



Senior Design 1 First Draft

# *UniverSOL Charge Station*

*The Smart Solar Powered Cell Phone Charging Station*

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## **Project Narrative Description:**

Cherished memories are important to every human on the planet. People are always looking for the best ways to remember the good days they had and the people they shared them with. Today's advances in technology have made this so much easier than ever before. Smartphones are now equipped with cameras with megapixels comparable to leading digital cameras on the market. They have internet that can surf the web at speeds just as fast as they can surf on their home computer. However, as more features are developed for smart phones, much more energy is needed to power them. In an app driven society, it is almost impossible to freely use all of the features of your phone without monitoring your battery levels. People are constantly surfing the web, updating their status on their social media, watching videos, and taking tons of pictures to digitally capture every moment of their lives. Since about one out of every five people on this planet own a smartphone, there is an ubiquitous demand for energy across the globe.

Many people can testify that there isn't anything worse than being in a special place surrounded by your best friends or family, and wanting to take a picture but your phone is dead. Our project is designed to help people avoid this situation and help them continue to have those memories recorded and shared with their friends. We have invented a solar powered charging station that can be placed within almost any establishment. Therefore, people can have the convenience of leaving their phones to be recharged and picked up later with a full battery.

Due to the advancements in science, we are now aware of the devastating effects that burning fossil fuels to produce energy has on our precious planet. So not only is there an incredibly high demand for energy, but there is also a demand for cleaner, alternative, and sustainable energy. Our design utilizes solar power to help meet these demands with zero carbon emissions. However, one of the biggest challenges for harnessing solar power is converting it into electrical energy efficiently. Due to a combination of natural conditions, a great amount of energy is lost within the system during its energy transfer. As a result, we've designed our solar powered charging station with advanced technology that can harness the sun's energy and charge cell phones at optimal efficiency. Plus, it's free to all of its users. The convenience of having a free charging station will bring in many customers for many businesses, and companies can easily gain revenue on this product by selling advertising slots.

The ultimate goal of our product is to not only supply an alternative and sustainable way to charge cell phones with renewable energy, but to build awareness of healthy environment practices by implementing “The Green Chart” feature. Once a person has entered their information and created a pin number using the color touch screen, “The Green Chart” feature stores every user’s charging profile in a secure account. This is so they can keep track of how much clean energy they’ve used, it’s positive effects on the environment, and essentially work their way up to a 100% Green status through a virtual reward system. Phones will be automatically locked and unable to be retrieved by anyone other than the one who puts their phone in the charging compartment. Parents can leave their phones charging in the charging box and then be able to go on a ride with their kids and get their fully charged phone back after the ride to take pictures and share their day with all of their friends on their favorite social network website.

This device doesn’t only give someone more alternative choices in energy to charge their phones, but it also serves as a promotional booth that attracts heavy traffic for businesses. With more battery level there is more of an option for people to share their pictures on their social media. It is cost effective and it utilizes renewable energy efficiently, as well as serving as a greener energy alternative by emitting zero carbon emissions. Therefore, this invention is a win for both sides and is great for everyone.

## **Specifications**

- 1 - Metal/Aluminum Enclosure (24" x 19" x 36")
- 6 - (10" x 6") Phone Charging Compartments
- 1 - 3.5" TFT Color Touch Screen
- 2 - Printed Circuit Boards (PCB)
- 1 - 16F Series PIC Microcontroller
- 1 - Buck - Boost/CUK Switch Mode DC to DC Converter
- 1 - 18.5V Rechargeable Lithium - Ion Battery
- 1 - 60W -100W 12V - 16V PV Solar Panel
- 1 - 16" x 2" LCD Screen
- 6 - LCD Screen Charge Status Indicators
- 1 - 12V Relay
- 1 - Voltage Regulator
- 6 - Red LED

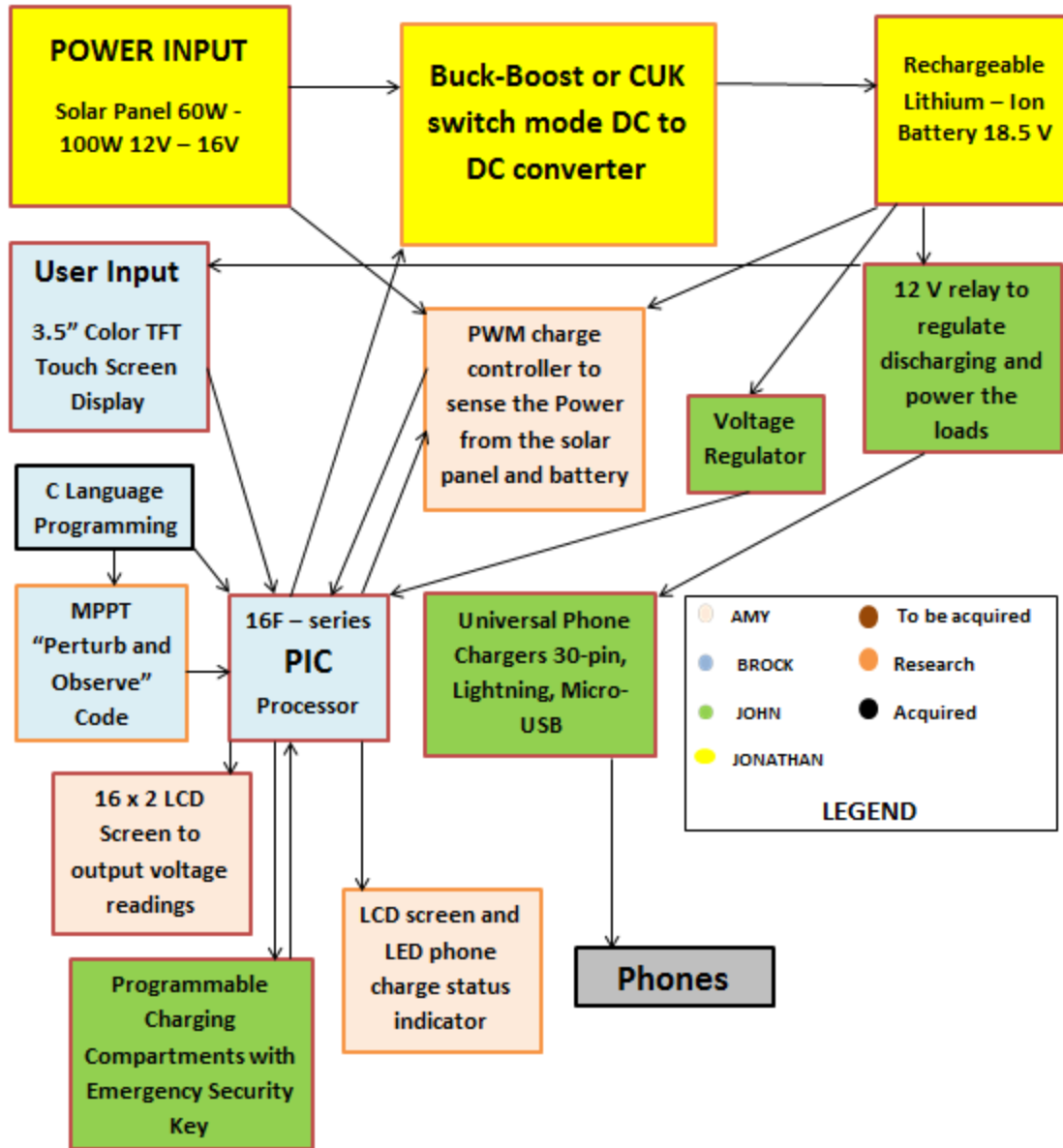
6 - Green LED

1 - PWM charging controller to work with the MPPT Algorithm

### **Requirements:**

- The PWM charge controller sensors measure the current and voltage from the solar panel and battery by using the PIC MCU's built in analog to digital converter
- The data is sent to the PIC MCU to run through the MPPT "Perturb and Observe" code, which will then test and match the impedances of the solar panel and lithium-ion battery.
- The PIC MCU will then send a signal to throw the switch of the DC to DC converter which will allow the battery to begin to charge at optimal efficiency.
- The voltage from the battery will run through a voltage regulator to supply the required 5V to operate the PIC MCU and 3V for the touch screen
- The voltage from the battery passes through a BJT controlled by the PIC and a 12V relay before being outputted to the load
- The PIC MCU is programmed to receive data from the user's inputs on the touch screen and store his/her's charging profile into a secure account.
- The State of Charge (SOC) of the phone's battery is outputted to the LCD screens to read from 0% - 100%
- Green LEDs indicate a full charge and Red LEDs indicate a still charging mode

## Block Diagram



## **User Charge Station Function List**

1. The user enters requested information and creates a permanent six digit pin on the touch screen to access a charging compartment.
2. The PIC MCU runs through a piece of code to validate the selected pin and creates a secure user account that will monitor charging activity to be recorded into a personal Green Chart. If the pin is not validated then the PIC MCU sends an outputs specific instructions to the touch screen for the user to create a different pin.
3. The PIC MCU sequentially outputs to the screen a list of user instructions and awaits for user ACK.
4. The user ACK triggers the available charging compartment to open it's door automatically.
5. The user then shuts the compartment door and removes the emergency security key.
6. There is an onboard cell phone battery tester that will also determine the current state of your battery, whether it is good or defective and needs replacement.
7. The State of Charge (SOC) of the phone is outputted to the LCD screen displaying the battery's charge percentage and time remaining, which is located on the face of the compartment door, plus a corresponding Red LED is turned on.
8. When the charge is complete, "Battery Charged 100%" is outputted to the LCD screen and the Green LED is turned on.

## Budget:

Item	Price per unit	Quantity	Total Cost
Aluminum enclosure (24" X 19" X 36")	\$100.00	1	\$100.00
Solar panel 12v-16v (36" X 18")	\$125.00	1	\$125.00
Rechargeable Lithium Ion Battery 18.5 V	\$110.00	1	\$110.00
6 compartments	\$20.00	6	\$120.00
Emergency key	\$5.00	6	\$30.00
3.5" TFT Color Touch Screen	\$45.00	1	\$45.00
Printed circuit board	\$100.00	2	\$200.00
Voltage Regulator	\$0.70	1	\$0.70
12V Relay	\$2.00	1	\$2.00
OP-AMPS	\$0.50	4	\$2.00
BJT	\$0.50	4	\$2.00
LED indicator lights	\$1.00	12	\$12.00
16" x 2" LCD screen	\$3.00	1	\$3.00
8" x 2" LCD screen	\$3.00	6	\$18.00
Universal Breakaway Cables	\$20.00	6	\$120.00
16F-series PIC MCU	\$1.00	2	\$2.00
PIC kit 3 Programmer	\$35.00	1	\$35.00
Miscellaneous (printing, tools, shipping)	\$100.00	1	\$100.00
TOTAL			\$1,026.70

\*Financing To Be Determined: Students will finance if sponsorship not obtained.

**Milestones:**

	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April
<b>Senior Design 1</b>								
Research								
Documentation								
Acquiring Parts								
Get computer set up								
Testing parts								
Programming								
<b>Senior Design 2</b>								
Building								
Testing software								
Testing Complete System								
Fix necessary bugs								
Complete Prototype								