Simple designed of charge controller based on microcontroller for caddy cars using solar panels

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Abstract. A charge controller is needed not only to improve the efficiency of the caddy cars but also to protect the storage batteries. The main function of a charge controller in Candy Cars is to charge the battery without permitting overcharge and deep discharge as an alternative power source. The study aimed to study and monitor a device that will obtain a controlled power supply. The results of the study obtained the design of voltage pulse generator has yielded a significant result, namely the maximum voltage V max pulse battery is approximately 3.08 % and the current on a step up/down module is 12.5 %

1. Introduction

The caddy cars or buggy cars are less effective and very harmful emissions to the surroundings. In some area like a university or places the utilization of candy car is gaining wide popularity. In this case, the electric carts are relatively efficient to the environment. The caddy cars do not have a long driving range and their onboard batteries require to regularly recharge [1][2]. A charge controller as the regulator is generally a voltage to keep batteries from overcharging. The charge regulates the current coming from the solar panels going to the battery. Medan Civil Aviation Academy (ATKP) has four caddy cars manage by management operational of ATKP. The caddy cars are generally operation during the daytime in ATKP area. In this study, we need to charge and recharge the candy's cars' battery to run the ATKP Candy Cars' using solar panels. A battery is a device consisting of one or more electrochemical cell that converts stored chemical energy into electrical energy [3], [4]. The solution for power supply design with the low cost, the simplicity of design and intrinsic efficiency is the monitoring. the battery charge is used to put energy into secondary cell forcing electric current through it. This study aims to design and develop a device that will obtain a battery power supply.

2. Method

The research method is conducted electronically as experimental in Fig.1 is a block diagram. The measurement sample is prepared in the Laboratory of Electronics, Medan Civil Aviation Academy (ATKP). The research methods in making the supply of microcontroller ATMega 16 uses a Power Supply [5]–[8] as amplification to increase voltage.

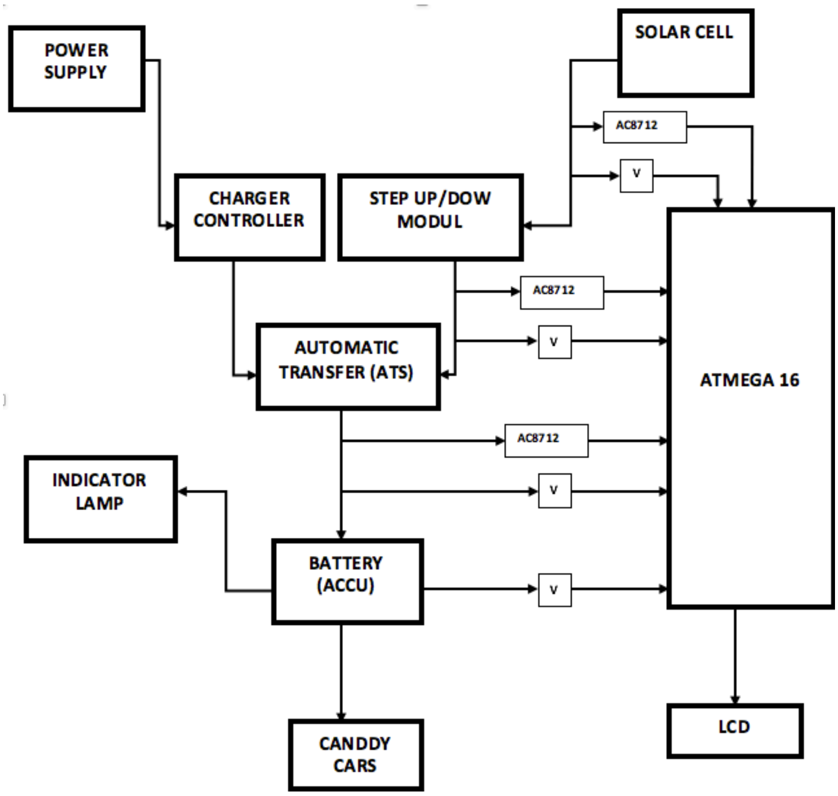

Figure 1. Modification of electronic circuits

In order to design the candy car charging, we define the main steps by determining the power consumption of candy cars, sizing the DC charger and sizing the batteries as shown in fig.1. The design for the schema if the PLTS was working, the current sensor and voltage divider circuit will run to read the current and voltage which passed the cable output from the solar cell, step up/down module, the Automatic Transfer Switch (ATS) and a battery. The data obtained from the current and voltage as an analog signal are forwarded to the ATMega 16 and generated to Liquid Crystal Display (LCD) as shown in fig.2.

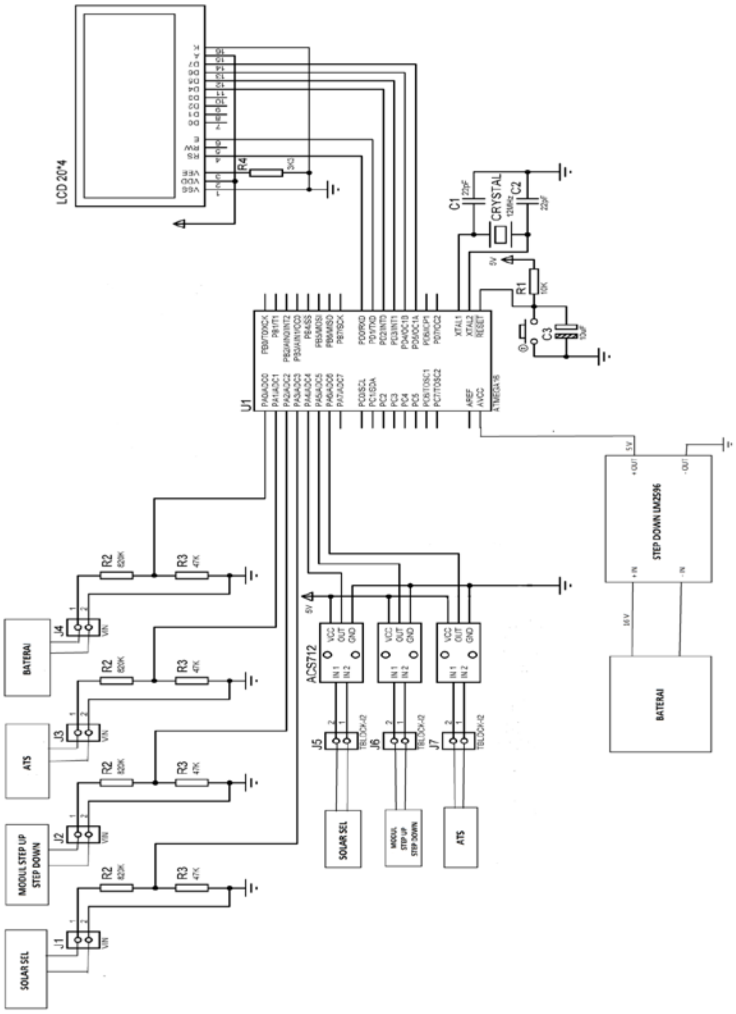

Figure 2. Monitoring Diagram Line

2.1 Material

The material in this research, consist of two-part, we use Trojan T-875, 8 Volt to supply the candy cars about 48 Volt. In this case, the battery we combine with makes the battery series. The power supply used Trojan not only using for Candy cars but also used to run ATMega 16 and LCD, 16 Volt. We used battery series to get the voltage 16 Volt, and 5 Volt for ATMega 16 and LCD. The output from the battery series was generated to be 5 Volt with step down LM2596 module.

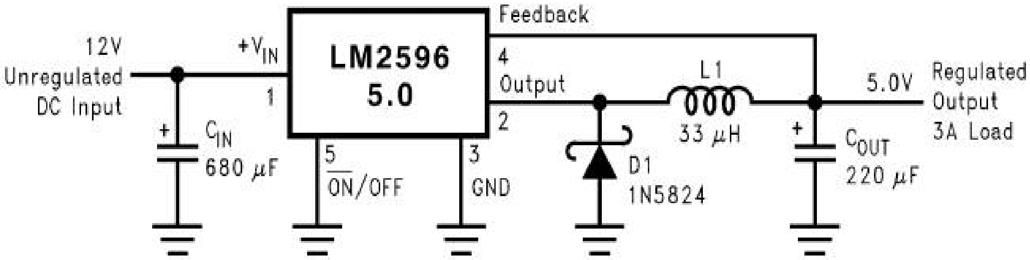

Figure 3. Modification of IC Regulator LM2596

We used the instruments to measurement by a digital/analog multimeter. Generally, pulse forming circuits in fig.3 can be made with various series and supporting components, including the use of AT-mega microcontroller components, IC Regulator LM2596, Dioda 50HF120, and LCD. The generator of pulses is known as an oscillator [3], [5], [6], [9]. The oscillator of the component is easy to adjust the duty cycle and frequency. theoretically, it can reach a ratio of 10:90%.

3. Result and Discussions

The results of this study are accordance and represented of the electronically as fig.4 which consists of a power supply using 8 Volt. The oscillator with IC Regulator LM2596 (under the power supply), driver or switching is the ACS712 sensor. While the part voltage, is a solar cell step up/down module, ATS, and battery. At the solar panels, which connected in series to the cascade fed to the plate electrode (stainless steel) parallel to the size for generating electric field pulses. In this circuit, the position of four solar cell units is connected in series, so that it can produce a voltage 48 V DC and 3 A [4], [10-12].

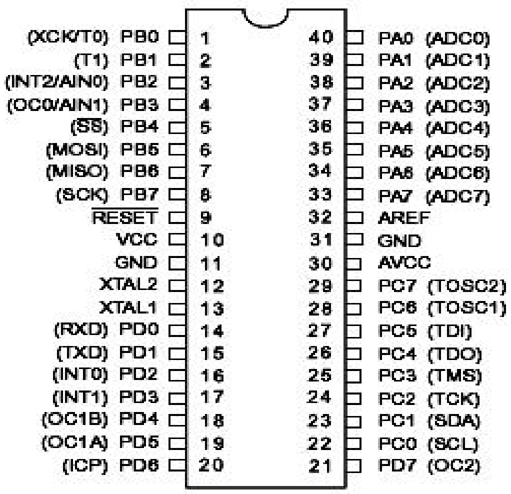

Figure 4. High Voltage Generator Circuit

The result of the design of the voltage generator and electric field pulse generator is shown in figure 5 below, the Automatics Transfer Switch (ATS) circuit are less or does not meet to charger or sore from PLN, when a portable charger is connected the power supply will automatically be disconnected by ATS and the portable charger is removed the power panels and passing the ATS through testing is 48 Volt and forwarded to charge the battery in the Caddy car.

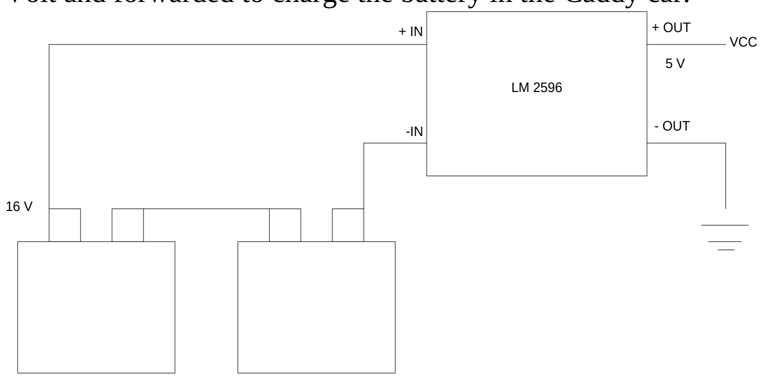

Figure 5. The design of battery with step modul LM 2596

In Fig.5 showed the visual test of test data was generated on Microcontroller ATMega to LCD. The voltage which entering into ATMega 16 analog as input to be processed. The microcontroller is connected to a 20x4 LCD to display of readable voltage.

Figure 6. Microcontroller ATMega 16 to LCD

The test data for the supply of pulse voltage at electrodes show in Table 1. From the test result of the calculation, it can be concluded that the voltage entering the ATMega 16 input is produced and generated from Voltage process.

Table 1. Test data for supply of Pulse Voltage at Electrodes

V In, (V)	R2 (k ohm)	R3 (k ohm)	V Out 1 (Volt)	V Out 2 (Volt)
48	820	47	45,3	2,6
24	820	47	22,69	1,3
12	820	47	11,34	0,65

Based on the occurrence of events, in this study, the voltage which entering to microcontroller ATMega 16 where the voltage had been passed through ATS will charge the battery. Among the ATS series and batteries, there is a diode 50HF120 to safety if the battery voltage is greater than the voltage that passes through ATS so that the voltage does not flow towards ATS. The visual of Microcontroller ATMega to LCD as in fig.6 is the result of Table 1 testing for voltage at electrodes.

4. Conclusions

Based on the results obtained in the study, the design of voltage pulse generator has yielded a significant result, namely the maximum voltage V max pulse battery is approximately 3.08 % and the current on the step-up/down module is 12.5 %.

Acknowledgment
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