

Fig 7.battery

3. COIN VALIDATOR: Coin validator [3] measure the width and diameter of coin. Diameter of coin is measured by two switches which is placed in round shaped, a particular diameter will be measured. Diameter of coin is greater than or less than coin will goes to return slot. Weight are measured by a coil. Coins are made of a particular metal & it has a particular weight. Coins fall in to a coil and generate corresponding voltage. Fig7. Shows coin validator.

Fig 8. Coin validator

4. MICROCONTROLLER: ATMEL 328 Microcontroller is used. It is a 28 pin dip with 5v vcc. It is the brain of the equipment and it control whole units of the system. Fig8 shows the microcontroller.

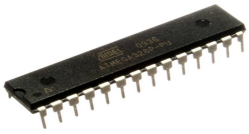

Fig 9. Microcontroller

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6. GSM MODULE: GSM module [4] is a messaging or an indication unit. It notifies the responsible person that the coin is almost full and the selling products are running empty. According the notification responsible person can refill the product or collect the coin. Fig 10 shows the GSM module.

Fig 10.GSM module

V. APPLICATION

The solar vending machine can be used to give any desired item also it is a mobile vending machine. We can transfer on place to another place easily. It can be also used in place of interest (garden, park, beach, remote areas), campus building.

VI. FUTURE SCOPE

Future scope of this project are replace coin validator by note validator & swiping machine. Balance return slot can be incorporated. Can add more number of products. Due to the heating of voltage regulator buck converter can use. Solar tracker for receiving maximum solar energy can be incorporated in the system. Also incorporate a water cooler for cooling the water.

VII. RESULTAND SIMULATION DIGRAM

Fig 11 shows the simulation diagram of solar operated venting machine. The simulation diagram done using proteus 8 ISIS. Each component of this circuit is selected from ISIS library. After adding the required component Hex code from computer is given to the microcontroller. The following results are obtained

- By operating the solenoid valve 150ml water will vending a disposable glass.
- By the operation of mechanical set up pen will be delivered by the output tray.
- Activation of 13th pin of microcontroller mobile charging port will be activated by a 30 mints.
- The products will be empty GSM module will give the notification in the form of a SMS.

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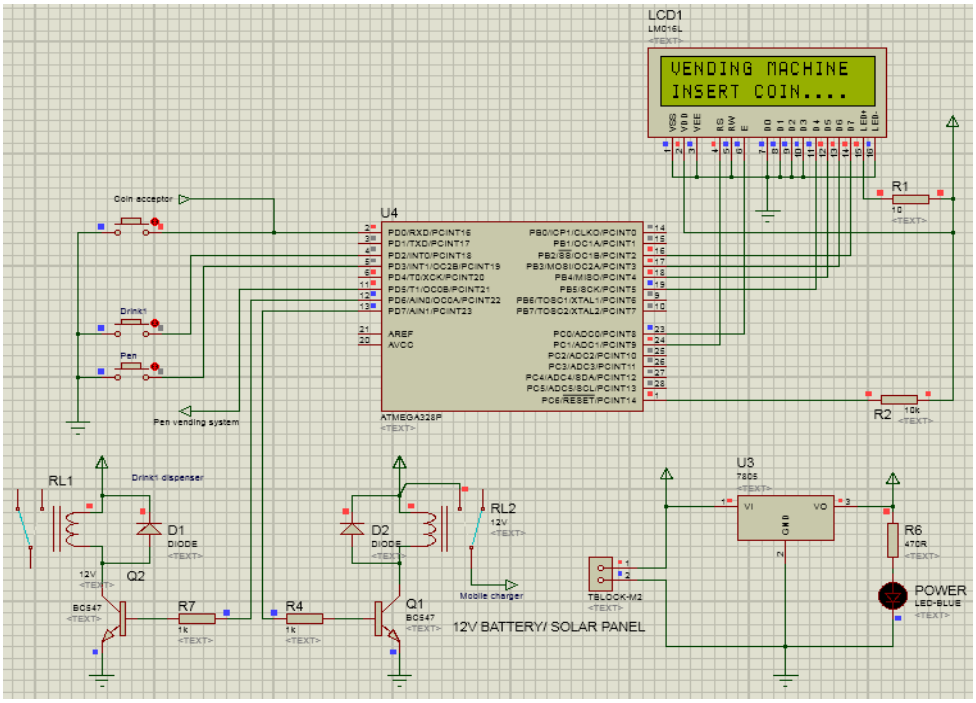

Fig 11.Simulation diagram

VIII.CONCLUSION

Solar vending has created a completely off-grid vending machine. That powers its vending mechanisms with solar power. Also this can implemented in our campus by changing the product and it will reduce work of office staff. Increase the wattage of solar panel we can incorporate cooling and heating mechanisms, also chaining the product as the consumer required without any drastic changes in the circuit. So it can be placed any rural areas as we required.

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