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Arduino Based PWM DC-DC Boost Converter for Traction System

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Abstract: ***Now a day's energy conservation is the most important thing in the world wide. The area of traction also take this into the consideration, so they take a step forward to use regenerative energy which is generated through the regenerative braking in the train. This regenerated energy most of the time get wasted in form of heat. Or most of the time it fed back to overhead equipment. Using regenerative braking energy battery energy storage system is charging used in many countries like japan, New Zealand, UK. This paper presents the implementation of a dc dc boost converter which used this regenerated energy in the traction system and boost the voltage of battery energy storage system. This paper presents the improved dc-dc boost converter which can be implemented in future in the Indian railways system. Arduino based PMW dc dc converter used in traction system to charge the battery energy storage system.***

Index Terms: DC-DC boost Converter, Arduino, PWM, regenerative energy, traction system.

I. INTRODUCTION

Past several years because the industry grownup, so fast that needs of everyone completely different like cost should be minimum, life span more, quality etc. ,to retain with these demands engineers have worked towards developing economic conversion practices related required proper growth of an knowledge domain field of power electronics. Power electronics industry capture worldwide as due to above mention benefits. Power electronics made world a compact place due to numerous changes day by day. Dc dc boost converter used in the many applications from medical to aerospace. This converter used where dc output is required. DC-DC boost convertor output voltage is higher than the input voltage. DC-DC boost convertor play a vigorous role. In this paper energy storage element used is MOSFET and combination of both L and C are used. MOSFET switch in the boost converter is turn on by using PWM TL494. Arduino microcontroller is used with PWM to generate the pulses and control of the output voltage of the dc dc boost converter. DC DC Boost converter required DC supply here adapter is used which gives DC supply to DC DC boost converter.

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Now in Indian traction system regenerative energy is used in WAP-5, WAP-7 and WAG-9 class of 3phase locomotives. These locomotives are saving up to 20% and 3phase electrical multiple units (EMU) are saving up to 30% energy through regenerative braking. This energy can be used to charge the battery energy storage system in railways with the help of dc dc boost converter. Recently Indian railways not use this regenerative braking energy to charge the battery, but in the future this improved dc dc boost converter will not only reduced energy consumption by using regenerative braking energy also reduced CO_2 emission.The paper is structured as follows in the section I introduction of power electronics. Section II system configuration is introduced section III simulations and result of model presented. Section IV is the conclusion part.

II . SYSTEM CONFIGURATION

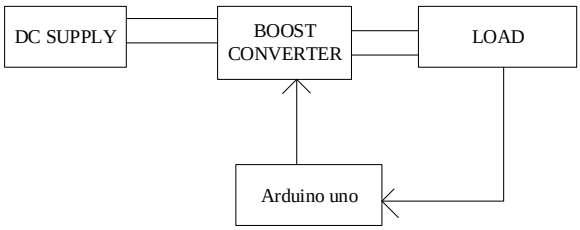

Figure 1 block diagram of Boost converter prototype model

Figure 1 shows the block diagram of prototype model of dc-dc boost converter proposal for traction system.
Prototype model used dc –dc boost converter which is used to boosted the output voltage. Lead acid battery of 14.2 V is used as battery energy storage system in the prototype model of traction system. Arduino based PWM controller is used to control the output of converter up to 14.2 V.PWM generate pulses so that MOSFET switch on hence in this way it control the output of converter by controlling duty cycle of it. Specification DC –DC Boost Converter output voltage 14.2V. ARDUINO UNO ATMEGA328P-PU controller is used. A MOSFET used as switching element in this project. 12V supply is used as a source. MOSFET (IRFZ44E), inductance (0.28mH), capacitance (100nf) and diode (IN4407) are used in the circuit. These are the dc dc boost converter parameters. TL494 PWM have a facility called direct MOSFET driving means it doesn't need additional driving circuitry. It can directly ON and OFF MOSFET.

III. SIMULATION AND RESULT

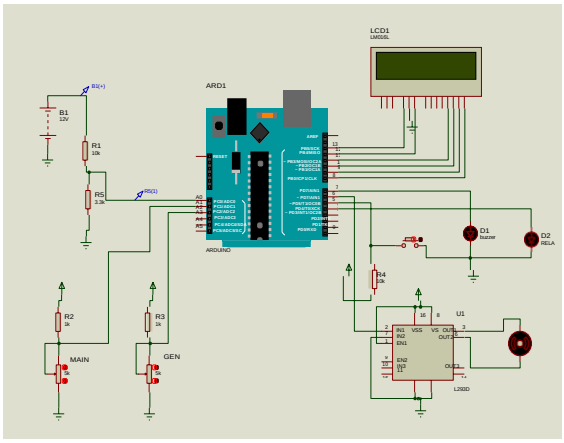

Figure 2 Proteus simulation

Figure 2 shows the proteus simulation. First the program should be burned into Arduino controller .Input voltage may vary to any value but with the help of PMW TL494 duty cycle of this adjusted through arduino Uno. In this ardunio controller shows three voltages on display 1. Generated voltage 2. Battery voltage 3. Mains voltage designing a prototype model for traction system where we can use this dc-dc boost converter to charge the battery. In japan due to natural disaster train stop at one point to avoid such kiosk japan implement the battery energy storage system. Here trying to implement prototype model of train so we need battery storage system in which energy can be stored and use this energy in any natural disaster condition. We need 12 V battery, to charge this dc-dc boost converter is used which charge the battery up to 14.4V to maintain the output voltage constant we use PMW TL494 with ardunio controller. By controlling duty cycle output voltage of boost converter maintain constant for any change in input voltage. Here ardunio controller play key role. This controller shows three voltages: Generated voltage, Battery voltage and Mains voltage. Normally battery of railways charged through 25KV catenary overhead supply. Rectifier house is near to each station. Regenerative energy generated from braking action is normally fed back to OHE, here we are going to use this regenerative power from braking action to stored charge in the battery. In the prototype model figure 3 shows ,if mains are available ardunio show mains voltage.

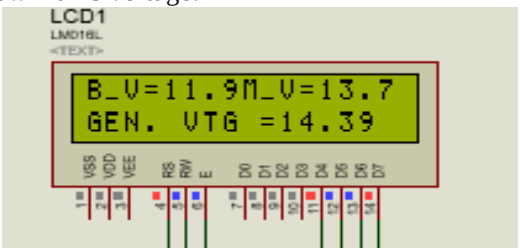

Figure 3. Mains supply is available

Figure 4 shows, if supply cut it shows traction system on battery

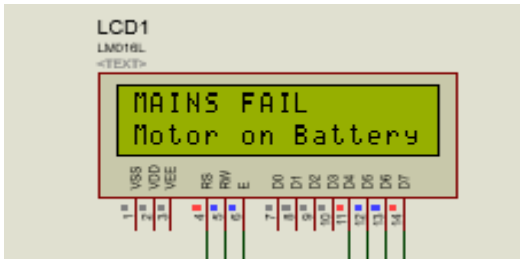

Figure 4 mains fail

Figure 5 shows that it keep on searching near station to stop.

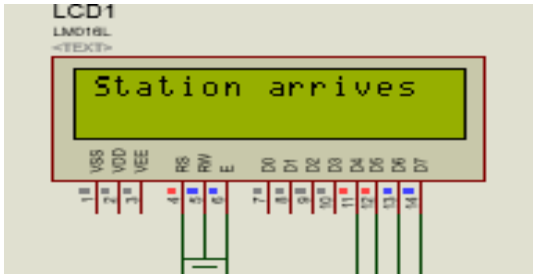

Figure 5 Station arrive

IV. MAIN CIRCUIT TESTS

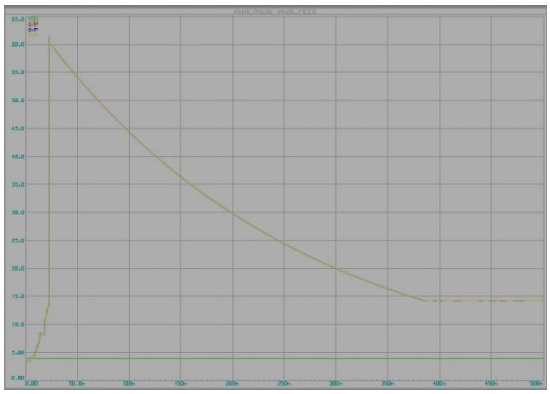

Figure 6 voltage vs. distance

As shown in figure 6, as input voltage increases output voltage remains constant that is 14.2 V.it also shows the distance with respect to voltage.

V. CONCLUSION

This paper is the implementation of such DC-Dc Boost converter which charges the battery with the help of arduino Uno and PMW. Output voltage of converter remains same that is 14.2V. This is the simplest way to regulate the dc output voltage. This DC-DC boost converter for charging battery in the traction system which not only used regenerative energy but also co2 emissions reduces. This dc dc boost converter used near future in Indian railways where this regenerative braking energy charged the battery energy storage system and used if mains supply fail or any other problem due to DC feeder or mains get isolated that time it helps the train to travel near station within the reach.

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