MOBILE PHONE POWER BANK OUT OF SCRAP LAPTOP BATTERY PACKS

ABSTRACT

Communication using technology is the most efficient way for people to achieved maximum productivity. The discovery of various communicating device such as mobile phones made efficient communication possible. Mobile phone is a very remarkable invention. Nowadays it became a main tool used in human life. It is an electronic device that is used to perform several operations, run an application, connectivity of wireless networks and data sharing in a network and cloud computing environment. The most important aspect of this communicating device is the efficiency of the battery as energy source. In this study, it sought to determine the efficiency of mobile power bank out of scrap laptop battery packs. It specifically looked into (1) the level of efficiency of the mobile power bank out of scrap laptop battery packs; (2) the significant difference between the mobile power bank out of scrap laptop battery packs and a commercial power bank in terms of (a) capacity (mm Amp hr), (b) discharging time; and (c) cost. Using quantitative-experimental research design, it came out that the scrap laptop battery packs as mobile power bank has 80% efficiency. The t-test determined that there is a significant difference between the power bank out of scrap laptop battery packs and a commercial power bank in terms of capacity (mm Amp hr), discharging time and cost. It was concluded in that the improvised powerbank is efficient since it reached the standard percentage of efficiency of 70-80%.Therefore, it is effective and reliable sources of energy of mobile phones thus the improvised Powerbank is more efficient when it comes to capacity (mm Amp hr), discharging time (minute), and cost (Peso) as compared with the commercial powerbank.

Keywords: Mobile Phone, Scrap battery, Powerbank, Efficiency,

Introduction

In this modern world where almost everything is about technology, people's lives depend much on the use of modern communication technology such as mobile phones, tablets, iPad, laptop, television and other computer generated devices. Today's generation is addicted to mobile phones, this has been in a study where the result showed that young people are so addicted to mobile phones and they feel incomplete without using them as part of their daily routine. Researches also suggests that 15 per cent of children had more expensive handsets than their parents. A study conducted by the University of Maryland, it showed the increasing dependence of the younger generation on technology and how it became a centre of their lives. (Alleyne, 2011)

Based on the latest survey conducted by Statista Research Department, the forecasted number of mobile phone users from 2015-2019 is 4.15-4.68 billion, respectively.The number of mobile phone users in the world is expected to pass the five billion mark by the year 2019. An estimated 62.9 percent of the population in the world already owned a mobile phone in 2016.

The mobile phone penetration is assumed to continue to increase, rounding up to 67 percent by 2019. In 2017, China was predicted to have just over 1.4 billion mobile connections, while there were over one billion forecasted in India. Today, there is 2.71 billion smartphone users in the world. This means that in the world of wireless, 35.13% of the world's population is using a smartphone today. (Statista Research Department, 2016)

In the Philippines, the number of mobile phone users in the Philippines as of July 16, 2019 is 41.3 million. (Sanchez, 2019) This data only implies that mobile phone is not only an accessory but it is a necessity, that people finds it important to have mobile phone to be able to connect globally. The use of mobile phone is not only for communication, it is also used to store data and serves so much in many fields. In education, the use of mobile phones also plays a very important role. According to Sevari (2012) mobile phone improve and increase learners' understanding of difficult concepts, completion of teachers' instructions, it also meets the need and interest of learners, improve the abilities & critical thinking skills, and many other meaningful uses.

While mobile phones provide people with so much satisfaction, as it eases the path of communication and help people do task easier, it also reach some point of downfall when low batteries came and there is no way to charge them specially during power interruption. The Philippines mostly in some rural areas experience longer and more frequent power interruptions during maintenance most often during and after typhoons. Each year, an average of eight or nine tropical cyclones make landfall. According to PAGASA, the Philippine Atmospheric, Geophysical and Astronomical Services Administration, eleven typhoons have affected the country in 2014, compared with the record of 19 that smashed into the coast in 1993. (Whiteman, 2014)

As the number of uses and features of mobile phones increase, problem had accumulated as it becomes a common and major problem of the users. Majority of the people are feeling panicked, annoyed, and hunting for a spare charger if the red icon on their mobile phones occurred. They rushed to their homes just to charge their mobile phones and this sort of discipline can be classified and called, "Low Battery Anxiety". Possible effects of low battery anxiety are ruining relationships, chances of missing important information, school activities and many other things. The research also found 41 per cent of people fear missed calls the most when faced with a dead battery. The survey found 60 percent of people blamed a dead phone for not speaking to a family member, friend, co-worker or significant other if their battery was low. And what's more, one in three people have gotten into an argument with a significant other or romantic interest as a result of unanswered calls or texts because their smart phone was dead. 17 per cent of males missed a match on a dating app because their phone died before they could swipe. When faced with only a few minutes of power, half of smart phone users will use the remaining time to text, while 35 per cent will use their last moments to make a phone call. Around 46 per cent of people say they feel embarrassed to ask a total stranger to use their charger, but would anyway because the anxiety of a dead smart phone is too great. More than 60 per cent of millennial will turn off their smart phone, and half will refrain from taking photos in hopes of prolonging their battery life.In connection to this major concern, many studies said that there are a lot of solutions to cure the problem of low battery upon mobile phones. One of the most effective solutions is portable power banks. Portable Power Banks are comprised of a special battery in a special case with a special circuit to control power flow. With the use of this, you can charge your phone on the go. It extends the battery life of your mobile phones. Through this, you can now do important things you might miss without this.

The abovementioned facts triggered the researchers of the study to produce an affordable and quality improvised power bank to prevent the effects of low battery upon mobile phones and to extend the battery life. This device has a multi-Ampere millimeter which completely changes mobile phones and at the same time it has a low price to make this unique and more

superior to other portable power banks in the market. The study will be beneficial to everyone especially to the users.

Methodology

Quantitative-experimental research design was used to produce and test efficiency of the mobile phone power bank out of scrap laptop battery packs. The power bank was tested according to its efficiency and experimentation was done to test significant difference between the mobile phone power bank out of scrap laptop battery packs and a commercial power bank in terms of capacity (Mile-Ampere/hour), charging time, and cost. This study will test the efficiency of the Improvised Power bank in terms of Capacity, Charging time and the cost.

The research was conducted following the diffent stages: (1) disassembling the casing of the used laptop battery; (2) analyzing the physical feasibility; (3) cleaning the welding point of po-sitive and negative poles of the battery to remove any toxic materials; (4) measuring the voltage; (5) charging and draining the battery content; (6) analyzing temperature when charging power from electric outlet to power bank; (7) installing the battery in integrated instrument tools; (8) analyzing power capacity level indicator lamp; (9) trying the circuit by adding electric load; (10) analyzing voltage when power charged from power bank to recharged device; (11) analyzing transferred power capacity; and (12) analyzing the time needed to charge device using power bank. (Hartono, Sunarno,Sarwanto, 2017)

Several calculating procedures were used to measure if the power bank meets the efficiency requirement. In testing the efficiency of the Improvised power bank the voltage and current will be determined using the formula:

Power = voltage x current (Batteries of power banks are 3.7V output)

The efficiency were based on the power bank's conversion rate. Higher end power banks possess around 90% conversion rate. Power bank conversion rate is also related to batteries used in the production. Lithium-polymer rechargeable batteries have a work output conversion rate that is generally 85% -95%, and lithium-ion (18650) battery possesses an output conversion rate between 75% - 90%.

To calculate conversion rate with the real capacity and charging times the following will be considered:

Smartphone charging is dynamic of around 500MA-1000MA with the voltage at 5V.

Conditions:

If the battery power is marked 4000mAh, then the power of a 4000mAh power bank should be 4 * 3.7 = 14.8W, calculate by polymer batteries conversion rate of 80%, the real total power supply for charging can be 11.8W. For a 1500mA smart phone as a sample, the demand power is 3.7*1.5 = 5.55W, then it can charge the phone two times. For higher capacity gadgets, a larger capacity power bank is needed, the power bank capacity should be more than 8000MA and can provide high current 2A output charging requirements. (Sinmarket, 2014)

To test the efficiency of the Improvised power bank the data will be necessary in the table below:

	Improvised Powerbank				Commercial Powerbank			
Trial	mm Amp	Hour	Voltage	Wh	mm Amp	Hour	Voltage	Wh
1								
2								
3								
4								
Mean								

Using the Sample computation:

$$\text{Efficiency} = \frac{\text{output (Wh) (use)}}{\text{Input (Wh) (charging)}} \times 100$$

Use:

$$\text{Efficiency} = \frac{\text{mm Amp hr (use) x Voltage}}{\text{mm Amp hr (charging) x Voltage}} \times 100$$

The power bank must be at least 70% to 80% efficient, giving the rest of the energy as heat lost. (Sinmarket, 2014).To determine if there is a significant difference between the efficiency of the improvised power bank and the commercial power bank in terms of capacity, discharging time and cost, t-test was used for the significant difference, at .05 significance level. The test indicates whether or not the difference between two groups' averages most likely reflects a "real" difference in the population from which the groups were sampled.

Results and Discussion

The disassembling process of laptop rechargeable Li-ion battery type 16046 resulted in product as shown in Figure 1. Based on the technical data, type 16046 batteries have some specifications, namely: 18 mm diameter, 65 mm height, 14.8 volt voltage, 2630 mAh power capacity.

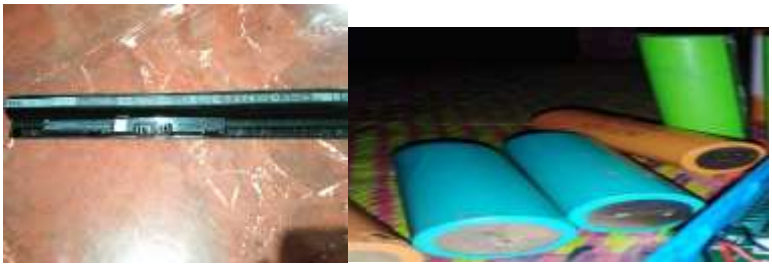

Figure 1. Type 16046 Batteries Fitted with Recycled Laptop Batteries

Some physical indicators were used to determine that the batteries still worked normally, such as 1) not excreting fluids or gases; 2) not having any bulge; and 3) not corroding. The most important thing in power bank circuit the performance of rechargeable batteries. The desired power bank module is shown in Figure 2. A power bank module consisted of some components: 1) 8 compartment batteries channel; 2) Micro USB charging socket with specification of 5V ± 5% ≡1A; 3) electrical outlet to-power bank charging protection circuit; 4) 4 LED power capacity level indicators; 5) power bank-to-recharged device charging protection unit; 6) female USB port with specification of 5V ± 5% ≡2,1A

Figure 2. A power bank casing with module

The 8 batteries were loaded in the Power bank Case with built in modules in a parallel arrangement as shown in Figure 3.

Figure 3. Loading of Batteries

Figure 4. Testing

Test for Efficiency

To test the efficiency of the power bank, a popular android mobile phone brand was used. The efficiency was determined to be 80% efficient. This result confirms with the efficiency range of 70% to 80% efficiency, giving the rest of the energy as heat lost. (Sinmarket, 2014). This result implies that the powerbank out of scrap laptop battery is efficient in charging such brand of mobile phone. This confirms with the study of Hartono et.al (2017) where it was discovered from their research that the performance of power bank using recycled laptop battery which would be used as a project learning media at Vocational High School was 89.4%. It was also mentioned by Dr. Mike Flying in his article High Quality Power Bank From Dead Laptop Batteries, that the cells in 'dead' laptop batteries still have life left in them for lower current applications.

Test for significant Difference

Capacity

In the test for significant difference between the power bank out of scrap laptop battery and the commercial power bank, it also came out that the t-stat which is 0.541004 is less than the t-critical value of 2.776445, this means that there is a significant difference between the capacity of the Power bank out scrap laptop battery and the Commercial Powerbank. It came out that the mean capacity of the power banks are 8333.33 and 6666.67 mAh, respectively.

According to Walton ((2018), batteries with larger mAh ratings generally last longer than those with smaller ratings, this is assuming that the batteries are subjected to the same usage patterns but this does not conclude that it is a better battery. The milliampere hour represents a unit of electrical charge that is commonly used to measure battery capacity. To simplify this could be like the size of a battery's fuel tank, as it measures the total amount of energy the battery supplies in an hour when fully charged.

Discharging time

The test for significant difference between the power bank out of scrap laptop battery and the commercial power bank in terms of discharging time came out that the t-stat is -2.37635 is less than the p value which is 0.09794. This results shows that there is a significant difference between the Improvised Powerbank and the Commercial Power bank in terms of discharging time in minutes. The mean discharge time for the powerbanks were 278.33 and 753.33(in minutes) respectively. In this result, it showed that the commercial powerbank has a longer discharge time compared with the power bank out of scrap laptop battery. The discharge time of a certain mobile phone battery may vary depending on the use and how the charging was done. According to Andie Francese in his article “How Long Does a Cell Phone Battery Charge Last?” A phone not in use can last for more than of 3 days, depending on the type of phone and applications packed onto it. The manner of charging also affects the life of the cellphone battery just like when leaving your phone plugged in when it's fully charged, is bad for the battery in the long run, this according to the Battery University. They also mentioned that batteries does not have to be fully charged to 100 percent. According to Battery University, "Li-ion does not need to be fully charged, nor is it desirable to do so, since high voltage stresses the battery" and wears it away as time goes.

Cost

The test for significant difference between the power bank out of scrap laptop battery and the commercial power bank in terms of cost shows that t-stat is -1.92722 is less than the t-critical which is 3.182446 which means that there is a significant difference between the two powerbanks. The mean cost in peso of power bank out of scrap laptop battery and the commercial power bank are P278.33 and P753.33, respectively. Where the total amount spent in assembling the powerbank from scrap laptop battery is only P278.33 for the materials such as the ready-made powerbank case. While commercial powerbank costs more. Based on the list of Power bank prices listed on online shops, the cost for a powerbank with a capacity of 20000 mAh ranges from P425 to P1, 150. These are based on 20000mAh Power Banks prices online in the Philippines September 2019. This suggest that the discovery of such power bank out of scrap laptop battery is a solution to the increasing prices of commodities which provides better economy and less expenses for the users, as they can still use their money for other important needs.

Conclusion

It was discovered from this research that the efficiency of the power bank using scrap laptop battery was 80%, based on the data obtained. It was also concluded that there is a significant difference between the power bank out of scrap laptop battery and the Commercial

Power bank in terms of capacity (mm Amp hr), discharging time (minute), and cost (Peso). In the future, it is hoped that the materials that are no longer used such as scrap laptop batteries will still be utilized to develop more alternative energy resources.