

Charging Time Control Using Arduino

Arun Francis G¹, Chandru L², Arun Kumar B², Nithesh Kumar R², Narendran S²

Assistant Professor¹, Student², Department of Electronics and Communication Engineering,
Karpagam College of Engineering, Coimbatore-641032.

ABSTRACT

This project titled “Charging time controller using Arduino” is designed to charge your device for a pre-defined amount of time. Usually, mobile phones are charged using charging adapter or sometimes power bank is used. When you forget to switch off the charge adapter that you plugged in the device, there occurs an issue. That is when the charge is full and the switch is in ON state. Advanced software has the feature to disconnect power from the charging adapter to the battery, when the device gets to 100%. After that, the device in a charging state known as trickle state. Charging at this time the temperature of the battery increases. Due to the heat it may affect the life time of the battery. Can there be any solution to overcome this? Yes, absolutely “Charging Controller” can be a good alternate. The main component of this project is Arduino. Initially time is set using a rotary encoder in the LCD 16x2 display. Then charging begins after the charging time gets completed, the charging adapter gets automatically disconnected using a relay. Consider a scenario, it is 10 pm. You need to charge your phone for 3 hours, you don't need to wake up at 1 am to turn off your charger. You can set to 3 hours in the LCD display, when the time is up automatically the adapter gets disconnected from the power supply at 1 am. You don't need to think about your phone.

KEYWORDS: Mobile phone charging, Arduino, Timing control, LCD, Rotary encoder.

INTRODUCTION

Mobile phone has become one of the essential part of our life. In mobile phone battery plays a vital role. In recent times every smart phone comes with an inbuilt battery. So maintaining mobile battery is mandatory. Since most of the mobile batteries are lithium ion they help in fast charging as well as they provide a compact size. Lithium ion as the name suggests, they are ions which performs best when ions keep moving freely as much as they can. Lithium ion batteries can have a damaging impact and behave poorly if experienced by elevated temperatures. If your device is in contact with the back case while charging, there might be no space to get rid of the heat at sometimes. This heat in the battery may also cause an effect. Over the recent times, we've been hearing news in the internet that some of the smartphones are getting burst due to over charging or due to the heat that occurs in the battery.

We use our mobile so heavily that it drains out in and around 18 – 20 hours of usage. Unless your battery is some 5000 mAh power packed newly unboxed mobile device. Generally most of the people plug their device in the night time before going to sleep, hoping that, when they woke up the device gets fully charged. The big concern arises, Is it really in need to keep the mobile plugged in even after the charge is 100%?

Leaving a device plugged in for overnight is sometimes okay, if you are just unable to find time throughout the day for charging it. Because, your smart phones are smart enough to disconnect power from the charging adapter to the battery, when the device gets to 100%. Since every mobile phone is working 24/7, even after it is fully charged, it consumes power. There will come a point in time when your battery decreases to 99%. Now, according to basic rules a phone follows, it should allow the battery to charge if the battery is less than 100%. Hence, the phone starts charging again. So, this cycle of hopping between 99% and 100% creates a problem for your smart phone. One of the disadvantage of charging the battery even after 100% is, the number of cycles of the battery gets reduced and it will affect the battery's lifetime.



Figure 1. Issue caused due to overcharging of battery

One can say the lifetime of the battery by depending upon the number of cycles it has. Temperature is also an important role in determining the batteries lifetime. Sometimes the temperature of the battery might be high which will cause to reduce the lifetime of the battery. Let us see about the features in the existing system and the proposed system.

EXISTING SYSTEM

Normal Charger

Nowadays almost every smartphone charger are superfast chargers. The size of the charger is good and the charging speed per hour compared to solar charger and wireless charger normal charger is good, but when it comes to users side these 3 types of chargers may create an issue when it is overcharged again and again. Because almost every user is busy at their work especially in the morning time, they want their mobile to fully charged so most of the user what they do is switch on the adapter while going to sleep so that in the morning it is fully charged. This overcharged initially doesn't create any issue because of the inbuilt software, as the day passes on this overcharging again and again reduce the number of charging time and leads to the cause battery failure soon.

Wireless Charger

Wireless charging is becoming more and more popular now a days, most of the famous mobile phone brands released their phones that support wireless charging. The meaning wireless charger, it does not have a normal cable to charge your device instead you can keep the device in the charging place directly which is much easy way and convenient than using wired cables. Wireless charger device gives a good look while charging and it is easily portable. But, what kind of charger it may be over charging issue is same for the device.

Solar Mobile Charger

Solar energy is a "renewable source" and it can be used for powering devices. Solar power is one of the widely consumed resource. Mobile charging using solar power is one of the good invention. But, the power available from a solar panel is highly dependent on the environment it is used. Such dependent things are light intensity, time and location. A good alternate for normal charger is solar charger. An advantage is that it can be used at any time and it is also portable. It uses solar panels to convert solar energy from the sun into electricity. But, what kind of charger it may be over charging issue is same for the device.

PROPOSEDSYSTEM

Charging time controller using Arduino is used to charge your device for a pre-defined amount of time. Can you find how it's going to happen. Let's see.

The Arduino is the vital component of this project. Other than this, the components used in this project are PCB board, rotary encoder, relay, LED, switch box and 16x2 LCD display.

Components like 16 x 2 LCD Display, LED relay, arduino can be placed on the PCB board. Rotary Encoder can be kept aside so that it can be easily rotated. Since mobile adapter is connected to the single socket power outlet it is also kept outside and it is connected with the relay. Initially time is set using a rotary encoder in the LCD 16 x 2 display. The phone is connected to the adapter and the adapter is connected to the single socket power outlet and the socket is controlled by a relay module. Soon after the charging time is up the LCD display shows charged up and the power supply to the battery and the charger adapter gets disconnected using a relay and LED is used for indication. At the charging time LED is in off state after the charging gets completed it is in on state.

TABLE 1: The requirement for the model.

HARDWARE REQUIRED	Arduino Relay LCD display Rotary encoder Power supply Jumper wires Soldering board potentiometer
SOFTWARE REQUIRED	Arduino IDE Tinkercad

BLOCK DIAGRAM

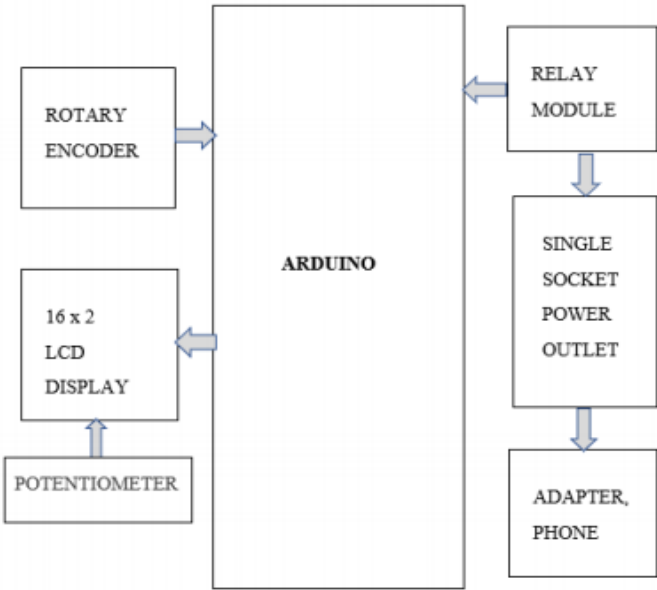


Figure 1: Block Diagram

BLOCKDIAGRAMDESCRIPTION

ARDUINOMICROCONTROLLER

The Arduino is one of the largest and popular platform for learning and trying out things in electronic circuits. The simplest thing is that you just write your code in the arduino ide and embed in to the board using a USB cable.

SPECIFICATIONS

TABLE2:Microcontrollerspecification

Microcontroller	ATmega328P 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage for Vin pin	7-12V
Analog Input Pins	8 (A0 – A7)
Digital I/O Pins	14 (6 PWM output pins)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (2 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz
Communication	IIC, SPI, USART

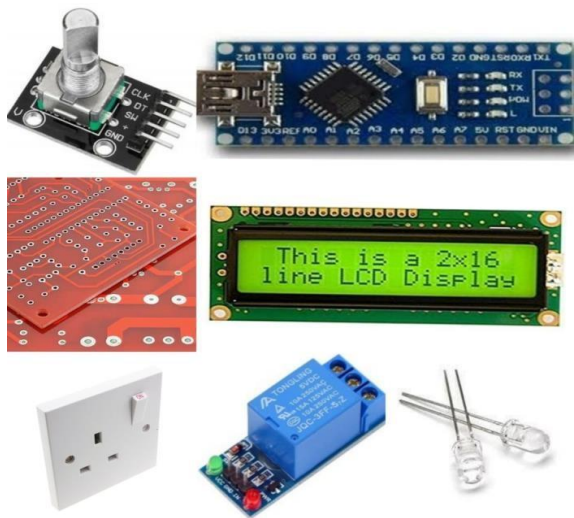


Figure2.HardwareComponents

LCDMODULE

LCD (LiquidCrystal Display) is an electronic display module that is used in a number of applications. The name 16x2 LCD display indicates it has 2 rows and each row with 16 columns that is, it can display maximum of 16 characters in a row. Each character in a row is 5x7 pixel matrix. It is used in many applications because it is used to display some result values. For example like sensor readings or to display output message.

ROTARYENCODER

The rotary encoder is also called as shaft position sensor is one of the important device to find out the position or distance or speed in an application. It is an electromechanical device that converts the angular position or movement of a shaft or axis into analog or digital outputs.

In this project rotary encoder is used for positioning the data in a particular column in the LCD display. By rotating the knob in the encoder we can walk through the characters in the LCD display.

RELAY

A relay is a switching device. In this project initially the flow of charge for the device is not available but once the user fixes the time, the coil is triggered and the relay allows the flow of charge and automatically switches over when the time comes to 0.

SOFTWARE

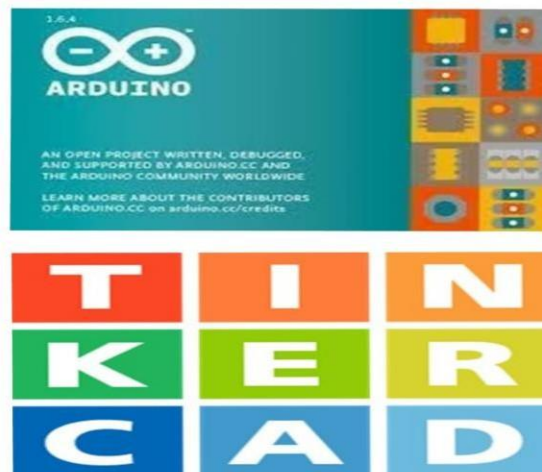


Figure3:Arduino IDE&Tinkercad

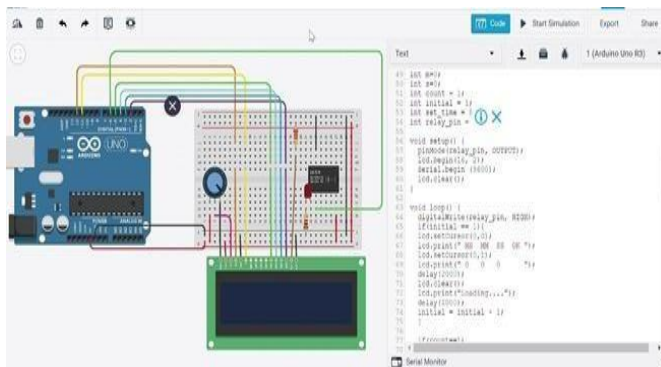
ArduinoIDE

The Arduino integrated development environment (IDE) is a software tool for working with arduino. It is a cross-platform which is usable in windows, Linux and macOS. This software is written using java programming but the arduino ide supports C and C++ with simple syntax and structures. It is easy to work in this ide and you can see output results in console window and you can embed the code in to the arduino board.

Tinkercad

An expansion to include circuits in its design capability called tinkercad Circuits. This brings a whole new side to tinkercad, revolving around simulating circuits with Arduino.

Tinkercad is also a best online simulation software. It is especially suitable for arduino circuits. Before an investment in the project you can virtually design and code and compile to see the results. In this software we had tried to implement the simulation model of the project.

Figure4:*SimulationMethod.*

HARDWAREARCHITECTURE:

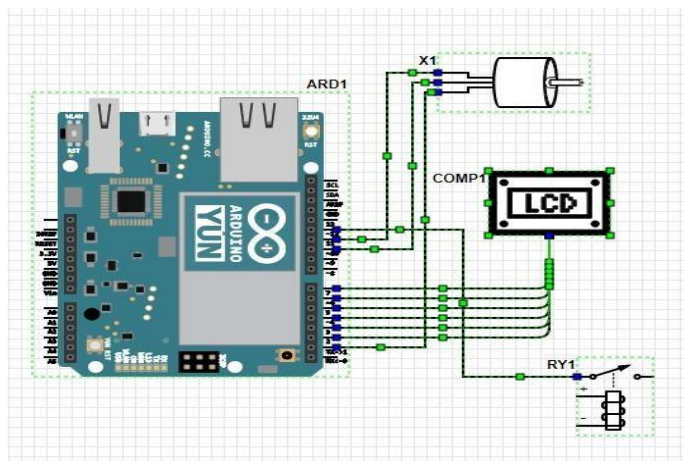


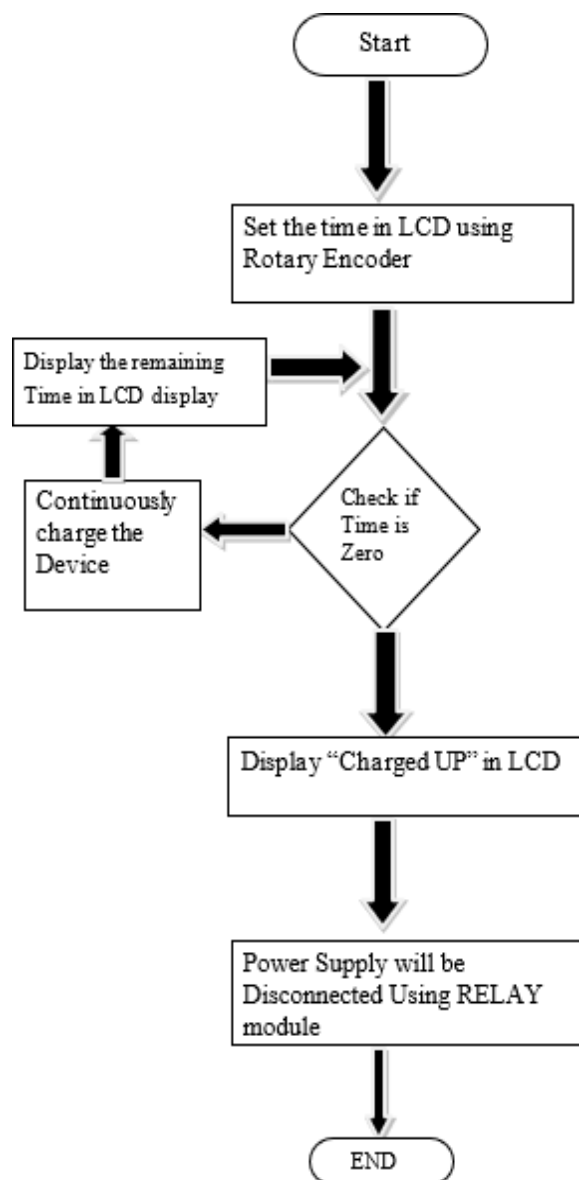
Figure5..*CircuitDiagram*

Working Principle

In the LCD, the read/write pin, data pins, Vcc and ground pins are connected properly to the microcontroller. In the Rotary encoder clock pin, data pin, button pin is connected to 10, 11, 2 pin of Arduino. Relay input pin is connected to pin 12 of Arduino. Normally open and Common pin is connected to the charging switch box. Necessary ground and Vcc pins are reconnected. After the hardware connections are made properly and when the power is given to the Arduino board at this time LED on the PCB board indicates the board is powered and LCD display is turned on showing the initial state of the time. Initially the LCD

display shows “HH(hour)MM(minute) SS(second)OK” in the 16x 2 screen. With the help of rotary encoder by rotating the knob and pressing it, you can set the time. First hours, then minutes, then seconds. After setting the required time you can press ok to fix the time. The process begins. Before charging it asks for a confirmation. In the load present state 5 seconds is given. If you want to change the time you can press “No” in the load present state and you can reset the time again and you can press “Ok”. At this time in the relay coil is triggered and the charging begins and the remaining time is displayed in the LCD board. The LED in the PCB board also automatically turns off. Time gets decrements second by second. When the time comes to zero LCD will display charged up and the state of the relay changes to disconnect the power supply and now the LED turns on which indicated the device is charged.

FLOWCHART



RESULT AND DISCUSSION

This project “CHARGING TIME CONTROLLER USING ARDUINO” has been designed and tested successfully. Once the charging time set by you in the LCD display comes to zero. The

power to the charging adapter gets disconnected using a relay. Thus, your phone is charged up for the fixed amount of time. This helps to maintain long life battery and you can charge your device at any time.

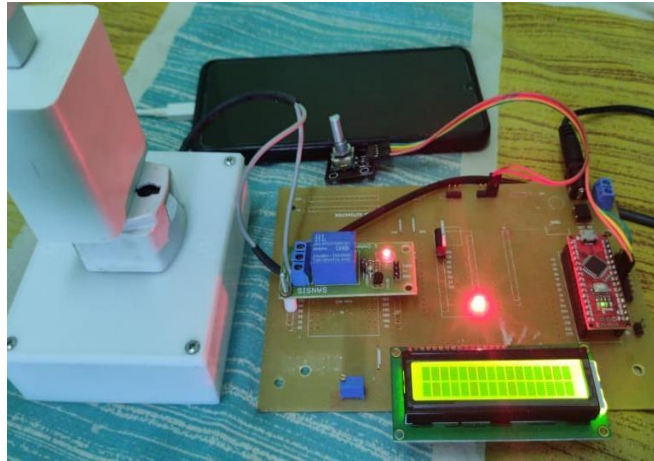


Figure 6. Hardware Implementation

CONCLUSION

Since people are generally busy at their work especially in the morning time, they want their mobile to be fully charged, so most of the users what they do is plug in their mobile to the adapter while going to sleep so that in the morning it is fully charged. This overcharging initially doesn't create any issue because of the inbuilt software, as the day passes on this overcharging again and again reduces the number of charging cycles and leads to the cause of battery failure soon. Thus this project is designed to charge your device for a specific amount of time which is good for the increase in battery performance. Since many technologies like wireless charger, solar charger are used, this project is designed to enhance the battery life of the device.

FUTURE SCOPE

Future scope of this project is to fetch the percentage of the battery and maintain it while charging.

- To maintain a good battery life is to charge your battery when the device is 25% and unplug it when it is 85%.
- Designing an app which gives battery percentage as an output to the hardware to automate the process of charging.

REFERENCES

- [1]. Bruno Francois, Di Lu, Hicham FAKHAM with "Power Control Design of a battery charger in a Hybrid Active PV generator for load following applications" IEEE Transaction on Industrial Electronics, Vol. 58, Iss. 1, pp. 85-94, Jan. 2011, TIE-09-1370
- [2]. S.M. Çınar and E. Akarslan Electrical Engineering Department, University of Afyon Kocatepe, Afyonkarahisar, Turkey with "On the Design of an Intelligent Battery Charge Controller for PV Panels" Journal of Engineering Science and Technology Review 5(4)(2012) 30-34
- [3]. Navjeet Kumar, Dorathy R, Shruthi M, Dr. Anusuyawith "IOT based smart charger ANESP8266 based automatic charger" Journal of Pure and

- Applied Mathematics Volume 115 No. 8 2017, 565-570
- [4]. Ashish Kumar, Guravareddy, M Srikanth with "Automatic Wireless Mobile Charger Using Arduino Feedback" International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN:2278-3075, Volume-8 Issue-6, April 2019
 - [5]. Kishore.B, Barath.C with "Design and Implementation of Solar Charge Controller" International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume:06 Issue:03 | Mar 2019 www.irjet.netp-ISSN:2395-0072
 - [6]. M. A. Kumar and G. A. Francis, "Survey on various advanced technique for cache optimization methods for risc based system architecture," 2017 4th International Conference on Electronics and Communication Systems (ICECS), Coimbatore, India, 2017, pp. 195-200, doi: 10.1109/ECS.2017.8067868.
 - [7]. Marufa Ferdous from BRAC university, Dhaka Bangladesh with "Designing smart charge controller for the solar solar battery charging station (SBCS)".
 - [8]. Francis, Arun & Arulselvan, M. & Elangkumaran, P. & Keerthivarman, S. & Kumar, J.. (2019). Object detection using ultrasonic sensor. International Journal of Innovative Technology and Exploring Engineering. 8. 207-209.
 - [9]. Y. Neelaveni and G. A. Francis, "Magneto-electric dipole array with optimized antenna parameters," 2015 Online International Conference on Green Engineering and Technologies (IC-GET), Coimbatore, India, 2015, pp. 1-4, doi: 10.1109/GET.2015.7453855.
 - [10]. Vignesh M, Kavin T P, A. F. G. G. C. R. K. S. (2020). Accident Detection and Alerting System Using GPS & GSM. International Journal of Advanced Science and Technology, 29(3), 3598 - 3601. Retrieved from <http://sersc.org/journals/index.php/IJAST/article/view/5037>.
 - [11]. S.Manikandan, T.Karthik, and G.Arun Francis, "Vector Monitoring Concurrent BIST Architecture using Modified SRAM Cells", International journal of science and advance research in technology, Vol. 1 No.9, pp.14-17, Sep 2015.
 - [12]. A.S.M. Jiaul Hoque, Md. Abubakar Siddik, Sabbir Ahamed and Sheik Md. Kazi Nazrul Islam from University of Information Technology and Sciences (UITS) with "Design and Implementation of a Microcontroller Based 12V-7A/10A Smart Solar Battery Charge Controller"