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Design of power bank mobile using solar panel based microcontroller atmega 328

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Abstract. The need for electric energy consumption is increasing. So, in search of new energy sources should meet the requirement that is generating a large amount of energy, economic costs, and no negative impact on the environment. One such energy source is solar energy. By using solar panels, solar energy can be converted into electrical energy. The use of solar panels as a source of electrical energy in the power bank, facilitate the charging of batteries when outside the room or when there is no source of electricity. In this experiment experiments using 5volt solar panels that function as a power source, 5000 mAh battery, and microcontroller ATMega 328 that serves as an output that displays the battery indicator through the LCD. This solar panel device becomes more economical and can be developed again by using components that have more power. Test results using 2 pieces of mobile phone can charge for 1 hour and successfully charge the battery of 26% and 22% respectively. With a fully loaded 5000 mAh battery capacity. Charge the battery by drying the power of the solar panel under the hot sun from 9 am to 3 pm.

1. Introduction

Currently the need for electricity consumption is increasing. So, in search of new energy sources should meet the requirement that is generating a large amount of energy, economic costs, and no negative impact on the environment [1]. One such energy source is solar energy [1]. By using solar cell, solar energy can be converted into electrical energy [2]. One of the communication tools that are very popular in the world is the smartphone [3]. But along with the progress of this battery cell phone storage has not been able to offset various applications in use in smartphones [4]. This makes people often bring power banks where they go [5]. But even powerbank does not have power that never runs out, then we need to fill it and can use it again. In addressing these issues, the author tries to design a battery charging device using solar panels, then made a tool entitled "Design Of Power Bank Mobile Using Microcontroller Based On Atmega 328" With the creation of this tool is expected to help for people who forget to charge the battery and often outside the room. By using a cell phone charger from the solar cell of course the problem can be overcome. The scope of this study is limited to the manufacture or assembly of Power Bank Mobile Using Solar Panel Based Microcontroller ATMega 328. Consists of assembly of battery charging device using solar panel and microcontroller ATMega 328[6]. The benefits of this study are as follows:For the community, Ease and help charging the battery when outside the room or when there is no electricity, More efficient because it uses a source of solar light as a source of battery charging power[7]. For the reader, Can know the Design of Power Bank Mobile Android Using Solar Cell, Know how to assembly the battery charging design components using solar cell, Adds insights in related fields[8].

2. Literature review

2.1 Solar panels

Solar panels are devices consisting of solar cells that convert light into electricity [1]. They are called solar over the Sun or "sol" because the Sun is the strongest source of light that can be utilized. Solar panels are often called photovoltaic cells, photovoltaic can be interpreted as "light-electric"[2]. The solar cell or PV cell depends on the photovoltaic effect to absorb the Sun's energy and cause the current to flow between two opposite charged layers [3].

2.2 Microcontroller ATMega 328

Arduino Uno is an ATmega328 microcontroller based circuit board. This integrated circuit has 14 digital inputs / outputs (6 outputs for PWM), 6 analog inputs, 16 MHz ceramic crystal resonators, USB connections, adapter sockets, ICSP header pins and reset buttons. This is what is needed to support microcontroller easily connected with USB power cable or AC adapter power supply cable to DC or also battery [4].

2.3 Battery

A device that can convert its stored chemical energy into electrical energy that can be used by an electronic device. Electrical energy generated by this battery is the same as accumulator, which is electric alias DC. The amount of electricity generated depends on how large the battery is. Generally, the battery consists of 2 main types of disposable primary batteries, and secondary batteries that can be refilled [5].

2.3.1 Primary battery (single use battery)

This primary battery or disposable battery is the most common battery on the market, due to its wide usage and its more affordable price. These types of batteries generally provide 1.5 Volts of voltage and consist of various sizes such as AAA (very small), AA (small), C (medium), and D (large). In addition, there is also a box-shaped battery with a voltage of 6/9 Volt [6].

2.3.2 Secondary battery (rechargeable / rechargeable battery)

Secondary battery is a type of battery that can be refilled or rechargeable battery. In principle, the way the secondary battery generates an electric current is the same as the primary battery. However, the chemical reaction of this secondary battery can be reversible. The types of rechargeable batteries we often find include Ni-cd (Nickel Cadmium) batteries, Ni-MH (Nickel Metal Hydride) and Li-Ion (Lithium Ion) batteries [7].

2.4 LCD (Light Crystal Display)

One type of electronic display made with CMOS logic technology that works by not producing light but reflecting light around it against the front-lit or transmitting light from the back-lit. LCD (Liquid Cristal Display) functions as a data viewer either in characters, letters, numbers or graphics [8].

3. Method

In planning a research project required a theme for research can run smoothly and not out of the path that has been set. The theme is "Design of Power Bank Mobile Using Solar Panel Based Microcontroller ATMega 328". Literature is a very useful reverence in the research of a project. Therefore the authors have obtained various literature studies to obtain additional information about the project to be made. Planning a research project includes all the things that will be implemented in research, namely: Determining Research Topics, Estimated tools and materials, Budget estimates, Estimated time, Possible applications and applications to be designed.

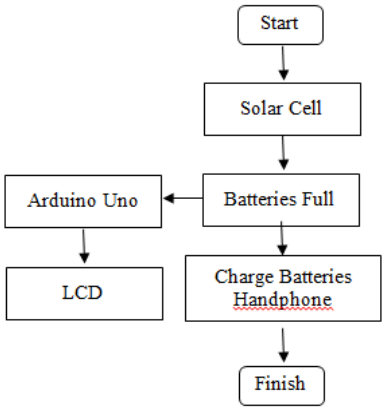
3.1 System Analysis

Phase analysis system is the stage of analyzing all the basic materials that will be used in research. All data that has been collected is analyzed to facilitate the work, such as:

- Microcontroller
- Solar Panel
- Thermoelectric Cooler
- Solar Panel Controller
- And other supporting materials

3.2 Coding / Programming

Coding is a programming component in which the programmed component is Arduino Uno. Here's a flowchart like the following picture:



Picture 1. Flowchart process

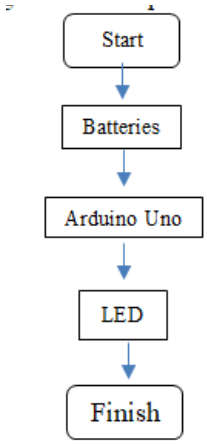
4. Results And Discussion

At the design stage and the previous implementation has been explained about the power bank design of microcontroller based on ATMega 328. The source code is input into the Arduino as a command for the tool to work properly. Here is the source display in the Arduino IDE app. Here's the source code:

```
Const float referenceVolts = 5.0; //

Const int batteryPin = 0; //

Void setup ()

{

Serial.begin (9600);

}

Void loop ()

{

Int val = analogRead (batteryPin);

Float volts = (val / 1023.0) * referenceVolts;

Serial.println (volts);

Delay (500);

}
```

Picture 2. Arduino IDE Display

Serial.begin (9600) This program is used for communication between Arduino with Computer or other devices using Serial communication line, Float volte = (val / 1023.0) creates a variable named voltage in the form of float, in order to generate a voltage value, Serial.println (voltage) displays the value in Serial Monitor, which is stored on the voltage variable. A good program should have an efficient way of working. To facilitate the making of the program then made a flowchart to get the steps sorted. Here is a flowchart for Arduino programming. Here's the picture:

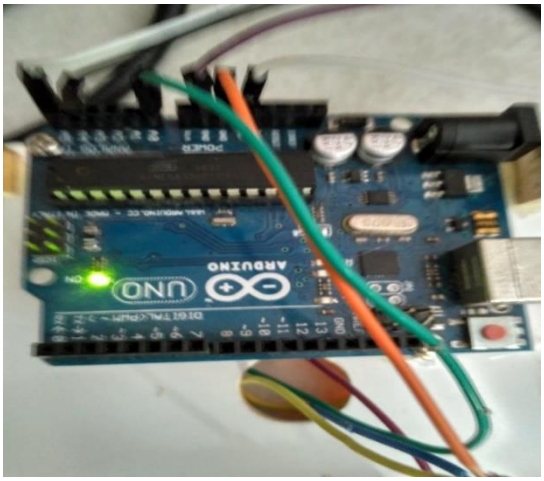


Picture 3. Flowchart Program

The discussion in this chapter is about testing each component of the pliers used and testing the whole system, whether it is running properly or not. The test stages are done with structural testing, functional trials and validation trials. Structural testing is done to ascertain whether all components are properly connected or not and also ensure that all components are structured. Here are the results of structural testing: The arduino and batteries are connected by cables on pins that are already available in each component. Here's the look in the picture:

4.1 Functional Trial

Arduino Uno module checking is done by connecting a 3.7 volt battery in the Arduino module. There is an indicator indicating that the Arduino module is on.



Picture 4. The green light on the arduino is on

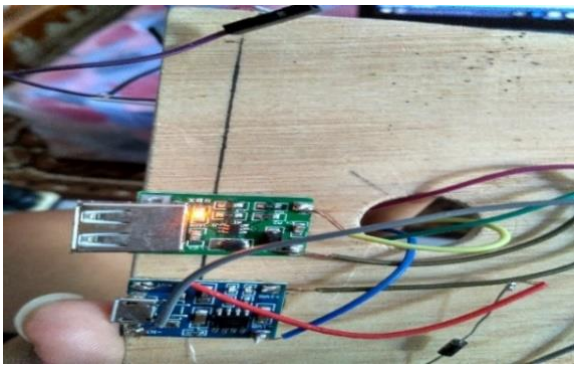
4.2 LCD Testing

LCD checking is done by connecting through arduino. under normal circumstances there is an LCD can be lit. The LCD is marked with a red led indicating it is working.

Picture 5. The lights on the LCD indicate that it is working

4.3 Validation Test

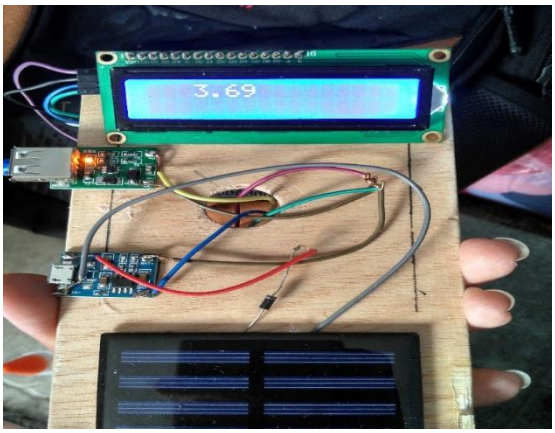
The validation test is a test of the program and the performance of the tool that has been created. In this test is checked for all the functions and features of the tool. mualai from the sensor check until the input and output checks are used. Here are the results of the trial. This test is done by entering usb cable through usb port to handphone, indicator of usb lamp lights indicating power bank can be used. Here's the picture:



Picture 6. USB Indicator

4.4 Arduino Testing

This test is done by giving input to the LCD to display the battery voltage indicator. This test is conducted to determine whether the tool is made to work in accordance with the program that has been made. Here's the picture :



Picture 7. The LCD displays the battery voltage

4.5 Test Results

Test results using 2 pieces of mobile phone with a time charger for 1 hour and managed to charge each battery is 26% and 22%. With a capacity of 5000 mAh battery that is fully charged. Charging the battery by drying the solar panel bank power under the hot sun from 9 to 3 pm. Here is the description in the table:

Table 1. Test Result

Handphone	Capacity	Time Charging	Ful Charging
Xiaomi Redmi 3	4100 mAh	1 jam	26%
Xiaomi Redmi 4A	3120 mAh	1jam	22%

5. Conclusion

Based on the results of this study can be concluded that this tool can work optimally if supported by natural factors that support such as sunny weather and heat from sunlight enough, for charging the source of electricity from solar panels can work optimally. Solar cel used is not too big so the charging process becomes old, can be developed again by using solar panels that have more power than current. The series used works well, able to charge the phone. The LCD circuit that is used as an indicator of the illuminated LCD battery has also displayed a voltage indicator on the battery. And the state of the battery when the tool stand by can also last long. Test results using 2 pieces of mobile phone can charge for 1 hour and successfully charge the battery of 26% and 22% respectively. With a fully loaded 5000 mAh battery capacity. Charge the battery by drying the power of the solar panel under the hot sun from 9 am to 3 pm.

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