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# Solar Powered Cell Phone Charging Station

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## Abstract

**This study is focused on the development of a cell phone charging station that is solely operated through solar power by means of a solar cell which is attached to the charging station through a backup storage battery. The device is mainly aimed for commercial use since it can require a certain fee for a specified period to charge a mobile phone. However, in case of calamities the charging station can be used as an emergency charging station in the event of prolonged power outages. Since the device is a standalone system it can charge mobile phone as long as there is sunlight. Even during night time, the device can still charge phone as long as the battery still has power.**

## Keywords

**Solar Powered, Cellphone, Charging Station**

**Subject Areas:** **Electric Engineering, Entrepreneurship**

## 1. Introduction

Abatement of global warming: Renewable energy use does not produce carbon dioxide and other greenhouse emissions that contribute to global warming. The carbon dioxide released when biomass is burned equal amount absorbed from the atmosphere by plants as they are grown for biomass fuel. Improving access to clean energy sources: Increasing the flexibility of power systems as electricity demand changes, reducing pollution and emissions from conventional energy systems. Reducing dependency, and minimizing spending on imported fuels.

Another advantage for many renewable energy technologies is that they are well-suited to small-grid applications and thus good for remote rural areas.

Electricity can be produced from renewable resources, the sun's energy can be used to heat fluids for turbines in solar thermal systems or can be converted directly to electricity using the principles of photovoltaic. The exponential rise in oil prices, the growing awareness of energy-related pollution, and the adverse effects of climate change have all contributed to a re-evaluation of energy use. This re-evaluation has resulted in the improvement in the efficiency with which energy is used in industry and power generation, as well as in lighting, household appliances and transportation. The efficient use of energy is a major factor that contributes to the improvement

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of in energy consumption that has occurred in the last decades in almost all industrialized countries. The amount of additional energy required to improve the desired energy services depends on the efficiency with which the energy is produced, delivered, and used. Energy efficiency improvement would help reduce financially investment in new energy supply system [1].

Cell phone is one of the most common means of communication today and through advancements in technology, also one of the most affordable electronic gadgets that one can avail. Many systems and devices have been integrated into the cell phone making it a multipurpose gadget that can process pictures, emails and the like [2].

But as with many electronic gadgets, cell phones rely on electric current to carry out its many functions and they require to be charged every so often. More so with android phones which consume battery power much faster than regular cell phones. In order to address the issue of presenting an alternative method of powering electronic devices, the researcher opted to develop a Solar Powered Cell Phone Charging Station.

## 2. Objective of the Study

The main thrust of this study is to develop a mobile phone charging station that is powered through solar energy. Specifically, this study aimed to achieve the following objectives:

1) Determine a solar panel that is appropriate for providing power for a cell phone charging station.

2) Design circuits and their corresponding interfaces that can safely provide charging power for mobile phones.

3) Determine a suitable timing system for providing cell phone charging services.

4) Determine the acceptability of the device based on the following:

a) Physical features;

b) Cost;

c) Durability;

d) Operation.

## 3. Data and Method

In an effort to be guided in the implementation of the study, the conceptual model has been used as a guide in developing the Solar Powered Cellphone Charging Station (**Figure 1**).

The INPUTS of the study are the conceptualization taken from similar studies and advised from experts.The design of the studio and set-up of equipments was also done during this stage. The equipment and materials as well of its costs have been identified.

The PROCESS composed of constructing the casing and interconnecting the essential circuit were also successfully undertaken. After all the equipments have been set-up and calibrated the station was tested and evaluated by faculty, students and potential users of the device.

The OUTPUT was the operational Solar Powered Cell Phone Charging Station after experts were satisfied and their recommendations were taken into considerations. The project foretold the limitation, conclusion and recommendation of the project.

## 4. Description of the Device

The device is composed of Circuits and interfaces that can safely provide charging power for mobile phones

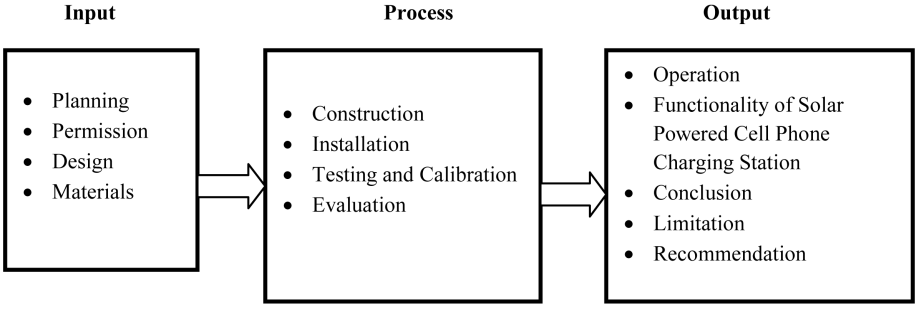


**Figure 1.** Conceptual model of the study.

namely, the Solar Cell Module, switching circuits for the coin switch and a regulator circuit for maintaining the voltage used for charging mobile phones (**Figures 2-6**).

## 4.1. Research Method

To attain the objectives set in the study, the developmental method of research was employed by the researchers.

Developmental Research aims to systematically examine products, tools, processes, and models in order to provide reliable, usable information to both practitioners and theorists. It is intricately connected to real world practice. It creates a loop with practice informing research and research, in turn, informing practice [3].

Specifically the Type 1 developmental study was utilized as the main method for achieving the objectives which is focused upon a given instructional product, program, process, or tool. They reflect an interest in identifying either general development principles or situation-specific recommendations. Typically Type 1 studies address not only product design and development, but evaluation as well. At times they may validate a particular design or development technique or tool [3].

## 4.2. Data Gathering Instrument

The researcher used evaluation questionnaires to determine the respondent's perception on the acceptability and functionality of the FM Broadcast Station Trainer. The profile of the respondents was shown below (**Table 1**, **Table 2**).

**Figure 2.** Solar module for powering the system and the solar powered cell phone charging station.

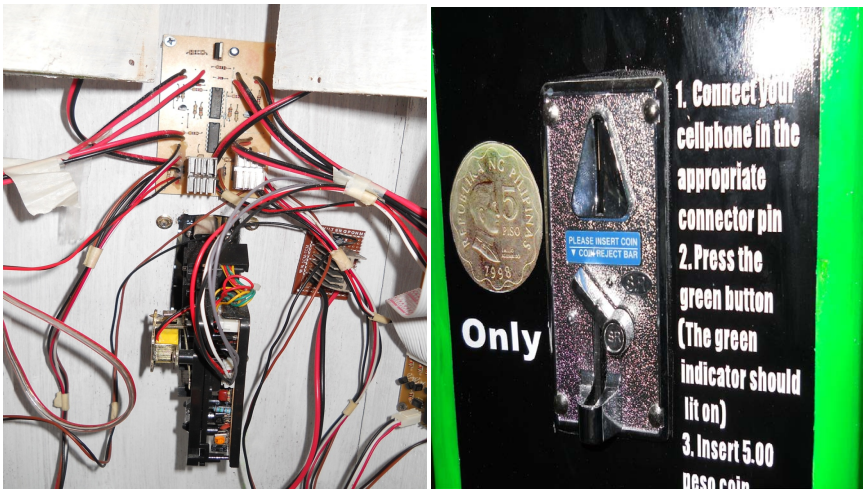


**Figure 3.** Coin slot circuit.

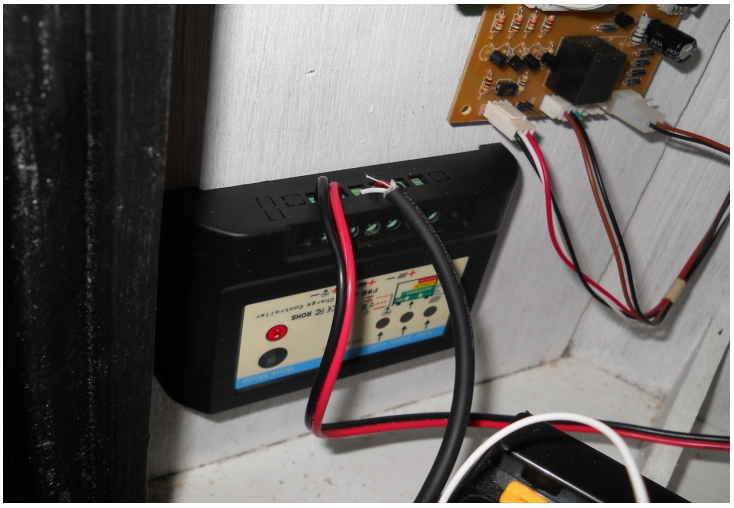

**Figure 4.** Solar cell control module and regulator circuit.

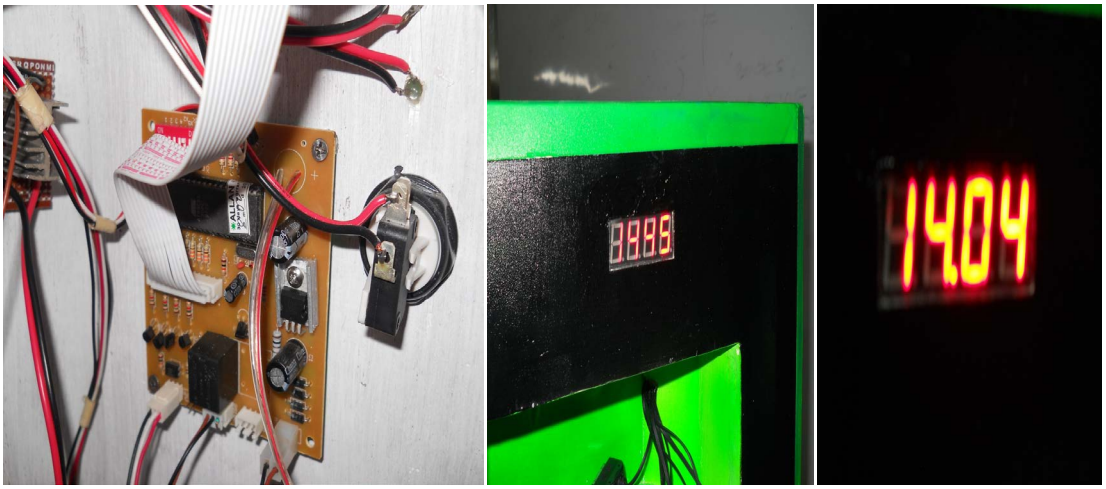


**Figure 5.** Timer circuit and time indicator of the charging station.


**Figure 6.** Cell phone charging compartment (the unit is provided with two compartments).

**Table 1.** Weighted mean and verbal description.

| Scale | Verbal Interpretation |
|---|---|
| 4.21 - 5.00 | Highly Acceptable |
| 3.41 - 4.20 | Acceptable |
| 2.61 - 3.40 | Moderately Acceptable |
| 1.81 - 2.60 | Unacceptable |
| 1.0 - 1.80 | Highly Unacceptable |

**Table 2.** Profile of the respondents.

| Teacher Respondent by Schools | Population | Sample Size | Percentage % |
|---|---|---|---|
| Bulacan State University | 12 | 6 | 50 |
| Bulacan Polytechnic College | 3 | 3 | 100 |
| AMA Computer University (Q.C.) | 15 | 15 | 100 |
| Lyceum of the Phil. University (Manila) | 3 | 3 | 100 |
| ABC 5 Engineers (2) | 2 | 2 | 100 |
| **TOTAL** | **35** | **29** | **83** |

### 4.3. Statistical Treatment of Data

Weighted Mean

For the Trainer for each indicator.

## 5. Results and Discussion

The group of evaluators composed of EEC Department faculty, engineers, people who are in the field of broadcasting and the beneficiaries were requested to evaluate the acceptability of the Station in terms of the following criteria, namely: 1) Physical Features, 2) Cost, 3) Durability, and 4) Operation (**Table 3**).

### 5.1. Physical Features

Based on the result of the evaluation, the appearance of the project was generally very acceptable as shown by the computed over all mean of 4.26.

### 5.2. Cost

The group of the evaluators proved the acceptability of the research project as far as appearance and construction is concerned.

The evaluators strongly agreed, as revealed by the computed mean = 3.36 for the cost of research study materials used are locally-available with standard quality and some of the materials and components are slightly used to be alternative source to attain reasonable costing (**Table 4**).

### 5.3. Durability

The table shows the materials used in the Solar Powered Cell Phone Charging station are of quality standard as revealed by an average mean of 4.05 which means that the materials used in Very Acceptable (**Table 5**).

### 5.4. Operation

Since the instructions on how to use the device were clearly printed on the front panel, the evaluators needed no assistance on how to operate it and rated the device with a mean rating of 4.17 with a descriptive rating of Very Acceptable. And since it is solar powered it requires minimal maintenance. Thus, in terms of operation, the device was evaluated with a mean rating of 4.21 with a descriptive rating of Very Acceptable (**Table 6**, **Table 7**).

**Table 3.** Mean & descriptive ratings for physical features.

| Physical Features | Mean | Interpretation |
|---|---|---|
| Physical features workmanship<br>– The quality imparted to a thing in the process of making. | 4.3 | Very acceptable |
| Acceptability of the circuit sub-assemblies<br>– Easy to use or understand | 4.2 | Very acceptable |
| Labelling of the parts well presented<br>– Slip of paper, cloth, or other material, marked or inscribed, for attachment to something toindicate its control and destination. | 4.3 | Very acceptable |
| **Average** | **4.26** | **Very acceptable** |

**Table 4.** Mean & descriptive ratings for cost.

| Cost | Mean | Interpretation |
|---|---|---|
| Material Cost<br>– Amount paid or required in payment for a purchase. | 3.3 | Moderately Acceptable |
| Development Cost<br>– Amount paid for the improvement of the project. | 4.0 | Very Acceptable |
| **Average** | **3.36** | **Moderately Acceptable** |

**Table 5.** Mean & descriptive ratings for durability.

| Durability | Mean | Interpretation |
|---|---|---|
| Quality of materials used pre-established measure of the quality of a material, expressed in physical units. | 4.1 | Very Acceptable |
| Rigidity of construction<br>– The property of a substance that renders it inflexible, stiff, or no pliable. | 4.0 | Very Acceptable |
| **Average** | **4.05** | **Very Acceptable** |

**Table 6.** Mean & descriptive ratings for operation.

| Operation | Mean | Interpretation |
|---|---|---|
| Easy to operate/user friendly<br>– Functioning effectively; efficient. | 4.17 | Very Acceptable |
| Absence of the risk of electric shock<br>– The danger or probability of loss to an insurer. | 4.3 | Very Acceptable |
| Low Maintenance need<br>– not needing much effort or money. | 4.1 | Very Acceptable |
| **Average** | **4.21** | **Very Acceptable** |

**Table 7.** Over-all mean and descriptive rating of the evaluation of the acceptability of the device.

| Criteria | Mean | Descriptive Rating |
|---|---|---|
| Physical Features | 4.26 | Very Acceptable |
| Cost | 3.36 | Moderately Acceptable |
| Durability | 4.05 | Very Acceptable |
| Operation | 4.36 | Very Acceptable |
| **Total** | **4.008** | **Very Acceptable** |

### 5.5. Findings

Based on the set objective of the study, the following findings were derived:

1) The solar panel appropriate for providing power for a cell phone charging station is an 80 watt solar panel.

2) Circuits and interfaces that can safely provide charging power for mobile phones are the Solar Cell Module, switching circuits for the coin switch and a regulator circuit for maintaining the voltage used for charging mobile phones.

3) Timing system utilized for limiting the charging time is a simple 555 timer monostable circuit.

4) Based on the evaluation conducted to determine the acceptability of the device, the device was deemed as highly acceptable by the respondents.

## 6. Conclusions

On the basis of the foregoing findings and the result of the evaluation, the following conclusions were derived:

1) The solar panel does not harness the optimum voltage during certain times of the day and has to be directed manually towards the direction of the sun.

2) The time programmed for charging (15 minutes) was deemed to be too short for charging cell phones.

3) The main charging station was considered by some to be too high for short operators.

## 7. Recommendations

Based on the foregoing findings and conclusions, the following recommendations were made:

1) Height of the charging station should be lowered.

2) Standard charging time should be 20 minutes.

3) A voice warning prompt should be programmed on the device to inform the user of the time remaining.

4) A sun tracker can be installed to the solar panel to automatically direct the panel for maximum energy harnessing.

5) It is highly recommended, that a follow up feasibility study be made to determine the business potential of the device.

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