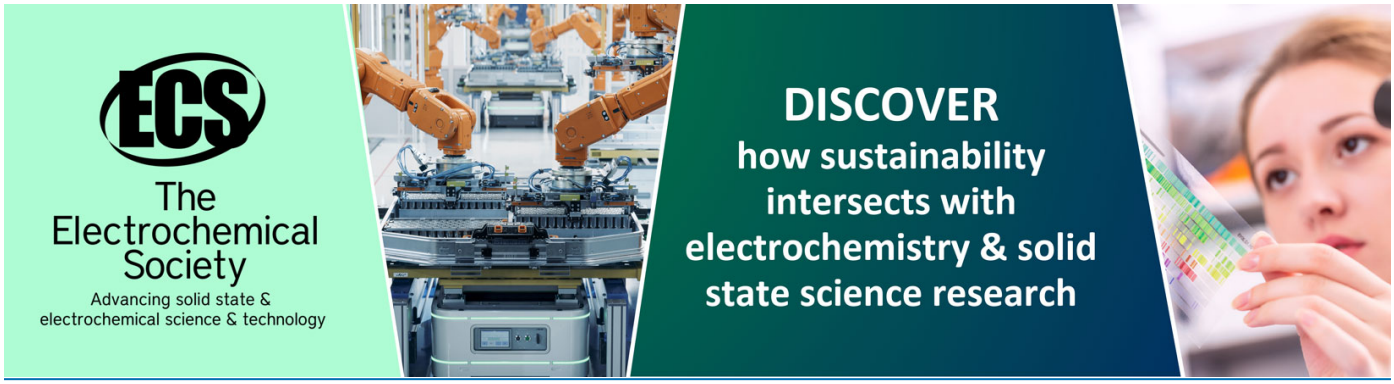
The automatic battery charger based on floating technique



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The automatic battery charger based on floating technique

E Mulyana*, T D Atmoko and L Kamelia

Department of Electrical Engineering of Science and Technology Faculty UIN Sunan Gunung Djati Bandung, Bandung, Indonesia

*edim@uinsgd.ac.id

Abstract. An automated system will simplify all the work done by humans. One of the automatic systems that has been used is the battery charger system that can be cut by itself. This paper discussed the implementation of automatic systems for battery chargers based on floating techniques. The system will automatically fill and repair the battery from several causes of damage such as overcharging the battery. This charger functions with the switch system turning on and off. The circuit works by comparing the input that goes into the IC, and makes the control input as the main standard of 1.10 V which is attached on a positive foot (pin3) on the IC. The main control system consists of Transistor BC547, IC LM358 and Transistor 2N2907A. This system also uses two transformers, each of which is used to support control and power supply. For the control section using 1A transformer and for power supply using 2A. This system will automatically switch on when the load level is below 12.27 V.

1. Introduction

Aside from being a supplier of energy for vehicles, batteries are also used as an alternative in electricity providers, for example solar panels. For some regions in Indonesia that utilize solar energy, not all people are able to install solar panels, so they can only afford it buy a battery then charge it, provided a battery charger service [1].

Not a few of them complain because the accumulator batteries tend to not last long. There are several factors that cause battery life to last a long time, in addition to not maintaining the battery, there is a possibility of over-charging while charging the battery, as it is known that over-charging is a problem causing damage to the battery [2].

To overcome over-charging, an automatic cut-off device is made, which is a Charger system that is used for battery chargers, when the battery is fully charged it will cut off electricity to the battery [3]. But the cut-off system has not been able to overcome the problem of self-discharger on battery batteries, because as long as the battery is not used, a slow chemical reaction will occur which causes a reduction in battery capacity. This reaction is called self-discharger, this reduction will continue to occur when the battery is being used or not used. Such properties cannot be avoided and occur on all batteries. This situation occurs because the negative plate reacts directly with sulfuric acid from the electrolyte to form lead sulfate (PbSO4). Short relationship between positive plate and negative plate through deposits of active material [4].

In this research an automatic tool for charging the battery is designed, this tool is equipped with a led indicator, and several safety devices such as a reverse voltage prevention from the battery, and a cut-off charging system, and development to overcome the self-discharger on the battery by floating

charging. Floating is a battery charging battery with a method of comparing the input voltage level, which will later be used as the basis for determining the operation this series. If the battery level has reached full charge, battery charging will be disconnected by the cut-off system. After charging is terminated the battery is in full state and will experience self-discharger and the charge will continue to decrease over time, in this situation when the battery level is below the charging level the circuit will automatically change its condition to the charger is back. This way, the battery will always be in a condition ready for use.

In a previous study, researchers named Aurino P Adityawan et al. Analyzed how Adaptive Batteray Lead Acid Filling System in this paper analyzes the use of batteries based on the type of charge, depending on the requirements, depending on battery usage. In standard charging, charging a battery with an Ampere value of around 10% of the value possessed by a battery is a way that can be done to be able to keep the battery long, because fast charging results in a faster reduction, the maximum speed of charging is 50%, if more than that it is possible that the battery will not last and possibly experience faster damage [3].

While in the second journal named Wildan Budiman, Nasrun Hariyanto, Syahrial explained about the design of batteries from pikohidro power plants, and batteries used as power storage media, in a pikohidro power plant, in this design the battery system has not equipped with an automatic system, so the possibility of the battery is not durable. The design of the battery uses a common charger system so that when there is excess charging there is no breaker so that the battery is likely to experience over charging [5].

In the third paper the author named Solomon, J.E contains learning about integrated circuit operational amplifier (IC Op-Amp) to explain the details of its behaviour in a simplified and understandable way. Included is an analysis of the effects of thermal feedback on gain, the basic relationship for bandwidth and the rate of change in voltage, and a discussion of frequency compensation for polar separators. A short section is included in the new JFET bipolar circuit and area reduction techniques that use trans conductance reduction [2].

In the fourth paper the author named D. Setyawan designed a battery charging device with the LM338K Regulator. The fast filling method is derived from the Ampere supply value supplied from the transformer. But in its design, not paying attention to the current supply used, the authors only concluded that the larger the amperage used to fill, the faster the battery will be full, even though the given current should not be more than half the ampere value at the load. And giving an ampere rating that exceeds standard capacity will only damage the battery, and shorten the life of the battery. In this design there is no back voltage protection from the battery when the battery is fully charged. and in war it is only cut off, when turning on the circuit must use the switch [6].

Based on the reference above, there are several studies and analyse in the field of battery chargers, but no one has designed a charging system with floating techniques, in other words a smart battery charger, which is able to live when connected to the source, and disconnects when it reaches a full charger, then turn on after the battery is at a certain level. Then make a charger with a system that supports quality and safety, to support battery life.

2. Methods

In order for the study to run in a directed manner, the stages of this research are arranged as follow: Literature study, Problem Definition, Requirement Analysis, Design, Implementation, Testing, and Result Analysis.

The approach method used to create an automatic battery charger is the floating technique. The Floating is a battery charging battery with a method of comparing the input voltage level, which will later be used as a determining basis in the operation of this series. If the battery level has reached full charge, battery charging will be disconnected by the cut-off system. After charging is terminated the battery is in full state and will experience self-discharger and the charge will continue to decrease over time, in this situation when the battery level is below the charging level the circuit will automatically

change its condition to be the charger again. This way, the battery will always be in a condition ready for use.

The requirement analysis determines the components to be used and determines the value of each component used. Because in designing a battery charger, we must determine how much value is needed to be able to charge the battery. Charger analysis is based on battery batteries that will be used, because the battery batteries to be used are 12V 3A battery batteries, then the output of this Charger ranges from 13 Volts. Control circuit is a series that will control the charging process to the battery. It includes: Output voltage 13 V, Voltage rectifier, Flow-reducing regulator, Voltage adjustment, regulator, cut off, Switching, and a security in the form of transistors and diodes

The design is a stage where the desire or plan is poured into writing or drawing. The design describes the structure and behavior of the system solution that will be made. In this study a block diagram of an automatic battery charger system will be described based on floating technique.

The implementation stage in this research is a stage where the proposed design is realized into the real circuit.

The testing phase is the stage where the results of realization are tested to ascertain whether the system is working properly as expected or not.

3. Result and discussion

The result of the design step is a block of full automatic battery charger series as shown in figure 1 as follow.

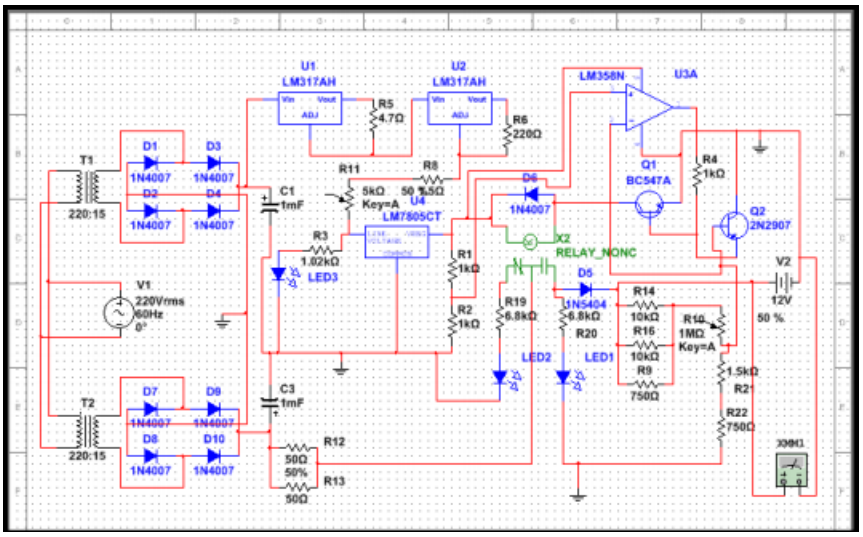

Figure 1. The block of full automatic battery charger series design.

Based on the figure 1 above, it can be seen that the block of full automatic battery charger consists of two major parts, the control and the power supply. The control part integrates the voltage reducer, rectifier, current reducer, voltage adjustment, cut-off, switching, and safety transistor. The power supply part integrates voltage reducer and rectifier. The power circuit is deliberately separated from the control considering the voltage and amperes used are different from the controls.

After the design step is implementation step. The implementation step result is a realization of an automatic battery charger circuit. The realization of the circuit is shown as figure 2 as follow.

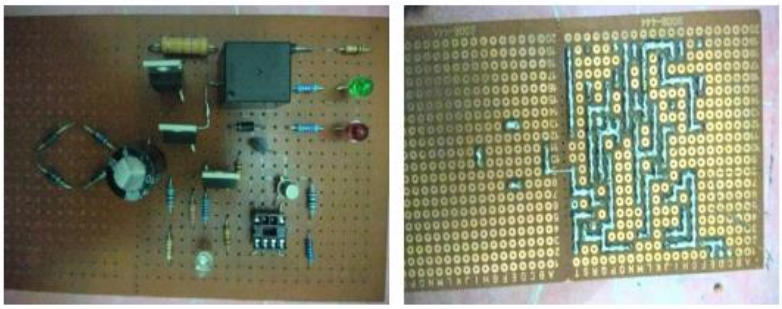

Figure 2. The Realization of a full Automatic Battery Charger.

After the implementation step is system testing step. The system testing is done so that the device is made as expected. This testing consists of output voltage test and filling process. The filling process consist of filling process 10 minutes and filling process 60 minutes. The result of each testing is going to describe as follow.

3.1. Output circuit test results

From the output voltage test results, it shows that the battery supply output is 14.13. While in the simulation the battery output is at 15.67 V. When viewed from the incoming supply, the voltage is 12V, the output voltage can increase due to use capacitors, capacitors in this circuit are functioned as voltage boosters and smooth DC currents which are originally AC currents.

3.2. Test results of the filling process for 10 minutes

Tests carried out showed the battery before the charger had a voltage of 5.96 V. Then it was charged for 10 minutes, showing a result of 6.64 V. This situation indicates that the circuit can charge the battery, the difference in voltage before and after charging for 10 minutes is 0, 68 V.

3.3. Test results of the filling process for 60 minutes

The measured voltage value in the first 15 minutes is 6.85 V then at 33 minutes measured at 6.89 V at 43 minutes measured at 6.92 V then measured at 55 minutes at 6.98 minutes to 69 measured at 7 V. With thus the charging process increases the voltage every minute. The amount of tension measured for one hour in the first test is 1.85 V.

Testing for 1 hour is carried out for 10 times resulting in the following voltage shown in table 1 as follow.

Table 1. The voltage produced in filling 10 time test.

The Voltage produced in 10 time test (Volt)									
1	2	3	4	5	6	7	8	9	10
1,85	1,99	1,26	5,88	3,77	0,25	0,26	0,58	0,19	1,25

4. Conclusion

From the results of the design step, the implementation step, and the testing step, the there are some conclusions that can be concluded as follows:

- The float charger circuit automatic battery was successfully designed, using the Comparator IC as a voltage comparison then the BC547 transistor and 2N2907A transistor which functioned as switches, the success was seen when the circuit was used for 12 V battery charger.

- From the manufacture, the tool is then tested and the result, the system switches on and the switch off runs according to plan and when processing the battery charger, the battery is charged 1,728 V in 1 hour, which means the battery charging process takes around 7 hours to reach the switch off
- From the test results, the switch off circuit is obtained at the level of 12.27 V and will switch on when it is below the level of 12.27 V. Thus the battery charger circuit with floating technique as a state of the battery so that it is always ready to use, has operated.

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