Development of Practical Instructional Guide in the Production of Portable Universal Serial Bus (UBS) Charger

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Abstract: *This research work focuses on development of practical instructional guide in the production of portable Universal Serial Bus (UBS) Charger. Two research questions were set to guide the study. The study was carried out in Federal College of Education (Technical) Omoku Rivers State. The study adopted research and development design. The population for this study is 337 NCE I, II, and III electrical / electronics technology students. The sample of the study consists of 103 NCE I, II, and III which were randomly selected 34 NCE I, 42 NCE II, and 27 NCE III electrical / electronics technology students respectively. The instrument for data collection was a structured questionnaire item consisting of 33 items which adopted a five (5) point Likert scale of (VHR) very highly Required, (HR) Highly Required, (R) Required, (MR) Moderately Required, and (NR) Not required with the corresponding values of 5, 4, 3, 2, and 1 respectively. The research instrument was face validated by three lecturers in department of electrical / electronics technology in Federal College of Education (Technical) Omoku Rivers State. The reliability of the instrument was established using the Cronbach Alpha (α) reliability coefficient which was computed to be 0.87. Data collected from the questionnaire item was analyzed using mean. Based on the findings, it was observed that the materials and steps shown in table 1 and 2 respectively are the required ingredients in the production of portable Universal Serial Bus (UBS) charger. Therefore, it is recommended that developed portable Universal Serial Bus (USB) charger should be kept away from damped environment; hence, it may affect its functionality.*

Keywords: Practical Instructional Guide; Portable Universal Serial Bus (USB), Development

1. Introduction

Electronics is playing a leading role in the scientific and technical revolution. The introduction of electronic devices in various areas of human activity contributes in large and often decisive measure to the resolution of complex scientific and technical problems, to an increase in the productivity of physical and mental labour, and to the improvement of economic indices of production (Brown & Vranesic, 2009).The achievements of electronics have formed the basis of an industry that produces electronic equipment used to aid communication, and industrial.

Portable Universal Serial Bus (UBS) Charger practical instructional guide provides information (like pictures and steps involved) about instructional program formats; and instructional methods used by successful instructors, and detailed instructional plans of how it can be produced. It also shows how various principles that underlie effective facilitation of learning can be put into practice when designing instructional systems (American Technical Publisher, 2015). The effects of the practical instructional guide in teaching, learning and assessing process in electronics technology provides the students and teachers with creative thinking, achievement, interest, and retention, assist teachers in the teaching, providing them with tools to illustrate some points or processes as well as to support long distance educational system, enable the students associate between concrete and tangible facts from the abstract and facilitate the achievement, interest, retention, simulation and recovery phases of the students (Okoro & Ekpo, 2016).

Development of practical instructional guide involves putting together the right technologies in making a commercially viable product. As a result, the technological world has finally coalesced around a charging standard, after years of proprietary adapters and ugly wall-wart power supplies (Ismail, 2017).Seeing some fragmentation in terms of the new USB-C connector, which could eventually replace USB in charging of phones, plugging of tablet into any computer, transferring audio streaming, display photos from a digital camera directly on a television, and linking data usage from the phone to the PCs as against the application of LAN or WAN (Key, 2005).USB has seemingly become as much a standard for connecting power to portable devices as it has for serial communication. Recently the power aspects of USB have been extended to cover battery charging as well as AC adapters and other power sources (Crowe, 2017). A

tangible benefit of this wide-spread use is the emergence of interchangeable plugs and adapters for charging and powering portable devices. This, in turn, allows charging from a far wider variety of sources than in the past when each device required a unique adapter (Kars, 2012).

Arguably the most useful benefit of USB's power capabilities is the ability to charge batteries in portable devices (Lens, 2014). Nonetheless, there is more to battery charging than picking a power source, USB or otherwise. A well-designed charger optimizes safety and the user experience. It also lowers cost by reducing customer returns and warranty repairs (Castor-Perry, 2010).However phone's batteries die when on a hiking trip and want to take a beautiful photo, trying to find friends and relation in a festival full of people which is usually at the worst possible moment. Hence, charging batteries with USB requires balancing battery "care and feeding" with the power limitations of USB and the size and cost barriers ever present in portable consumer device designs (Sherman, 2016).

According to Dan (2014) a USB system consists of a host with one or more downstream ports, and multiple peripherals, forming a tiered-star topology.
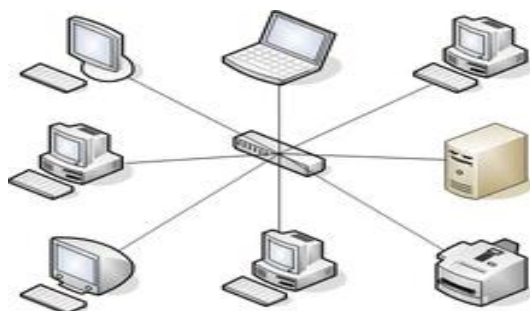
Star topology in use in a network

The star topology reduces the impact of a transmission line failure by independently connecting each host to the hub. The hub, hosts and transmission lines between them, form a graph with the topology of a star. Data on a star network passes through the hub before continuing to its destination. The hub manages and controls all functions of the network. It also acts as a repeater for the data flow. Each host may thus communicate with all others by transmitting to, and receiving from, the hub. The failure of a transmission line linking any host to the hub will result in the isolation of that host from all others, but the rest of the network will be unaffected (Roberts & Wessler, 1970). The star configuration is commonly used with twisted pair cable and optical fibred cable. However, it can also be used with coaxial cable.

Universal Serial Bus is an industry standard that establishes specifications for cables, connectors and protocols for connection, communication, and power supply between personal computers and their peripheral devices (Sherman, 2016).Portable Universal Serial Bus (USB) Charger is another form of charger that is familiar to all. It has an average charging time of 3 hours, depending on the amperage chosen (Silvia, 2015). The USB cable charger also has data transfer capabilities,

which add to its versatility. The only downside is that when connected to a computer instead of a power charger, charging time is four times slower than a traditional charger (Peter, 2017).

USB device consist of several logical sub-devices that are referred to as device functions, which provide several functions, such as a webcam (video device function) with a built-in microphone (audio device function) (Strong, 2015). An alternative to this is compound device, in which the host assigns each logical device a distinctive address and all logical devices connect to a built-in hub that connects to the physical USB cable.USB device communication is based on pipes (logical channels). A pipe is a connection from the host controller to a logical entity, found on a device, and named an endpoint (Yates, 2014). Because pipes correspond to endpoints, the terms are sometimes used interchangeably. A USB device could have up to 32 endpoints (16 IN, 16 OUT), though it is rare to have so many. An endpoint is defined and numbered by the device during initialization (the period after physical connection called "enumeration") and so is relatively permanent, whereas a pipe may be opened and closed (Plummer, 2017).

When a USB device is first connected to a USB host, the USB device enumeration process is started. The enumeration starts by sending a reset signal to the USB device. The data rate of the USB device is determined during the reset signaling (Heron, 2007). After reset, the USB device's information is read by the host and the device is assigned a unique 7-bit address. If the device is supported by the host, the device drivers needed for communicating with the device are loaded and the device is set to a configured state. If the USB host is restarted, the enumeration process is repeated for all connected devices. The host controller directs traffic flow to devices, so no USB device can transfer any data on the bus without an explicit request from the host controller. In USB, the host controller polls the bus for traffic, usually in a round-robin fashion. The throughput of each USB port is determined by the slower speed of either the USB port or the USB device connected to the port (Sebastian, 2015).

High-speed USB hubs contain devices called transaction translators that convert between high-speed USB buses and full and low speed buses (Janssen, 2014). There may be one translator per hub or per port, because there are two separate controllers in each USB host, USB devices transmit and receive at USB data rates regardless of USB or devices connected to that host. Operating data rates for earlier devices are set in the legacy manner (Kurt, 2011). During USB communication, data is transmitted as packets. Initially, all packets are sent from the host via the root hub, and possibly more hubs, to devices. Some of those packets direct a device to send some packets in reply. The basic transactions of USB include: OUT transaction, IN transaction, SETUP transaction, and Control transfer exchange. The USB charger to be produce intends to supplies power at 5V ± 5% to power USB downstream devices like the mobile phones (Gao, 2014).Therefore, the general purpose of the study is to investigate the processes involved in the development of

practical instructional guide in the production of Portable Universal Serial Bus (UBS) Charger. Therefore, study will sort to determine the development of practical instructional guide in the Production of Portable Universal Serial Bus (UBS) Charger**.**

2. Statement of Problem

In the recent years, hundreds and thousands of people have been killed in many disasters across regions of the world, such as tsunami, floods, and earthquakes (Kurts, 2011). As a result of these disasters, most of the electricity supply will be disrupted, and then the telecommunication networks will fail. During emergency response, the necessity to have portable charger for mobile phone arises as the victim could communicate with the relevant authorities or volunteers (Metz, 2003). Therefore the need to develop portable charger for mobile phone using intermediate battery charging which can be used effectively during disaster event arises. Hence, the study focuses on the development of practical instructional guide in the Production of Portable Universal Serial Bus (UBS) Charger.

Purpose of the Study

The purpose of this study is on the development of practical instructional guide in the Production of Portable Universal Serial Bus (UBS) Charger. Specifically, study will sort to determine the:

1. Materials required for the development of portable USB charger, and
2. Steps involved in the production of portable USB charger.

Research Questions

The following research questions were set to guide the study:

1. What are the materials required for the development of portable USB charger?
2. What are the steps involved in the production of portable USB charger.

Portable Universal Serial Bus (USB) Charger

This invention relates to a Mobile phone battery charger with USB interface which is composed of a compatible plug, a DC converter and a Mobile phone battery charging plug. The compatible plug can be inserted into the USB interface socket of computer or any environmental equipment so as to get electric power from computer, furthermore, the DC converter can convert computer USB interface into necessary charging voltage and transmit to different type Mobile phone by means of the Mobile phone battery charging plug for charging Mobile phone battery. In addition, the Mobile phone battery charger with USB interface also can be connected to various Mobile phone batteries charging seat for charging.USB is a plug-and-play interface that lets a computer connect with components and other devices. USB-connected devices cover a wide range from keyboards to music players and flash drives. In the development of the portable universal serial bus charger the following 9 components and circuit diagram according to Dahl (2017) needs to be solder onto a board: Project board, Voltage regulator 7805, 2 x Resistor 75 kΩ, 2 x Resistor 51 kΩ, Resistor 330 Ω, Light-Emitting Diode, Rectifier Diode, USB socket, Strip board, and Battery holder 6 x AA. This is summarized as a part list below;

Part List for Development of Portable Universal Serial Bus (USB) Charger

Components	Types	Values
D1	Rectifier Diode	1N4001 to 1N4007
U1	Voltage Regulator	LM7805
LED	Light-Emitting Diode	Red, Standard Output
R1	Resistor	330 Ω
R2	Resistor	75 kΩ
R3	Resistor	75 kΩ
R4	Resistor	51 kΩ
R5	Resistor	51 kΩ
USB	USB Socket	Type A

(Dahl, 2017)
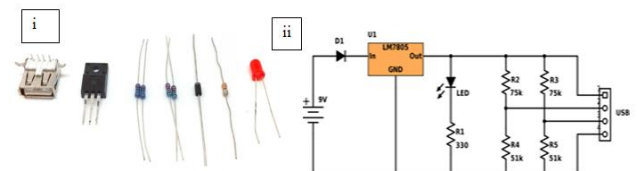

i. Pictures of components needed
ii. Circuit diagram of Portable USB Charger(Dahl, 2017)

According to Axelson (2015) this section shows step by step approach on how to build the USB Charger. Keep in mind that for all components except the resistor, it matters which leg is on which side.

Step 1: Add the rectifier diode

- Start by adding the rectifier diode to the board.
- Connect from the top row of the board, down to a the hole 4 rows below.
- Leave some space to the left (a column is sufficient for connecting the battery holder later)
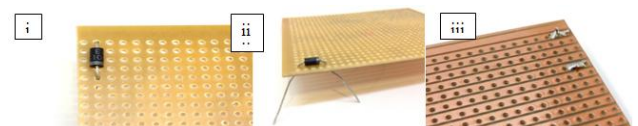
i. The copper strips run horizontally on the back of the board in this image.
ii. The rectifier diode with its legs slightly bent.
iii. The rectifier diode is soldered onto the board

Step 2: Add the voltage regulator

- Ensure that the left leg of the voltage regulator is connected on the same row as the bottom leg of the diode as shown in the image below.
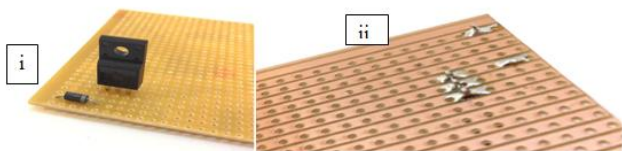
i. The voltage regulator mounted
ii. The solder-side of the board after adding the voltage regulator

Step 3: Add the indication LED (**power supply"-part of this circuit**)**:** To see that the charger is working

- Add an LED that will light up when the output from the voltage regulator is on. An LED is always connected with a resistor that controls the current going through it. Without this resistor, the LED will quickly break.
- Connect the 330 Ω resistor from the output of the voltage regulator, up to an unused copper strip four rows up.
- A piece of wire is needed to connect the ground (or the minus) from the voltage regulator to an unused row two rows up. By doing this, it will be easier to connect USB socket later on. If you don't have a suitable piece of wire.
- Connect the LED between the row that connected the resistor to and the row that connected the wire from minus to, remember that an LED has a positive and a negative side. The positive side is easy to find because it usually has a longer leg and the negative the shorter leg.
- Ensure to connect the positive side on the row where the resistor is connected and the negative side where the minus wire is connected.
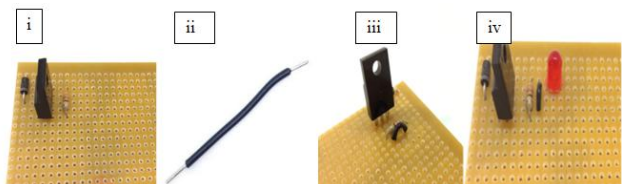

i. A resistor for reducing the current in the LED
ii. A piece of wire for connecting two rows
iii. piece of wire used to connect the minus two rows up
iv. Indicator LED connected

Step 4: Break copper strips

- Connect a battery holder with 9V on the input and get 5V on the output. But, for a USB charger you need a bit more. The reason for this is that the device needs to know how much current the charger can give as a maximum. Some chargers can supply 2.1A of current, while others can only supply 500 mA. The device needs to know, so that it can charge with the correct rate.
- VCC marked with red and GND marked with black. In between them are D+ and D- marked in blue. D+ is on the right and D- on the left.
- Break a copper strip by using something sharp like a pocket knife, a drill bit or some scissors on the back to

isolate them.. Twist it around in a hole until the copper disappears.
- Connect the USB port which has four wires: VCC Connects to plus 5V, GND Connects to 0V, D+ Must be 2V, and D- Must be 2V. This is arranged like (i):
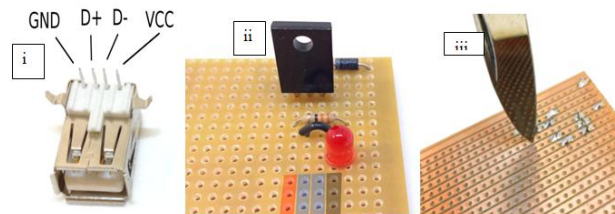
i. The USB socket upside down
ii. The four copper rows for USB connection are marked
iii. Twisting a pocket knife to break the copper line

**Step 5: Add resistors for the USB connection** (Connect the resistors)

- Add the four resistors that will set the voltage on the D+ and D- line to 2V.
- First, add the two 51 kω resistors that will connect from the GND line. One from gnd to D- and one from GND to D+.
- Add the two 75 kω resistors that will go from the VCC line. One from vcc to D+ and one from VCC to D-.
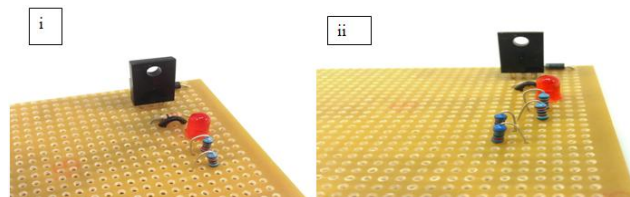
i. The two resistors going from the GND line
ii. All resistors in place

Step 6: Connect the USB socket

- Connect the USB socket.
- Place it with its opening pointing away from the components.
- Ensure its four pins line up correctly with VCC, GND, D+ and D-.
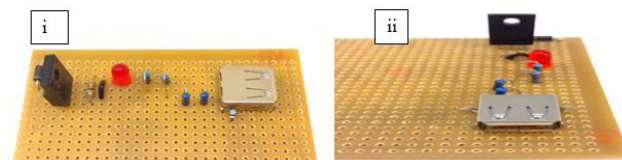
i. The USB socket in place
ii. The USB socket is lined up with the rest

Step 7: Connect the battery holder

- Connect the battery holder.
- Connect the red wire (+) from the battery holder to the upper left hole, where the rectifier diode is connected.

- Connect the black wire (-) 5 holes down, so that it's connected to the same row as the middle pin of the voltage regulator.


Wires from the battery holder connected

When all the batteries have been inserted into the battery holder, the LED will light up. That means the voltage regulator is working. If the connections are alright, plug in the phone and test (Blanco, 2016).

Step 8: Cut the board (to make your charger smaller and more portable)

- Carefully cut off the parts of the board not in use.
- Box it to make it look nice.
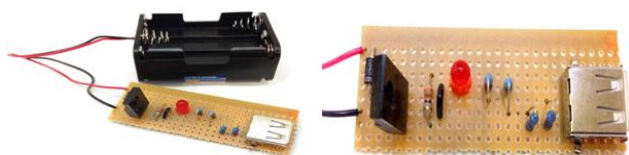
Finished circuit board

Operation of the Portable USB Charger

The main component in this circuit is the voltage regulator 7805 (U1). This is a component that takes an input voltage of 7V or above and gives out 5V. The diode (D1) placed in front of the input of the 7805 does two things:

- It makes sure you can't damage the circuit by connecting the plus and the minus of the battery the wrong way around, and
- it drops the voltage from the batteries 1V down, from 9V to 8V, which helps take some heat away from the voltage regulator. The Light-Emitting Diode (LED) is there to show you when the charger is working. The resistor R1 makes sure the LED doesn't have too much current flowing through it. The resistors (R2-R5) are there to tell your phone that this charger supports up to 500 mA (0.5 A) charging (Liz, 2017).

3. Methodology

Area of the Study: The study was carried out in Federal College of Education (Technical) Omoku Rivers State in south-south Nigeria. The choice of this location is that the electrical / electronics students lack the basics of putting into use the active and passive components of electronic into the production of electronic article.

Research Design: The researcher employed research and development design. The research design was adopted because it will help in building broad and comprehensive vision of innovative activity that is acknowledged by the most of developed and developing technologies as the key driver behind the economic growth and competitiveness.

Population for the Study: The population for this study is 337 NCE I, II, and III electrical / electronics technology students of Federal College of Education (Technical) Omoku Rivers State.

Sample and Sampling Technique: The sample of the study consists of 103NCE I, II, and III electrical / electronics technology students of Federal College of Education (Technical) Omoku Rivers State. Simple randomly sampling technique was employed in selecting 34 NCE I, 42 NCE II, and 27 NCE III electrical / electronics technology students respectively for the study.

Instrument for Data Collection: The instrument for data collection was a structured questionnaire consisting of 33 items. The questionnaire items were generated based on the information gathered from the reviewed literature. The questionnaire was sub-divided into two which is in line with the specific objectives of the study. Section A, with 9 items consists of information on the materials needed in the development of portable universal serial bus charger and section B, with 24 items consisting of information on the steps involved in the portable universal serial bus charger. The items adopted a five (5) point Likert scale of (VHR) very highly Required, (HR) Highly Required, (R) Required, (MR) Moderately Required, and (NR) Not required with the corresponding values of 5, 4, 3, 2, and 1 respectively.

Validity and Reliability of the Instrument: The research instrument that was used is structured questionnaire item, which were face validated by three lecturers in department of electrical / electronics technology in Federal College of Education (Technical) Omoku Rivers State. There technical input and correction were effected before dissemination. The reliability of the instrument was established using the Cronbach Alpha (α) reliability coefficient. The Cronbach Alpha was used to test the internal consistency of the instrument. The Cronbach Alpha was used because the items scores take on a range of value. The instrument was administered to five lecturers in the electrical / electronics technology in government technical college Ahoada in Rivers State. The alpha (α) was computed on section A and B, for section A, the reliability coefficient was 0.85, section B was 0.89. The reliability coefficient for the entire instrument was computed to be 0.87.

Method of Data Collection: A total number of 103 copies of questionnaire were administered to respondents by the researcher and with the aid of two research assistants. The instrument was also retrieved immediately after the completion by the respondents.

Method of Data Analysis: Data collected from the questionnaire item was analyzed using mean. Any item that attains the mean scores of 3.50 and above was considered as a required, while any item with the mean score of 3.49 and below is considered as not required.

4. Presentation and Analysis of Data

This presents the analysis of data collected in the research. Data analysis is organized in accordance with the research questions.

Research Question 1

What are the materials required for the development of portable USB charger? Data for answering answer to research question 1 are presented in Table 1.

Table 1: *Mean Scores of Materials required for the development of portable USB charger*

N=103

S/N	Items	VHR 5	HR 4	R 3	MR 2	NR 1	Mean ($\bar{X}$)	Decision
1	Project board/ Strip board	61	39	2	1	-	4.55	Required
2	Voltage regulator 7805	49	28	20	6	-	4.40	Required
3	2 x Resistor 75 kΩ	39	44	12	8	-	4.11	Required
4	2 x Resistor 51 kΩ	41	40	18	4	-	4.15	Required
5	Resistor 330 Ω	52	16	20	5	-	3.83	Required
6	Light-Emitting Diode	78	21	-	4	-	4.68	Required
7	Rectifier Diode.	56	39	4	3	-	4.41	Required
8	USB socket.	81	18	2	2	-	4.73	Required
9	Battery holder 6 x AA.	79	19	3	2	-	4.68	Required

X = Mean, cut-off point = 3.50

The result presented in Table 1 shows that all the items on materials required for the development of portable USB charger have the mean values ranging from 3.83 and 4.73 which are greater than 3.50. This indicates that majority of the response shows that they are required materials required for the development of portable USB charger.

Research Question 2: What are the steps involved in the production of portable USB charger? Data for answering answer to research question 2 are presented in Table 2.

Table 2: *Mean Scores of steps involved in the production of portable USB charger.*

N=103

S/N	Items	VHR 5	HR 4	R 3	MR 2	NR 1	Mean ($\bar{X}$)	Decision
10	Start by adding the rectifier diode to the board.	33	47	9	6	8	3.88	Required
11	Connect from the top row of the board, down to a the hole 4 rows below.	41	35	17	7	3	4.01	Required
12	Leave some space to the left (a column is sufficient for connecting the battery holder later)	39	32	23	3	6	3.92	Required
13	Ensure that the left leg of the voltage regulator is connected on the same row as the bottom leg of the diode.	52	28	12	11	-	4.18	Required
14	Add an LED that will light up when the output from the voltage regulator is on.	62	31	6	4	-	4.47	Required
15	connect the 330 Ω resistor from the output of the voltage regulator, up to an unused copper strip four rows up	56	23	14	10	-	4.21	Required
16	a piece of wire is needed to connect the ground (or the minus) from the voltage regulator to an unused row two rows up.	31	42	11	9	10	3.73	Required
17	Connect the LED between the row that connected the resistor to and the row that connected the wire from minus.	50	38	9	6	-	4.28	Required
18	ensure to connect the positive side on the row where the resistor is connected and the negative side where the minus wire is connected	54	29	11	9	-	4.24	Required
19	connect a battery holder with 9V on the input and get 5V on the output	48	33	11	11	-	4.15	Required
20	VCC marked with red and GND marked with black	37	42	13	11	-	4.02	Required
21	break a copper strip by using something sharp like a pocket knife, a drill bit or some scissors on the back to isolate them	29	42	13	10	9	3.70	Required
22	Connect the USB port which has four wires: VCC Connects to plus 5V, GND Connects to 0V, D+ Must be 2V, and D- Must be 2V	61	39	2	1	-	4.55	Required
23	add the four resistors that will set the voltage on the D+ and D- line to 2V	49	28	20	6	-	4.40	Required
24	add the two 51 kΩ resistors that will connect from the GND line.	39	44	12	8	-	4.11	Required
25	add the two 75 kΩ resistors that will go from the VCC	41	40	18	4	-	4.15	Required

	line							
26	Connect the USB socket.	52	16	20	5	-	3.83	Required
27	Place USB socket with its opening pointing away from the components.	60	14	13	13	3	4.11	Required
28	Ensure USB socket four pins line up correctly with VCC, GND, D+ and D-.	59	39	2	3	-	4.47	Required
29	Connect the battery holder.	55	28	20	-	-	4.34	Required
30	Connect the red wire (+) from the battery holder to the upper left hole, where the rectifier diode is connected.	48	39	16	-	-	4.31	Required
31	Connect the black wire (-) 5 holes down, so that it's connected to the same row as the middle pin of the voltage regulator.	38	45	20	-	-	4.17	Required
32	Carefully cut off the parts of the board not in use.	45	32	10	10	6	3.97	Required
33	Box it to make it look nice	66	30	7	-	-	4.57	Required

X = Mean and cut-off point = 3.50

The result presented in Table 2 shows that all the items on the steps involved in the production of portable USB charger have the mean values ranging from 3.70 and 4.57 which are greater than 3.50. This indicates that majority of the response shows that they are required steps involved in the production of portable USB charger.

5. Discussion of Findings

The major findings of the study are discussed in line with the organization of the research questions for the study. The data analysis presented in table 1 above revealed that those materials are required for the development of portable USB charger. This indicates that majority of the responders are of the view that they are required materials required for the development of portable USB charger. This is in consonance with Dahl (2017) who earlier stated that Project board, Voltage regulator 7805, 2 x Resistor 75 kΩ, 2 x Resistor 51 kΩ, Resistor 330 Ω, Light-Emitting Diode, Rectifier Diode, USB socket, Strip board, and Battery holder 6 x AA are the materials required with for the development of portable USB charger. From the interaction with the responders some modification can still be made in areas of the resistors in other to enhance the gain of the USB charger.

The data analysis presented in table 2 above revealed that those are the steps involved in the production of portable USB charger This indicates that majority of the responders are of the view that they are required steps involved in the production of portable USB charger. This is in line with to Axelson (2015) who earlier stated that add the rectifier diode: start by adding the rectifier diode to the board, connect from the top row of the board, down to a the hole 4 rows below, and leave some space to the left (a column is sufficient for connecting the battery holder later); add the voltage regulator: ensure that the left leg of the voltage regulator is connected on the same row as the bottom leg of the diode; add the indication led to see that the charger is working: add an led that will light up when the output from the voltage regulator is on, connect the 330 Ω resistor from the output of the voltage regulator, up to an unused copper strip four rows up; break copper strips: connect a battery holder with 9v on the input and get 5v on the output, and connect the USB port which has four wires; add resistors for the USB connection: add the four resistors that will set the voltage on the d+ and d- line to 2v, and add the two 51 KΩ resistors that will connect from the

GND line; connect the USB socket: place it with its opening pointing away from the components, and ensure its four pins line up correctly with VCC, GND, d+ and d-.; connect the battery holder: connect the red wire (+) from the battery holder to the upper left hole, where the rectifier diode is connected, and connect the black wire (-) 5 holes down, so that it's connected to the same row as the middle pin of the voltage regulator; and cut the board: to make your charger smaller and more portable, and box it to make it look nice.

6. Recommendations

The following recommendations were made on the basis of the finding of the study:

1. The developed portable Universal Serial Bus (USB) should be kept away from damped environment; hence, it may affect its functionality.
2. Always remove the dead battery from the battery holder in other to avoid local action when using the simple voltaic cell.
3. Avoid connecting developed portable Universal Serial Bus (USB) to a 240v/50Hz without an adapter, in other to avoid damage.

7. Conclusion

Conclusively, the present invention has the following advantages:

- The Mobile phone battery charger with USB interface has smaller volume because it does not install any AC to DC converter or transformer.
- The Mobile phone battery charger with USB interface can be switched to any computer or environmental equipment having USB interface for charging without utilizing the AC 110V or 220V power or others.
- The Mobile phone battery charger with USB interface can be connected to different Mobile phone power connector directly for charging phone battery.
- The Mobile phone battery charger with USB interface can be connected to different Mobile phone battery charging seat for charging Mobile phone battery.
- The Mobile phone battery charger with USB interface has a simple circuit which can prevent user from shocking.

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