



Khalifa University of Science, Technology and Research

ENG220: technical writing

# INNOVATION REPORT

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Solar Mobile phone Battery Charger

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**1. Abstract**

## 2. Introduction

### I. Purpose ( the aim )

The purpose of this report is to present the result of attaching solar cells to the mobile phones in order to achieve longer battery life using natural resource.

### II. Scope ( the topics )

~~The report covers the details of the problems people face with present mobile batteries, then it propose a solution for the problem.~~ After that,..<< to be continue after the report is done

### III. Procedure (sources)

To begin with, fifteen students at Khalifa University were asked to complete a survey (Appendix A).The purpose of the survey was to come up with a new idea that our target customers may think about in order to improve our product and innovation. In addition, some information was gathered from several references such as books and websites.

### IV. Background

With the fast increase of technology and science in engineering disciplines, new innovations are created in every single minute. As the populace relies more and more on mobile phones, features always were requested to be improved, applying the latest technology. Therefore, a lot of features and applications in the mobile uses up all the energy.

### 3. Discussion

#### I. The problem

Figure 1 shows that more than 30 students agreed to consider the short battery life considering as a serious problem for any mobile phone users, as they charge it twice or more a day.

In our daily lives, carrying cables everywhere in order to avoid switching off the mobile makes the mobile phone devices usage unpractical.

“According to the Global System for Mobile Association (GSMA), the Average Revenue per User (ARPU) of mobile operators reduce in the 10 – 14% range when mobile subscribers are either out of network coverage area or when their batteries

are out of the power”[1]. Therefore, our new innovation will focus on extending the battery life using solar cells. According to the survey results, only 7.16 % students don't have any clue about the solar cells and wondering about the visibility of the innovation (shown in Appendix #).

#### II. The solution

From the birth of the universe, the sun shined every day and glowed over our world. Every day it sends huge amount of solar radiation. This energy is used to produce electricity for different purposes. As well as it can solve a valid daily problem which most of people face such as the battery life. However, this problem can be solved using solar cells attached to the electrical battery to be recharged and extend its life, which will be discussed in more details later.

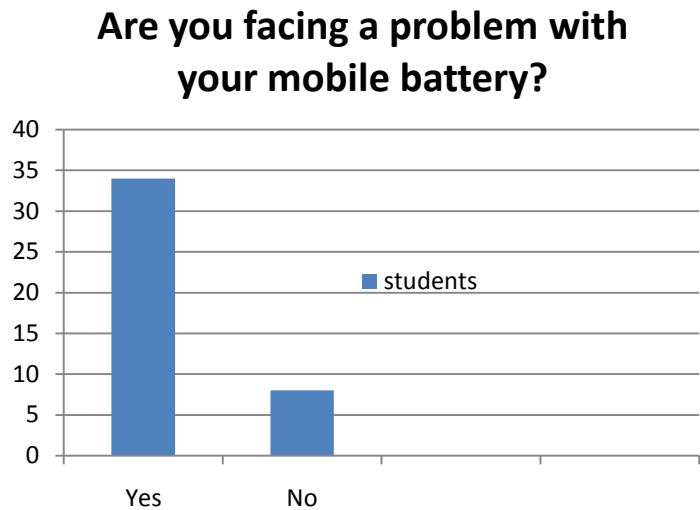


Figure 1: The result of the survey shown whether the mobile battery is an issue or not.

### III. Technical details and Implementation

There are two basic components to construct our innovation. The first component is mobile phone and the other one is solar cells. In this part of the report, we will cover all the details and the information needed to understand well the component of the innovation and how it works. First we will take a deep look on the solar cell and understand how it works. Then, we will discuss how the electricity that is generated from the solar cells is going to be used in order to recharge the mobile battery. Moreover, a comparison between the electric battery and the solar cells will be presented. Finally, this paper will demonstrate how the solar cells will be attached to the mobile phone.

#### III.I Solar cells.

##### Definition:

Solar cells are the main unit of the solar panel. It is also called Photovoltaic (PV) cell, “which as the name implies (photo meaning “light” and voltaic meaning “electricity”)[2]. The main job of the PV cell is to convert the sun light which consists of photons to electricity. As Figure 1 illustrates, the solar cell consists of 6 layers. The glass cover, antireflective coating, Contact grid, two silicon layers and back contact. Each one of them will be explained throughout the paper.

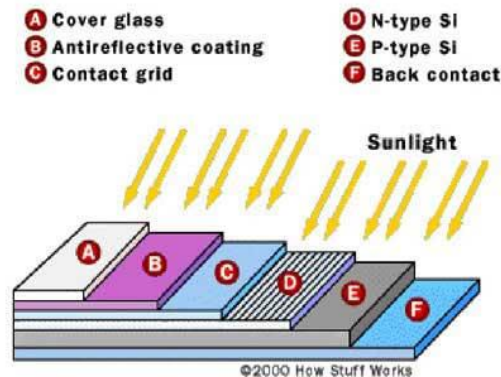


Figure 2: Solar Cell Component

## **Components:**

### **The glass cover:**

The solar cells should have a non colored material to allow the sun light to hit the silicon in order to use the solar energy. In our innovation, plastic is used since the glass is very heavy this solar cell will be attached to the mobile battery. The user will always prefer the lightest device; in addition the plastic will solve the cost problem. The plastic is non colored material and has a small weight.

### **The Antireflective AR Coating:**

As [3] it is required to reduce the optical loss of a variety of optical devices, e.g., compound lenses and solar cells.” In our innovation, we will double this layer to enhance the efficiency and to avoid the reflection and increase the absorbed light.

### **Contact grid:**

This layer is a metal that conduct and collect the electrons.

### **The silicon layers:**

The most important layer is the silicon layer since it is responsible of generation electricity. The silicon is a semiconductor material that can be doped. Doping as [3] “is the addition of controlled amounts of specific impurity atoms with the sole purpose of increasing either the electron or hole concentration.” The location is in the middle as Figure[2:1] Shows.

In general, as shown in Figure [3], when photos are sent from the sun to the solar cell it is absorbed by a specific material. If the energy of the photon is sufficient enough it can excite electron from its level to higher level of energy. The excited electron come to its original state , but in our situation we don't want that to happen for that we have to have electric filed which force the electrons to move in one direction.

This electric field can be constructed by attaching two layers of doped silicon. There are two type of doping to build an acceptor known as P type and donators known as N type (see Figure [2:2]). When putting the two layers next to each other as shown in Figure [2:3], the magic is happened, and an electric field is constructed. This is going to force the excited electrons to flow from the P type to N type exactly as Figure [2:4].

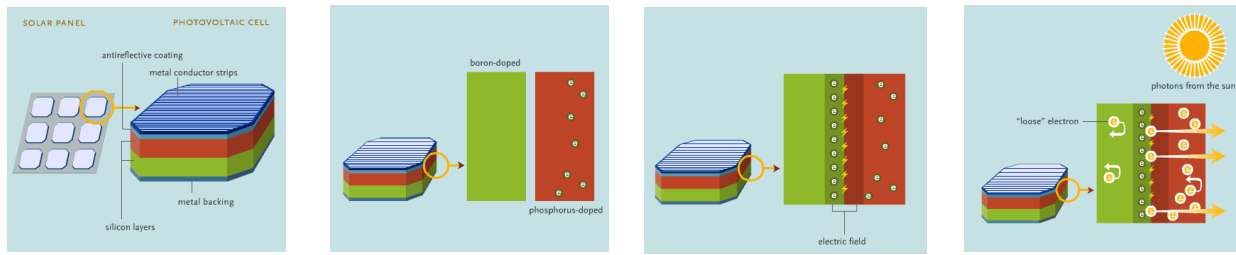


Figure 3: (a) shows the solar cells main component with the middle silicon layers (b) shows the 2 doping layer (c) shows the electric field (d) shows the flow of the current when the electricity produced

### The back contact:

it is made of metal to conduct.

### The process:

To summarize, as shown in Figure [3] the sun sends a photons to the solar cell and the photons are absorbed. Next, the photons will have sufficient energy to excite electrons, with the existence of the electric field, electrons move from P type to N type. An electromagnetic force (emf) is produced and current is flowing. Electricity is produced and ready to be used.

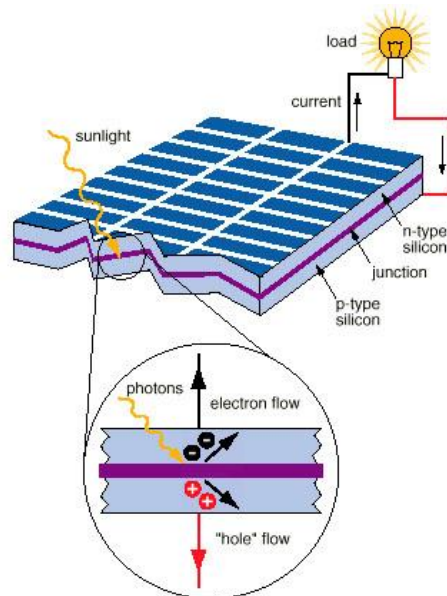


Figure 4: How Solar Cell Works

But there is a small problem which is that the voltage constructed is very small, approximately 0.5 volt as mentioned in [5]. The mobile battery need 12 Volt to operates. Therefore, as [5] mentioned, we need 36 solar cell connected in series to get the 12 volt. We are going to build module as shown in Figure [4] but it will be divided to 36 cells in one module and another 36 cells in another module. These modules are connected in series and there will be a diode which is connected in parallel to each one of them. As in [5] mentioned that the diode are connected to “



avoid the complete loss of power which would result if one of the cells in series failed” Connecting modules to each other will give us an electricity generator which is called panel that generates electricity that can be used and saved at the same time.

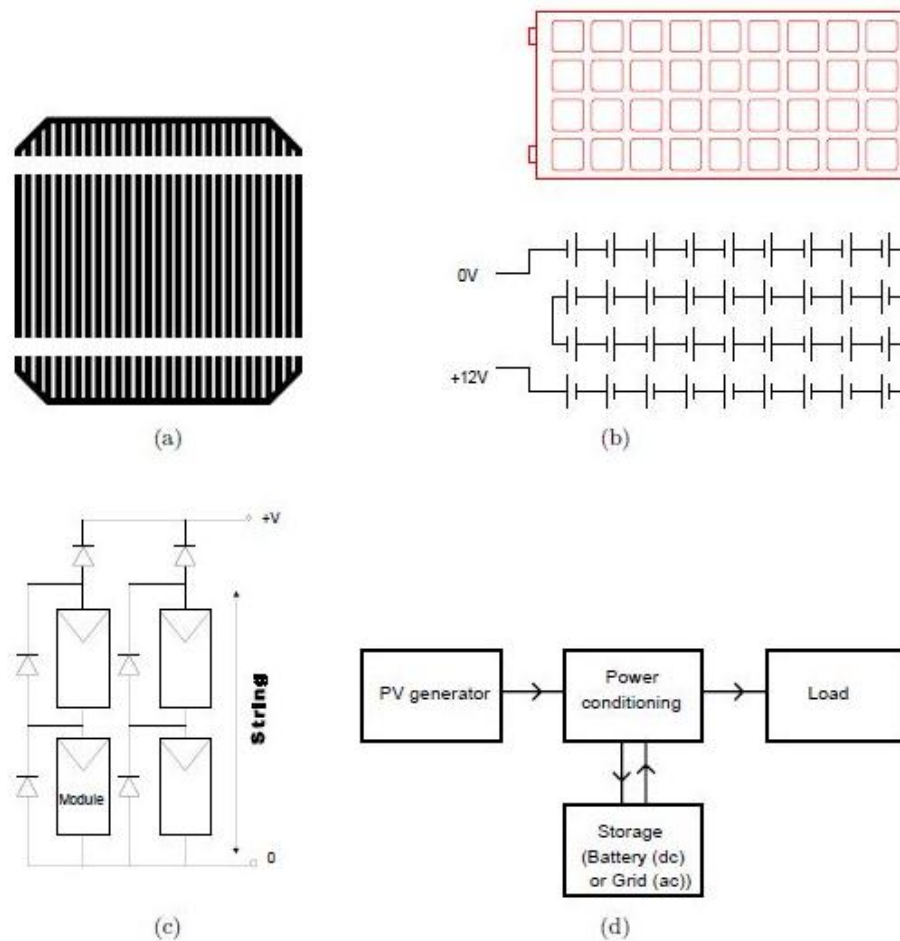


Figure 5: (a) Photovoltaic cell showing surface contact patterns (b) In a module, cells are usually connected in series to give a standard dc voltage of 12 V (c) For any application, modules are connected in series into strings and then in parallel into an array, which produces sufficient current and voltage to meet the demand. (d) In most cases the photovoltaic array should be integrated with components for charge regulation and storage.

### How solar cells work:

As we mentioned, the sun can be used to generate solar electricity, but to get this electricity, solar energy must go through a long process starting from the sun. First, “the Sun produces radiant energy by consuming hydrogen in nuclear fusion reactions” [6]. Second “It takes millions of years for the energy in the sun core to make its way to the solar surface, and then just a little

over eight minutes to travel the 93 million miles to earth” [7] at a speed of 186,000 miles per second. In the next step, the solar photovoltaic cells on the earth receive solar energy, and convert it into electricity . Each photovoltaic cell is packaged into modules; a group of modules is called an array. Photovoltaic arrays (groups of modules) are acting like a battery when the sun is shining, “producing a stream of direct current (DC) electricity and sending it into the building or sharing it with the grid” [8].

According to my study on How Solar Energy Works. Somewhere near the array, there is a weather station. The weather station contains some dives like anemometer, pyranometer and thermometer. Each of these dives has a special function. So, weather station measure wind speed using anemometer, and measure the amount of solar energy reaching the array using a pyranometer, and also measure the temperature using thermometer. After that, the weather station translates the electronic signals to the data acquisition system. Then, the direct current electricity (DC) converts it into alternating current electricity (AC) by the inverter to be used in the devices. Finally, the electrical distribution panel receives electricity, combines it with other electricity, and routes the energy throughout the device. Now, we get this electricity and use it to charge the mobile battery.

### III.II mobile battery

#### Charging the innovated solar battery

After the solar cells absorbing the light from the sun. the main process for charging the solar battery will start by passing through the photovoltaic (PV) panels. First, the PV panel will receive the solar energy start acts as p-n junction semiconductor which converts the sun energy to current or voltage, also the PV panel helps the solar energy to enter to the system. In the second step, the current will be regulated by passing through the charge controller which controls the charging and discharging functions.

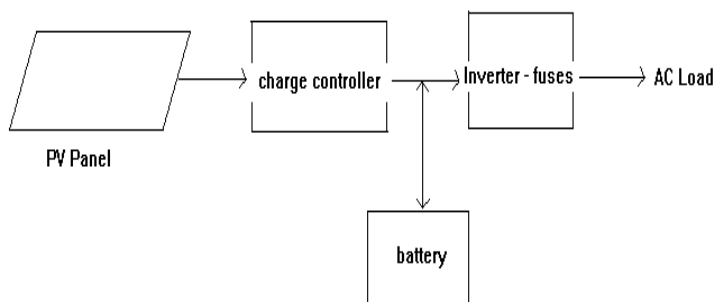


Figure 6: Photovoltaic system components frm (1)

After that, the current will be haggard from the battery achieving our innovation by extending the battery life time. This step is only needed when the current should be converted from one type to another appropriator.

According to a study made by us at the charging process, we found that the appropriate current in our innovation is the AC current. Because the amount of electrons in the alternative current AC are moved from both directions while in the direct current DC it flows only on one direction.

After these steps an electric field will be created which leads to create an output current that goes to the load which its connected with and the current will help in generate power which the device need (Figure6).

### **Solar cell compared with conventional battery**

The comparison between solar cell and the simple DC battery can be summarized in four main aspects. First, the electronic motive force (e.m.f) in the simple DC battery caused by a permanent electrochemical potential difference between two phases in the cell. On the other hand, the e.m.f of the solar cell is due to a temporary change in the electrochemical potential which will be caused by the sun light. Second, battery's power which delivered to the load resistance is constant, while the solar cell's power depends on the intensity of the light incident. Third, regarding to the battery life, solar battery can be continually recharged with light and never exhausted but the simple DC battery will be discharged when it reaches to the end. Forth, the battery is a voltage generator that is the electrical model of it. The electronic motive force is the main characteristic that the battery is distinguished by. Another two main characteristics are the charge capacity and the polarization curve which describes how e.m.f. varies with current.

The solar cell is a current generator, for normal not large loads the current. Taken from the cell is independent of load. Though the characteristic of the cell depend on the nature of the illuminating source, and so  $I_{sc}$  and  $V_{oc}$  must be known for standard test conditions.

## Connection

The primary idea for this innovation is to use the solar cells which will be attached to the inner surface of the cover figure 4.

That will lead to find a way to make the direct connection between battery and the solar panel. Therefore, a battery terminals part (b) which made of copper to acts as a conductor in order to transfer the electricity. In our innovation it will help in transfer the solar energy to the battery in to achieve the solar battery charging which can deliver the power to the mobile.

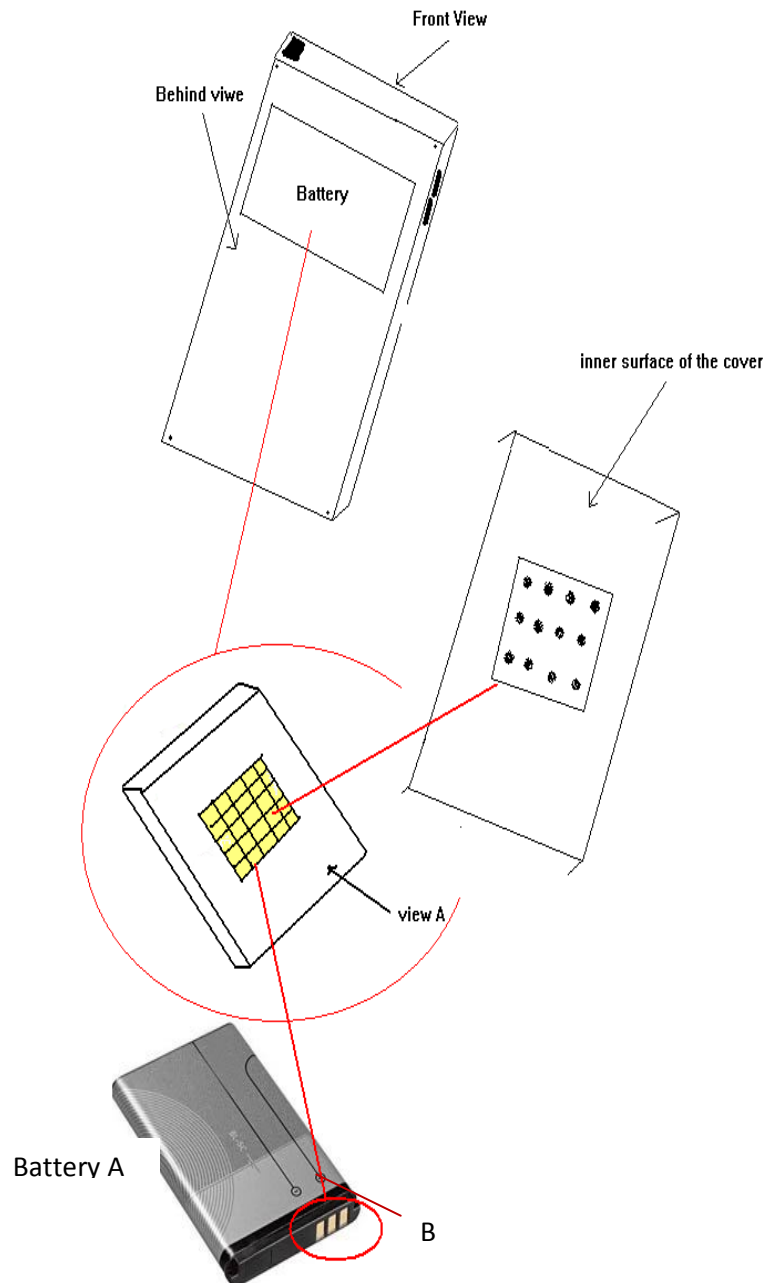


Figure 7: Innovated solar battery connection

## IV. Survey

Appendix # shows the survey that has been conducted on 50 students at Khalifa University. This survey aimed to get the percentage of students suffering from their mobile battery life, percentage of students that have background about solar cells that will be the main part of the innovation, the student's opinion on the innovation, and finally, the percentage of student that would like to try this innovation.

	Yes	No	Not sure
Q1	80.9%	19.1%	-
Q2	80.9%	19.1%	-
Q3	69.04%	7.16%	23.8%
Q5	52.38 %	11.9 %	35.71%
Q6	66.6%	7.1%	26.1%
Q7	69.04%	4.7%	26.16%

Table 1 : survey results

As in Table1, 80.9% of the students are facing a problem with their mobile batteries and all of them wish to solve this problem. Only 7.16 % do not have any idea what is solar cells. Some students are not sure that they will buy the innovation because of its cost. 66.6% of the students think that this innovation will decrease their electric bill cost and 69.04% believe that it can be published over the world.

### 4. Limitation and alternative

(If there are many >> discussion. If there are just few >> conclusion)

On one hand, benefits of solar energy may make us this innovation more convinced that the sun is the main source of energy and the best source as well. On the other hand, “there are two basic problems that have so far limited the use of solar power on a large scale”[8]. One of them is the energy intensity, where the amount of solar energy reaching the ground is small. That's because “the efficiency of the system depends on the location of the sun” [9]. And also, “the production of solar energy is influenced by the presence of clouds or pollution in the air”[10]. The second problem is the high cost of the technology used to run this type of energy production. Although solar energy saves money as the full energy comes from the sun, solar cells and other technology that's need to convert this energy are expensive. Where “the solar energy technology is relatively expensive compared to, say, coal-fired power plants” [11].

## 5. Conclusion

## 6. References

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7. Appendix

**Q4 : What do you think about attaching solar cells to your mobile in order to extend battery life?**

