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DC TO DC BOOST CONVERTER

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ABSTRACT

In this paper converter use innovative technique, the loads power can be flexibly distributed between input sources. Also, charging or discharging of energy storages by other input sources can be controlled properly. The purpose of this project is to design and test a functional proof DC to DC boost converter. A microcontroller provides the necessary control signal to the switching circuit and it also monitors the input and output voltage levels. The input and output voltages are displayed on an LCD. Based on the input from a potentiometer, the microcontroller adjusts the duty cycle of the control signal thereby controlling the output voltage. An input voltage between 6-10.5 Volts can be given and the device can produce a maximum voltage of 25V. This device is particularly useful in situations where standard voltage requirements do not match user's application.

KEYWORDS:-*DC power supply, ADC 0809,* Microcontroller *AT89s52, LCD Display*

I. INTRODUCTION

DC – DC Boost converter are a kind of high frequency converters, which convert unregulated dc power to regulated DC power .Since the output voltage of renewable energy systems or rectifier converter is basically unregulated DC voltage, as shown fig.1.1, DC-DC converters are necessary to adjust the DC voltage for different applications. Three basic configurations of DC – DC converters are buck, boost and buck-boost converters.

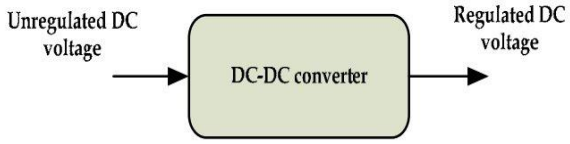

Fig.1:- DC-DC Converter

In a buck converter the output voltage is normally less than input voltage. However, a boost converter has the ability to increase the input voltage based on duty cycle of the switch. A buck-boost converter can either buck or boost the input voltage .A boost converter is usually applied in renewable energy systems as the output voltage of these systems is low and unregulated. Configuration of the boost converter is illustrated in Fig.1.In this converter, output voltage is a function of the duty cycle of switch (S), which can be defined by a proper modulation technique. When the switch is on, current flowing through it can charge the capacitor. However, in the next sub interval when the switch is turned off the inductor current will charge the capacitor. Second order LC filter in this configuration can regulate the output voltage and remove the high frequency harmonics. Power supplies are perhaps the most crucial elements of a battery- powered system .Battery-powered systems of ten stack cells in series to achieve higher voltages, but this is not always possible due to a lack of space. Switching converters use an inductor's magnetic field to alternately store energy and release it to the load at a

different voltage. With low losses they are a good choice for high efficiency. Capacitors connected to the converter's output reduce output voltage ripple. A switching power supply consists of a power stage and a control circuit. The power stage performs the basic power conversion from the input voltage to the output voltage and includes switches and the output filter. The control circuit monitors the output voltage and controls the power switch. The control circuit comprises of a microcontroller which generates the necessary control signal to turn on the power switch. The duty cycle of the control signal is varied to adjust the output voltage .The output voltage is monitored by the in-built ADC unit of the microcontroller. Boost converters are essentially a step-up converter that take in a low voltage input and provide an output at much higher voltage. The circuit diagram of the basic boost converter is shown in the figure below.

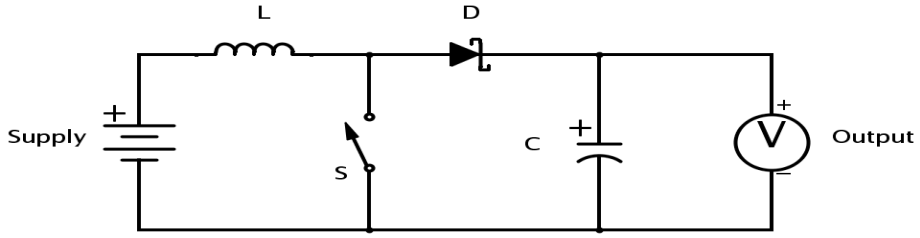

Fig.2:-Open Loop Boost Converter

The input and output voltage relationship is controlled by the duty cycle D, of the switch according to the equation given below.

$$V_{out} = \frac{1}{(1-D)} V_{in}$$

II. WORKING PRINCIPLE

In this project, we are increasing the level of the input voltage by innovative technology. Any electronic circuit need to be DC power supply. So we use the battery for 6V supply as input side source voltage that voltage is to be boosted. Some fluctuation and harmonics are introduced in the circuit this is removing by using of electrolytic capacitor. After that the input voltage is passing through the voltage regulator (7805).A voltage regulator is a device which converts the varying input voltage into a constant voltage supply. The voltage regulates the input supply 6V to 5V which is suitable for our circuit and microcontroller. After the regulation some fluctuation and ripple are also introduced in the circuit. So it removes by using of electrolytic capacitor and provides continues supply to the circuit.

We are using ADC0809 data acquisition component is a monolithic CMOS device with an 8-bit analog-to-digital converter 8-channel multiplexer and microprocessor compatible control logic. The 8-bit A/D converter uses successive approximation as the conversion technique.

ADC provides the digital signal by conversion of analog signal and easy to interface the microprocessors. And also provide the digital signal to the 2x 16 LCD display. The variable resistor provides the reference voltage to the ADC.

The microcontroller operates at 5v supply. The crystal oscillator generates the high frequency 22 MHz for the operation of microcontroller, crystal oscillator is provides the clock pulse to the AT89s52 microcontroller, Ceramic capacitor provide the stability to the crystal oscillator. AT89s52 has 8K bytes of flash memory, 256 bytes of RAM, 32 input /output line Watchdog timer, two data pointer, three 16 bit timer /counters, six-vector two level interrupt architecture, a full duplex serial port, on chip oscillator, and clock circuitry.

The microcontroller generates the PWM signal. The PWM signal is given to the booster circuit, the booster circuit having the combination of the diode and the capacitor. The capacitor charge, after charging the capacitor the C1 the diode D1 works on forward biased and another cycle the capacitor C2 charged and the diode D1 operates. Now the supply of diode circuit is applied on the H –bridge formation. The H-bridge formation consist of the combination of two transistors PNP and NPN transistor used. When negative cycle is applying on the PNP transistor .Now the transistor is ON and for positive cycle the NPN transistor is ON. Similarly, the transistors are switched OFF for

reversed signal. Thus transistors provide the high switching and the level of the DC voltage increased.

A Darlington array also used in booster circuit because Darlington array increased the current gain than output voltage will increase. The output voltage measured by multi meter and this output voltage shows on LCD display.

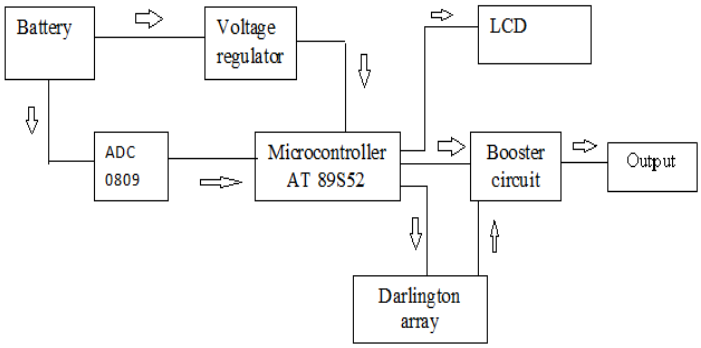

Fig.3:-Block diagram of DC-DC boost converter

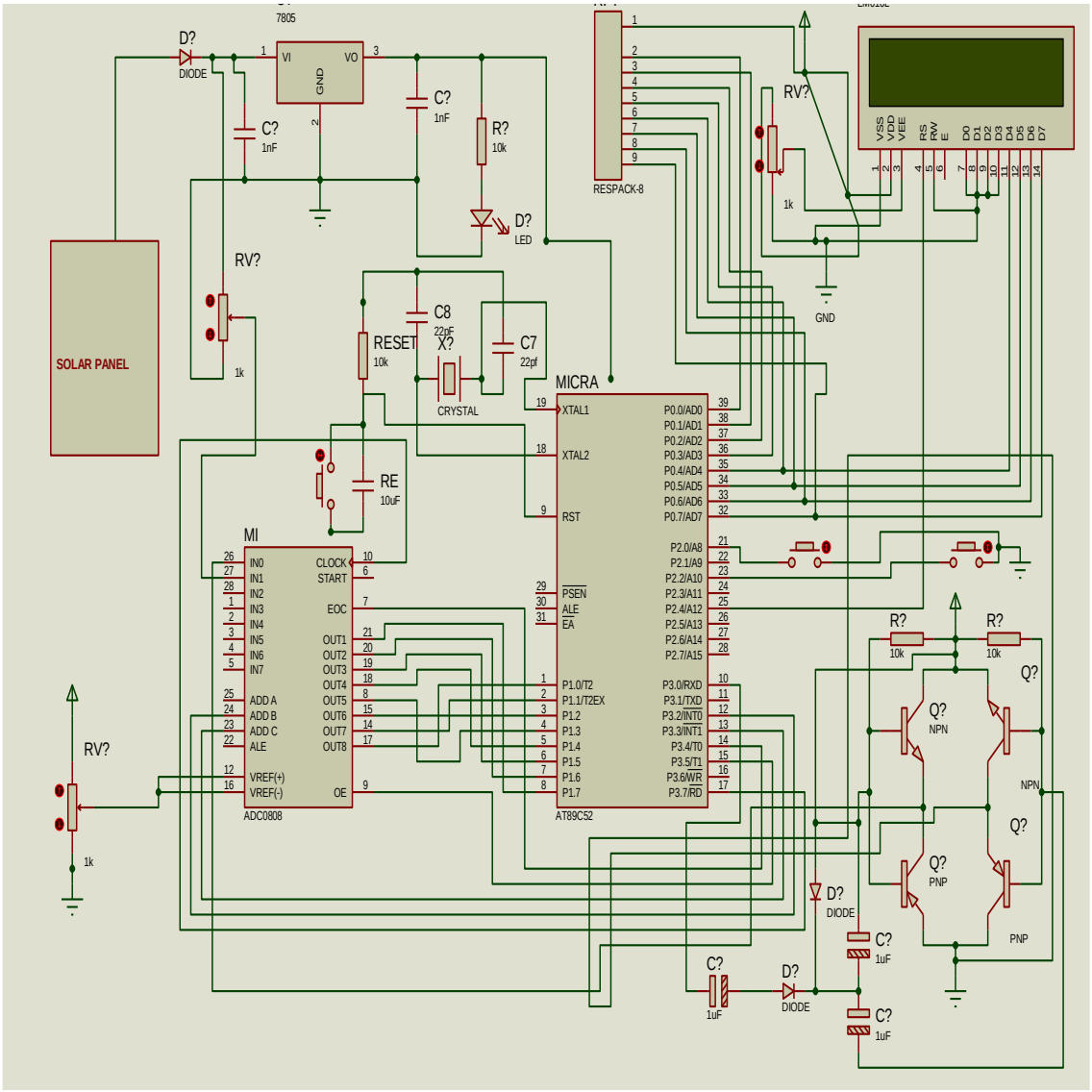

Fig.4:-DC-DC boost converter circuit

III. DESIGN METHODOLOGY

We make a project in different mode:

1. **Ist mode:**
   In this mode we design over all frame script such as
   - Idea of project,
   - Components list,
   - Circuit diagram.
2. **2nd mode:**
   In this mode we calculate the value of
   - Components.
   - Decide the component rating.
   - Name of components that may be use in project.
   - Purchase the components.
3. **3rd Mode:**
   - In this mode we design a circuit on PCB.
   - Assemble the components.
   - Test the soldering dry or not.
4. **4th mode:**
   In this mode we software for coding.
   - We use Kiel software.
   - We design a code in assembly or embedded c.
   - We create the hex file.
5. **5th mode**:
   - In this mode we design a circuit diagram on protest for simulation.
   - Try to simulation on protest.
6. **6th mode:**
   - In this mode we use the top-win software.
   - We programmed the IC.
7. **7th mode :** In this mode we test the features of project.

IV. COMPONENTS REQUIRED

- Switch
- Battery (6V)
- Electrolyte Capacitor(100µF-1000µF)
- Ceramic Capacitor
- Resistor (1k,10k,470 ohm,22k,56k)
- Pull up resistor(10 k Ω for each pin)
- Variable resistor
- Transistor (NPN and PNP).
- Power transistor
- Diode (in 4007).
- Microcontroller (at89s52)
- Analog to digital convertor.
- Crystal oscillator
- Regular circuit
- LCD(2 x 16 display)
- LED

- Reset button

1. Advantages:-

Only one switch, high efficiency, unidirectional output current, provides one polarity output voltage, low cost, easy to analyze, easy to understand, Simple circuit.

2. Disadvantages:-

Not suitable for high power conversion, low amount of dc step up, non-isolated SMPS, not a highly requirement

3. Applications:

LED driver, used for solar power system, used for domestic application, used in HVDC system, applicable for LCD Backlights & Flash Lights, used in HVE (Hybrid electric vehicles).

4. Future Scope of this Project:-

The DC to DC boost converter gives the output voltage greater than the input voltage by conversion of the dc voltage.
After sometime the convectional source of electricity may be finish because these are limited so we can use this technique to improve the power supply.

5. Results:-

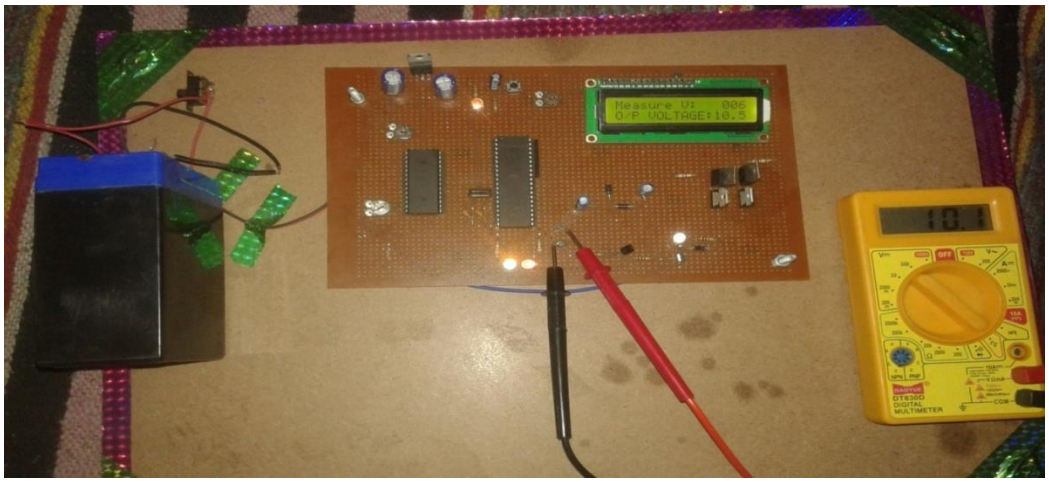

Fig.5:-Circuit Configuration of Dc –Dc Boost Converter

Fig.6:-Input Supply Test Waveform on CRO

FIG.7:-Output Magnitude Test of Dc-Dc Boost Converter on CRO

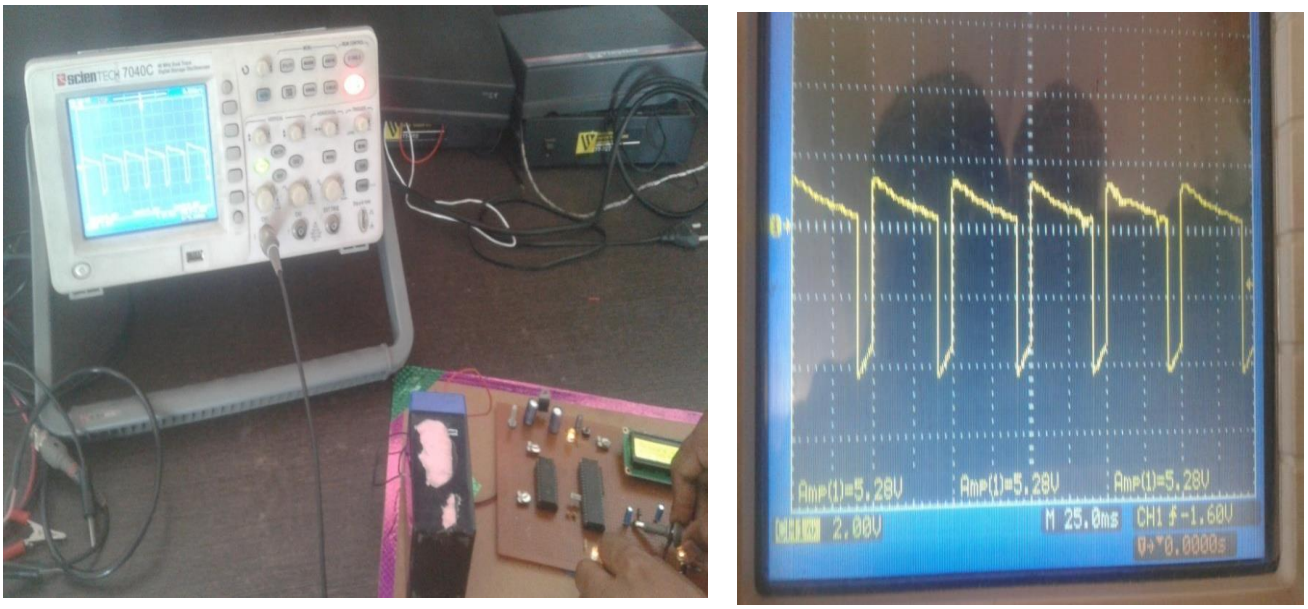

Fig.8:- PWM Signal Generate By Microcontroller At89s52

6. Calculation:-

$$\text{DUTY RATIO, (D)} = 1 - \frac{\text{Vin}}{\text{Vout}}$$

$$D = 1 - \frac{6}{10.30}$$

$$D = 0.42$$

$$\text{OUTPUT VOLTAGE, } V_o = \frac{\text{Vin}}{1-D}$$

$$V_o = 6/1\text{-}0.42$$

$$V_o = 10.32\ V$$

$$T = \frac{1}{F}$$

$$T=\frac{1}{22x10^{6}}$$

$$T=0.045x\ 10^{-6}$$

$$T=4.5\mu s$$

$$T_{on} = D \times T$$

$$T_{on} = 0.42 \times 4.5$$

$$T_{on} = 1.89\mu S$$

$$T_{off} = (1-D) \times T$$

$$T_{off} = 2.61\mu s$$

RIPPLE CURRENT (I_{RIPPLE}) =D x load current

$$I_{RIPPLE} = 0.42 \times 3.1$$

$$I_{RIPPLE} = 1.302A$$

V. CONCLUSION

In this project we gave the outline of our final year project on the topic of dc-dc boost converter. It includes introduction to the DC boost converter, its area of operation, present market value and several application of it. Also reveals the aim of the hardware implementation with several specifications to be considered during circuit implementation. DC to DC boost converter circuitry can be used in low power generation of DC power. In future the DC to DC boost converter can fulfillment our demand when the conventional energy sources will be ended.

Overall, the main objective of this project is achieved. The project works as DC to DC voltage level converter and give the out greater than the input voltage. The Boost converter with an operating frequency of 22MHz.The voltage Regulator regulates the input voltage into 5volts.The entire circuit is worked on the 5volt DC supply. The provided output voltages exceeding 11V approx. with inputs low as 6V.The input voltage is increased by booster circuit. The input and output voltage measuring circuits worked better than expected with errors also was ±0.1V.These errors occur due to the rating of the components. The microcontroller displayed these values on the LCD screen. This DC voltage, we can use in many application like DC operated vehicles, electronics rickshaw, streetlights, domestic application, and industry application.

The hardware equipment is tested and result is obtained, this project cost is effective. Implementation of this project in present day will effectively for any operation of the project.

REFERENCES

[1]. Ned Mohan, Undulant and Robin, 'Power Electronics: Converters, Application and Design', John Wiley and sons Inc., New York, 2006.
[2]. Rashid M.H., 'Power Electronics- Circuits, Device and Applications', Prentice Hall India, New Delhi, 2009.
[3]. Muhammad H. Rashid, "Power Electronics, Circuits, Devices, and Applications", Third Edition ,Pearson Education,Inc.,2004.
[4]. Carl Nelson &Jim Williams," Linear Technology, LT1070DesignManual",1986.
[5]. Marty Brown," Practical Switching Power Supply Design" ,New York :Academic Press, Inc.,1990.
[6]. Irving M. Gottlieb," Power Supplies ,Switching Regulators ,Inverters, &Converters ",New York: McGraw-Hill,1993.
[7]. D. M. Mitchell, "DC-DC Switching Regulator Analysis", New York: McGraw-Hill, 1988.
[8]. Anita Sonia," DC-DC Switching Boost Converter" ,ILLINOIS College o fEngineering,1999.
[9]. G. Segue, "Power Electronic Converters: DC-DC Conversion", New York, Springer- Verlag,inc.,1993
[10]. S. B. Jeer, J. K. Pederson, and F. Bleiberg, "A review of single-phase grid-connected inverters for photovoltaic modules, *IEEE Trans.* I*nd. Appl.*, vol. 41, no. 5, pp. 1292– 1306,Sep./Oct. 2005
[11]. B. Yang, W. Li, Y. Zhao, and X. He, "Design and analysis of a Grid connected photovoltaic power system, "*IEEE Trans. Power Electron.*, vol. 25,no. 4, pp. 992–1000, Apr. 2010.
[12]. D. D. Lu and V. G. Agilities, "Photovoltaic-battery-powered dc bus system for common portable electronic devices," *IEEE Trans. Power Electron.*, vol. 24, no. 3,pp. 849–855, Mar. 2009.

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