

Electric Vehicle Charging Station

Hamzah Aber

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Matt Stobb

Brandon Umscheid



Group: May13-22A

Client: Paragon

Advisor: Dr. Bigelow

Electric Vehicle Charging Station

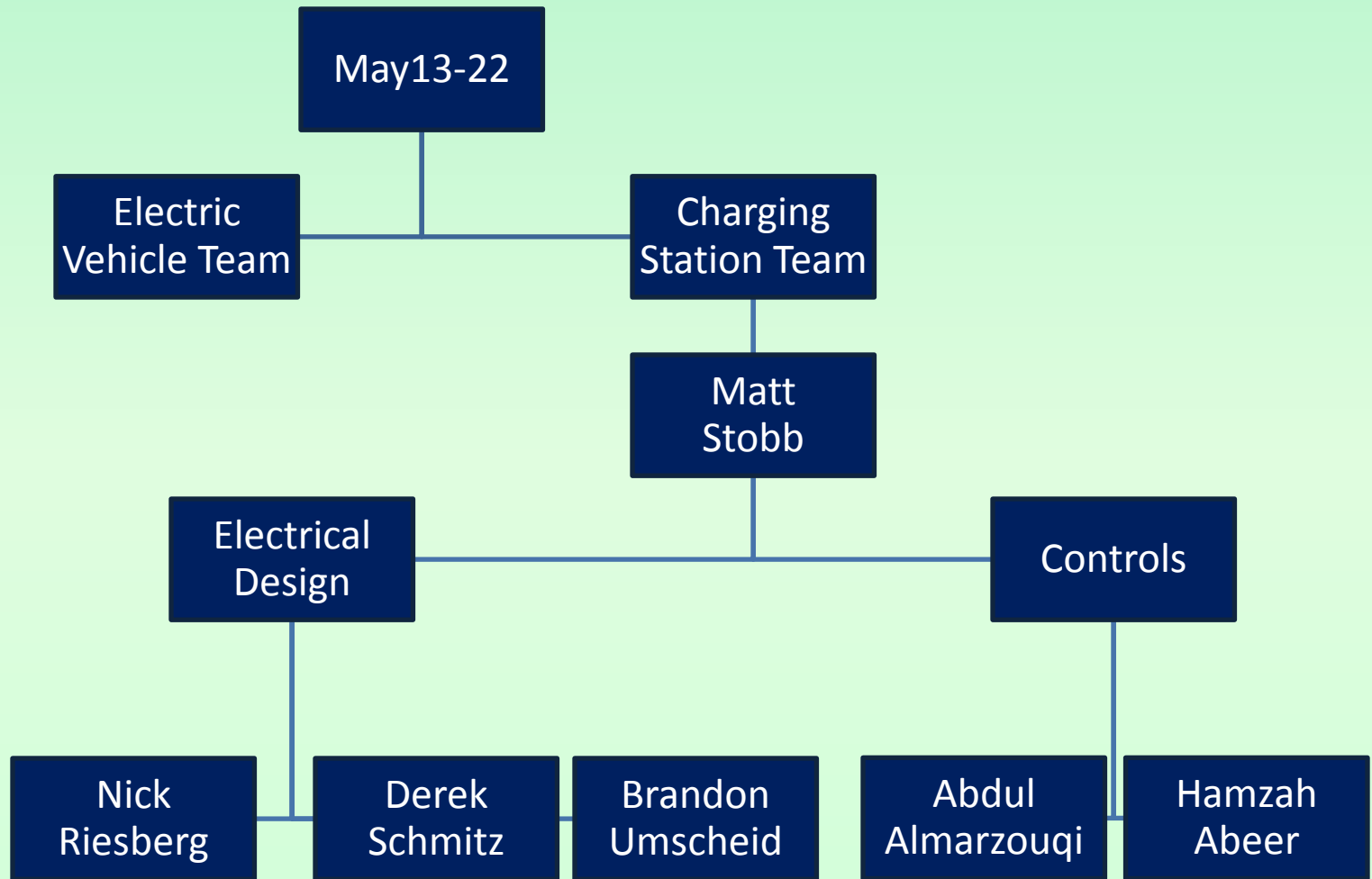
Background

Standards

Design

Microcontroller

Questions



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Electric Vehicle Charging Station

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- Based in Nevada, IA
- Family-owned company that started out making popcorn machines years ago
- Markets in 43 countries
- Main retail is concession stands and supplies
- <http://www.manufacturedfun.com/>

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Electric Vehicle Charging Station

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Our Mission

- Working with multi-disciplinary group to build an electric vehicle.
- Our task is to build a battery charger to recharge batteries for the vehicle.



Electric Vehicle Charging Station

Standards



2011 National Electrical Code

SAE Technical Standards

IEEE Standards



Electric Vehicle Charging Station

Background

Standards

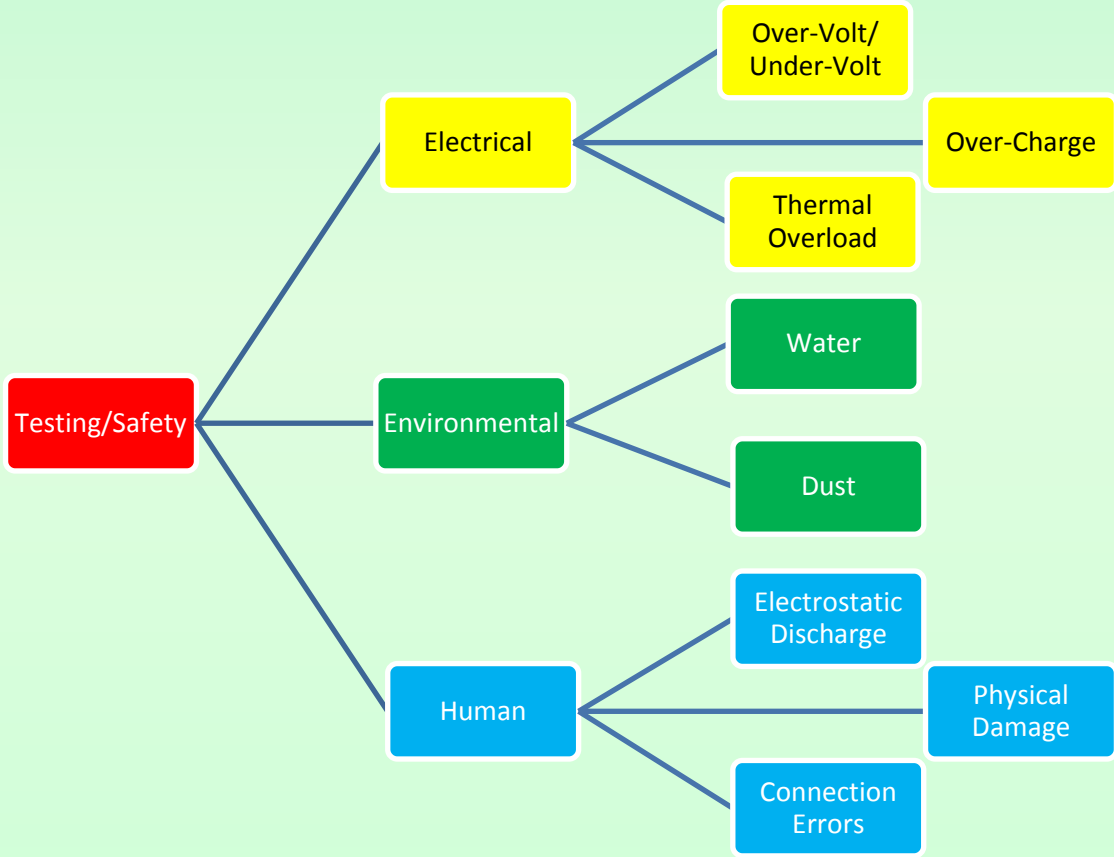
Design

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Safety Concerns



Electric Vehicle Charging Station

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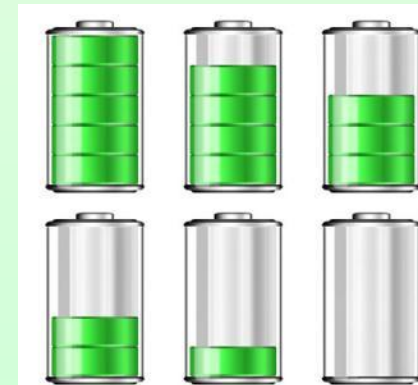
Design

Microcontroller

Questions

Requirements

- Rate of Charge must be at maximum 6-8 hours to reach full capacity
- The Charging Station must be designed will all current standards
- Charger maintains battery life for 3-5 years
- State of Charge (SOC) indicator



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Non-Technical Requirements

- Charger is Safe
- Charger is Reliable
- Easy to use
- May be used for different capacities



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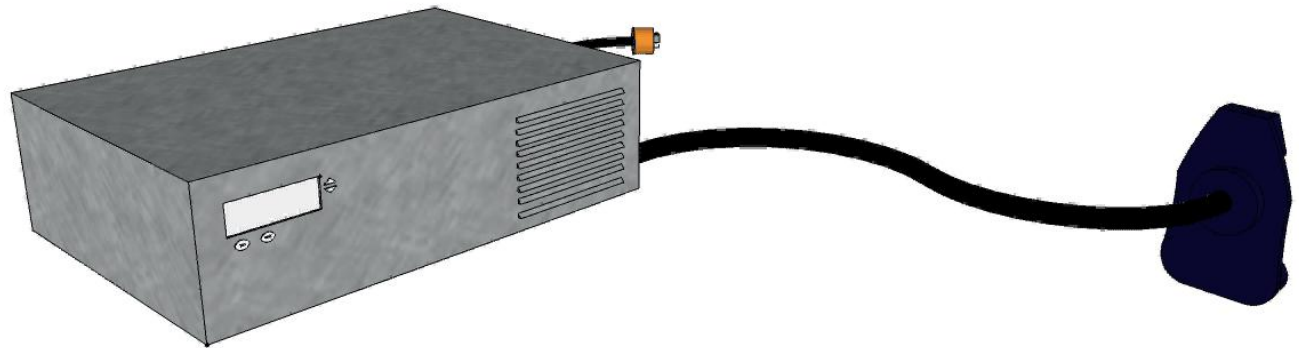
Standards

Design

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Conceptual Model



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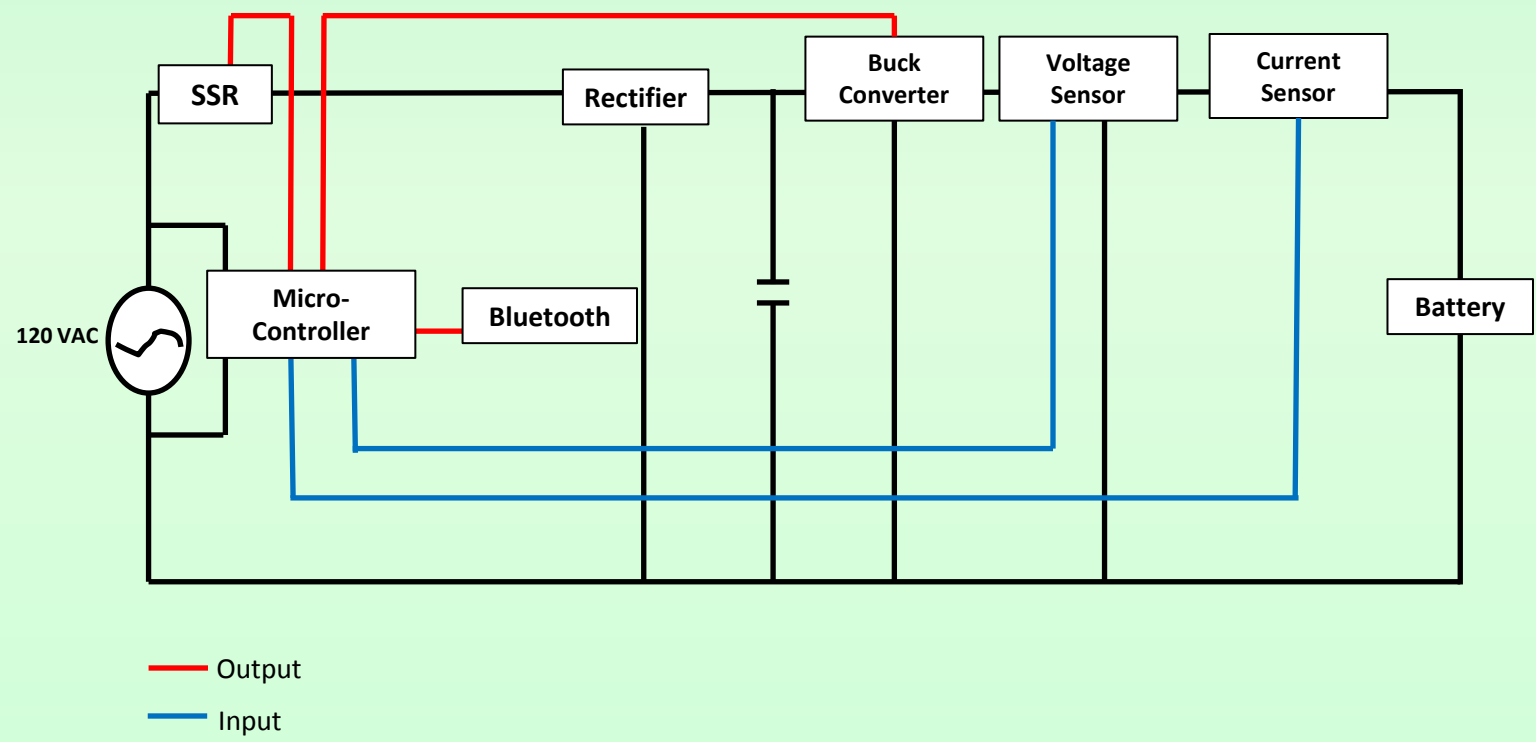
Standards

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General Layout – Update diagram



Presenter Brandon Umscheid

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Price List of Components

Component:	Model Number:	Distributor:	Request By:	Price (\$)	Shipping (\$)	Ordered (Y/N)	Arrived (Y/N)
Microcontroller	Atmega 128	Futurlec	Hamzah	29	0	Y	N
AC Wire (6Ft.) (12AWG)	---		Derek	\$10.00	\$0.00	N	N
DC Wire (6Ft.)(10AWG)	---		Derek	\$15.00	\$0.00	N	N
AC Rocker Switch	GRB066B802BR1	Digikey	Derek	\$2.43	???	N	N
Rectifier	VBE55-06NO7	Digikey	Derek	\$17.53	???	N	N
SSR	120D25	Opto22	Brandon	\$29.00	???	N	N
Temp. Sensor	DS18B20	SparkFunElectronics	Derek	\$4.25	???	N	N
Volt/Current Sensor	SEN-09028	SparkFunElectronics	Derek	\$19.95	???	N	N
LCD				\$2.00	???	Y	Y
AVR-ISP programmer		Futurlec	Hamzah	9	0	Y	N
MOSFET	IXFH80N20Q	Digikey	Derek	\$12.91	???	N	N
MOSFET	IXFH80N20Q	Digikey	Derek	\$12.91	???	N	N
Fuses				???	???	N	N
Bluetooth		H-Instruments	Hamzah	\$20.00	???	N	N
Future Things to Order							
Casing							
Circuit Board							
Buttons							
				\$154.98	\$0.00		

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Components

- Steady State Relay
- Rectifier
- Buck Converter
- Current and Voltage Sensors
- Microcontroller
- Bluetooth

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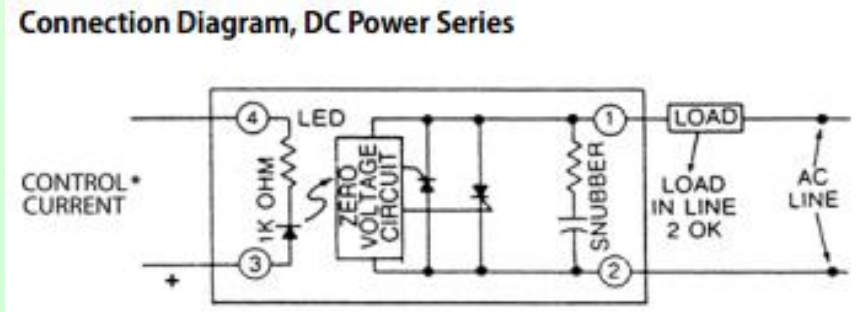
Design

Microcontroller

Questions

Circuit Shut Off

- Using a Steady State Relay (SSR) for the shut off.
- Uses a DC voltage sent from the microcontroller to be an On/Off switch.
- Has a built in snubber to help prevent unwanted turn on.



Presenter: Brandon Umscheid

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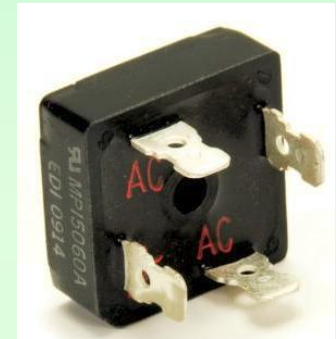
Microcontroller

Questions

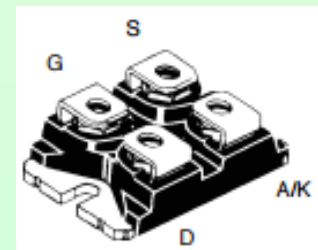
Rectifier and Buck Converter

- Full-Wave Rectifier converts stepped-down AC Voltage to DC Voltage.
- Buck Converter is an efficient DC-DC Voltage Converter that is controlled by a PWM signal from the Microcontroller.

Rectifier



Buck-MOSFET



Presenter: Derek Schmitz

Advisor: Bigelow

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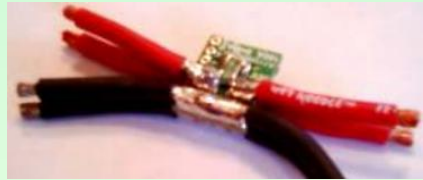
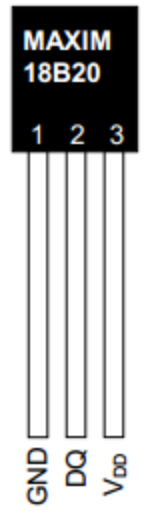
Microcontroller

Questions

Temperature Sensor

Sensors

Voltage/Current Sensor



Location on Circuit:

Connects Directly to Microcontroller

DS18B20

1-Wire interface

9 to 12 bit precision

Temp. Measure: -55° C to 125° C

Location on circuit:

Connected with microcontroller

In line with battery

Sen-09028

Small voltage and current sensor PCB

Measured over shunt resistors.

Scaled to a 3.3V ADC

Presenter: Nick Riesberg



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Design

Microcontroller

Questions

How the Battery Charges

- Charges at constant current then switches to constant voltage.
- Allows ability to charge Lithium Ion and Lead Acid.



Presenter: Nick Riesberg

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Advisor: Bigelow

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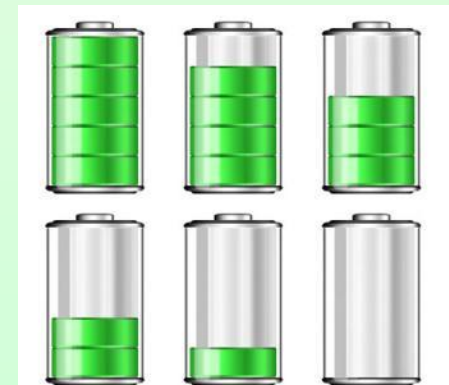
Design

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Requirements

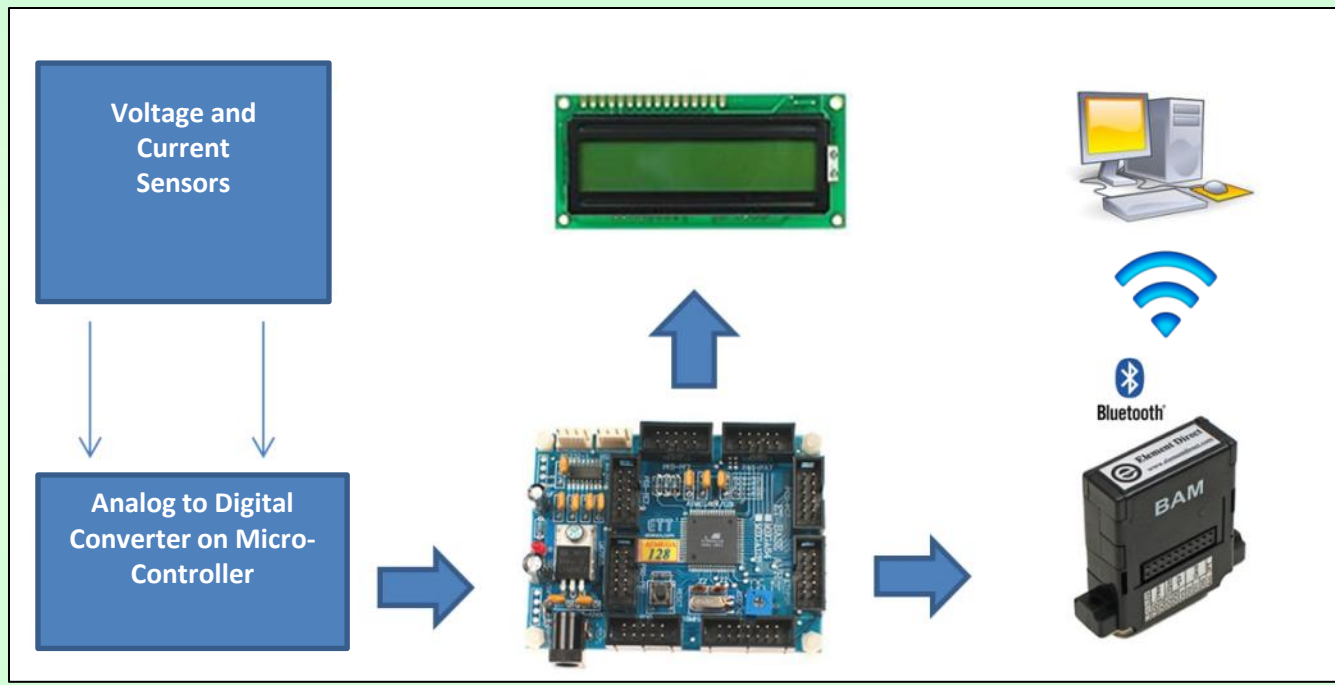
- State of Charge (SOC)
- Estimated time of charging
- Automatic shut-off
- Graphical User Interface



Presenter Hamzah Abeer

Electric Vehicle Charging Station

How it works



Electric Vehicle Charging Station

Background	Standards	Design	Microcontroller	Questions
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Arduino



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Functionality

- Programmed in JAVA code
- Controls charging voltage via PWM sent to Buck Converter
- Turns on the charging station via SSR
- Controls the user interface and charging station

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Questions

Objectives Achieved

- LCD
- PWM
- Shut-Off control
- Serial port communication

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Questions

LCD Display



24min 54sec 54%
12.6Volts .78AMP

LCD display acts as a user interface at charging station.

- LCD has two lines that will display
 - Line 1:
 - Estimated time to fully charged
 - Percentage Charge
 - Line 2:
 - Voltage Level
 - Current Level

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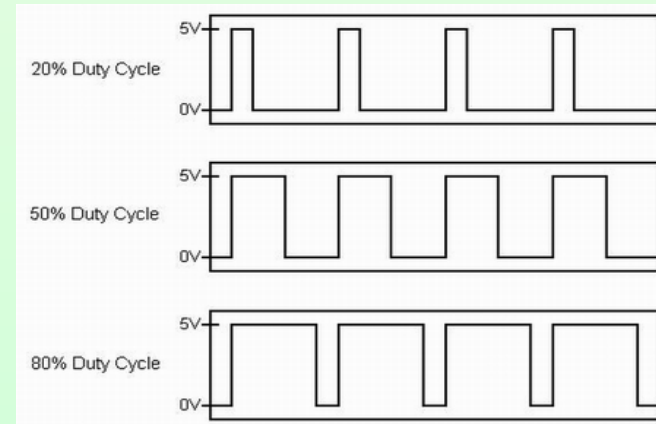
Design

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Questions

PWM and Shut-off

- Three different Duty cycle for three different voltage levels through buck converter.
- Shut-off circuit



Presenter Hamzah Abeer

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Still To Do

- LCD Buttons
- Bluetooth
- Graphical User Interface (GUI)



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Push Buttons

- 4 Push buttons
 - 1st is up arrow
 - 2nd is down arrow
 - 3rd is mode selection
 - 4th is turn charging on/off



Presenter: Abdulaziz Almarzouqi

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Questions

Bluetooth



Slave Wireless Serial Board

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Questions

Computer Interface

- Microsoft visual Studio to build GUI.
- Gives the user the ability to be remote, know the status of their battery charge and enable the user to shut-off the circuit.



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Questions

Questions?

Website: issuevcs.weebly.com

