Proposal to Create a Larger Capacity Portable Power Bank

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Date: April 30th 2020
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From: Abigail L. Ureña, Chemical Engineering, President of Research & Development
International Research Conglomerate
Subject: Proposal to Create a Larger Capacity Portable Power Bank for the Winplus AC56388 Car Jump Starter

Purpose

The purpose of this proposal is to request funding from Winplus Company Limited headquartered in Hong Kong, to fund the development of a larger capacity power bank for the Winplus AC56388 Car Jump Starter. The larger capacity battery will be developed to be used in a new model of a Winplus portable car jump starter.

Summary

Jump starting a vehicle is a reality that many consumers face. Traditional methods of jump starting a vehicle can be dangerous to the consumers' body. These methods can also have many limitations that prohibit the consumer from using the product in their greatest time of need. Jump start procedures that include the operation of lead-acid batteries may produce flammable gas on one side of the battery.

In coherence with the launch of their AC56388 Car Jump Starter, Winplus developed an efficient solution to a prominent problem. They created a product with a lithium-ion battery instead of a lead-acid battery, which could cause damage to the vehicle's battery.

The Winplus AC56388 Portable Power Bank and Car Jump Starter has a multitude of functions that would benefit from having a larger battery capacity. The consumer sentiment for this product has been outstanding. Improving the battery capacity of this product, could greatly improve its functionality, convenience, and versatility.

Accordingly, the International Research Conglomerate proposes to develop a 12,000-15,000 mAh battery for the purpose of implementing this new battery into a new model of the Winplus Portable Power Bank and Car Jump Starter duo.

The International Research Conglomerate, is a multinational world renowned research and development conglomerate.

We plan to begin developing a new battery in June 2020. This project will be developed by our research and development team in one of our facilities located in Hong Kong. This development is headed by Abigail L. Ureña, the president of this department, four fellow engineers and two interns. Before the inception of the development, we will provide Winplus Company Limited with a list of recommendations regarding our engineers and interns. We will additionally provide a report with details of our planned development and details on how we will proceed with the improvement to the power bank.

Introduction

A jump start, colloquially referred to as a boost, is a method of starting a vehicle with a discharged or dead battery. An external supply of electricity recharges the disabled vehicle's battery and provides some of the power needed to crank the engine.

Winplus Company Limited is one of the fastest growing companies that are marketing auto lifestyle products. Winplus Company Limited has created a solution to the dangerous lead-acid battery boosters. Winplus announces that “By adding innovation and style to our extended line of interior auto accessories and in-vehicle technology, our products enrich the lifestyle of everyone on the road.” Winplus Company Limited will be able to achieve this and more if they implement a lithium-ion battery with more capacity in the AC56388 Car Jump Starter.

The Winplus AC56388 Portable Power Bank and Car Jump Starter is a powerful jump starter that easily starts 12V vehicles, charges small electronic devices, and provides portable LED powered lighting. It has a capacity of up to 8000mAh.

The International Research Conglomerate’s Research and development team plan to develop a lithium-ion battery with a larger capacity. The current battery in the power pack is 8000mAh, this team is proposing to develop a 12,000-15,000 mAh battery of 12V.

A battery of larger capacity will significantly improve multiple of the functions of the power pack, including a faster charging time, and a longer lasting battery. Research has been under way in the area of increased safety based on the flammability and volatility of the organic solvents

used in the typical battery lithium. Strategies include aqueous lithium-ion batteries, ceramic solid electrolytes, polymer electrolytes, ionic liquids, and heavily fluorinated systems.

The International Research Conglomerate has developed a solution to this short battery life of the battery currently on the Winplus AC56388 Portable Power Bank and Car Jump Starter duo. Implementing the newly developed battery will relieve some of the issues with this battery pack.

Proposed Tasks

With the approval of Benson Leung,Vice President of Winplus Company Limited, the Hong Kong Research & Development team at the International Research Conglomerate would like to develop a 12,000-15,000 mAh lithium-ion battery for the Winplus AC56388 Portable Power Bank and Car Jump Starter duo.

This proposed development of a larger capacity battery will begin on June 1st, 2020. This project has an expected conclusion date on August 7th, 2020. The development of this battery will have costs in the range of $70,000 USD. The budget for this development includes: five salaries, housing for the research and development team, transportation, 2 Winplus AC56388 Portable Power Bank and Car Jump Starter duos; cathode materials, anode materials, electrolytes, and separators for one hundred lithium-ion batteries.

Task 1: Identifying current battery's systems

During this task, the Research & Development team from the International Research Conglomerate will dismantle and research the lithium ion batteries from the current battery pack. The team will use their previous knowledge from developing batteries to create a battery of 12,000-15,000 mAh. The cell designs and combinations of battery packs differ greatly. To establish a base understanding, these researchers will focus on the main cell designs and then on the materials, processing, and manufacturing.

The following tasks will allow for the team to create a more durable battery, while having a larger capacity, and make it more environmentally safe and low-cost.The first task will be divided into the following subtasks:

1. Disassemble the current battery
    - Disassembling the current battery from the battery pack will allow the researchers to see what improvements could be made to the battery without improving the capacity or charging capabilities.
    - This will also allow the researchers to make any improvements on the materials used for the battery.
2. Test the naturally occurring electrolytes

- A safe and long-lasting battery needs a robust electrolyte that can withstand existing voltage and high temperatures and that has a long shelf life while offering a high mobility for lithium ions. Liquid electrolytes are mostly organic, solvent based electrolytes, such as lithium-ion.
- Understanding the use of organic solvents and electrolytes in batteries is extremely beneficial. This is one of the most important considerations regarding their flammability.
- The battery separator will separate the two electrodes physically from each other, avoiding a short circuit. In the case of a liquid electrolyte, the separator is a foam material that is soaked with the electrolyte and holds it in place.
- Efforts will be made in materials processing and assembling to expand performance and to oversee unavoidable volume change have been driving toward composite materials with small scale and nanoscale particles.

3. <u>Developing and Calculating the cost of the new battery</u>
    - Battery cells will be assembled as follows: the electrolytes will be formed from pastes of active material powders, binders, solvents, and additives and are fed to coating machines to be spread on current collector foils, such as aluminum for the cathode side and copper for the anode side. Subsequent calendaring for homogeneous thickness and particle size is followed by slitting to the correct width. The other needed insulators, seals, and safety devices are then attached and connected. Then, the cells will be charged the first time and tested.
    - The raw material costs for this battery, will be based on the prices from the previous battery.

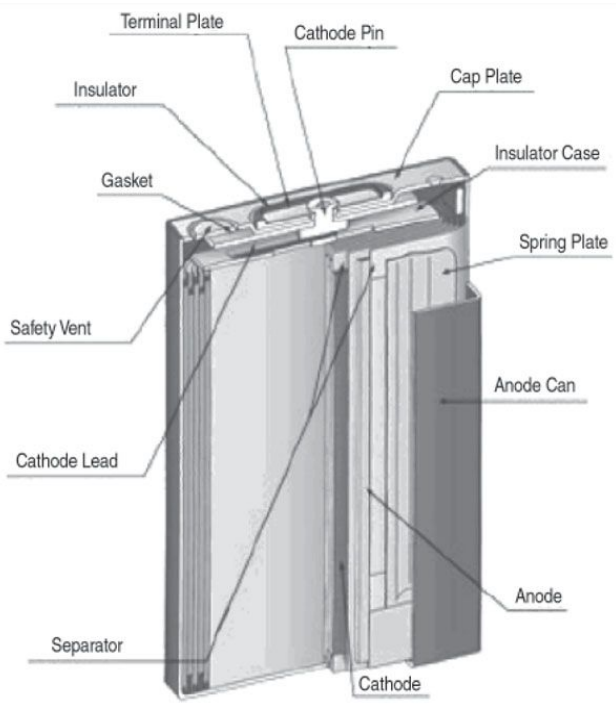

Figure 1. Image of a labeled battery that is found inside of a battery pack.

Task 2: Adding more cells and evolving the current charging board

1. Adding more cells
    - By combining multiple battery cells this will allow for the battery pack to have a larger capacity.
    - Having a larger capacity, will allow the battery to have more power to be used to jump start a vehicle or charge devices
2. Changing the charging board
    - When the researchers change the charging board, and implement a newly developed charging board, the battery will be able to charge faster.
    - The Winplus AC56388 Portable Power Bank takes 4-5 hours to fully charge. When the research and development team implement a new charging board to the new battery, the charging time can be reduced to about 3-4 hours.

Task 3: Analyzing the development

The final task will consist of the researchers writing the final report of all of their developments and improvements. Upon the successful development of a battery with a larger capacity and quicker charging times a report will be developed. This report will be provided to Benson Leung, the Vice President of Winplus Company Limited. The quality of the product will be tested, along with other factors such as ULUS approval which will allow for its sale in the United States and European countries. The battery will be tested for any defects during operation and to ensure safety and ease for the consumer. After the completion of these tests, all of the research and development, including the new battery will be surrendered to Winplus Company Limited.

The entire development will last from June 1st, 2020 to August 7th, 2020. This will last a total of 49 business days, working from 9 AM to 6 PM (GMT+8 time zone) with a 1 hour lunch break. The development will take place at one of the International Research Conglomerate's research labs located in Hong Kong. The report will be handed in, in print and email, on Friday August 7th by 5:30 PM.

Schedule

Tasks	Weekly Completion								
Task 1									
Task 2									
Task 3									
Weeks	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**

Figure 2. Weekly Completion Schedule

Budget

Item	Cost
Salaries	$5,000 per month x 5
Flights	$2,000 x7
Visas	$130 x7
Housing	$ 200 per week
Cathode	$10-15 For the entire lithium-ion battery
Anode	
Electrolytes	
Separator	
Winplus AC56388 Portable Power Bank and Car Jump Starter	$60 x 2
Total	Approx. $ 75,000

Figure 3. Chart of Estimated Budget

Conclusion

The goal of this proposal is to develop a battery that will be more efficient and have a larger capacity. The research team from the International Research Conglomerate will develop a battery

that is much more efficient and effective for the consumer. This battery will go through extreme scrutiny in the laboratories of these world renowned researchers. In order for these developments to take place, funding from Winplus Company Limited is essential.

Glossary

Ampere hour (Ah) - Ampere hour or amp hour is a unit of electric charge, having dimensions of electric current multiplied by time, equal to the charge transferred by a steady current of one ampere flowing for one hour.

Anode- An anode is an electrode through which the conventional current enters into a polarized electrical device. The positively charged electrode by which the electrons leave a device.

Cathode- A cathode is the electrode from which a conventional current leaves a polarized electrical device. The negatively charged electrode by which electrons enter an electrical device.

Electrolyte- Electrolyte serves as a catalyst to make a battery conductive by promoting the movement of ions from the cathode to the anode on charge and in reverse on discharge. The electrolyte of a battery consists of soluble salts, acids or other bases in liquid, gelled and dry formats.

Milliampere hour (mAh)- milliampere hour is one-thousandth of an ampere hour.

Separator- A separator is a permeable membrane placed between a battery's anode and cathode. They are important to batteries because their structure and properties considerably affect the battery performance, including the batteries energy and power densities, cycle life, and safety.

Volts (V)- The volt is the derived unit for electric potential, electric potential difference, and electromotive force.The SI unit of electromotive force, the difference of potential that would drive one ampere of current against one ohm resistance.

List of Figures

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