

# eBaja Battery Team

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# What is the eBaja

- Electric version of the SAE Mini Baja
- Designed for off-road entertainment use



# Project Overview

- Increased usable energy by 128%
- Designed exchangeable battery system
- Implemented 52V or 104V operating voltage
- Solved some issues with the vehicle frame



# Problems with Previous Design

- Limited range
- Difficult to troubleshoot
- Small frame issues



# Primary Objective

## 1. Increase operational time

- a) Double usable capacity compared to previous lead acid batteries
- b) Create interchangeable battery packs
  - Change batteries in under 60 seconds
  - Single person needed to exchange battery pack
  - User required to lift under 50 lbs



# Secondary Objectives

1. Allow for “high performance” operating voltage
2. Create fuel gauge
3. Fix small frame issues



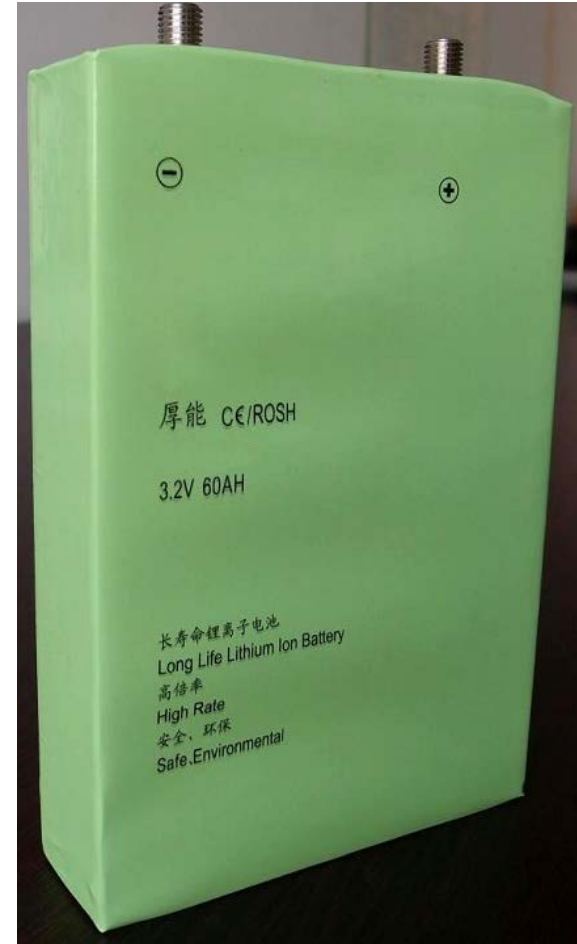
# Double Usable Capacity

- Change battery chemistry
  - Increase energy density



# Battery Cell

- New Energy LiFePO4
- 3.2 volt
- 60 amp hour
- 3.8 lbs
- 3700 charge cycles



[electriccarparts.com](http://electriccarparts.com)





# Double Usable Capacity

- Change battery chemistry
  - Decreased total mass by 130 lbm
  - Increase energy density
  - Increased usable energy

Lead Acid	LiFePO4	% Increase
2160 Wh	4915 Wh	128%

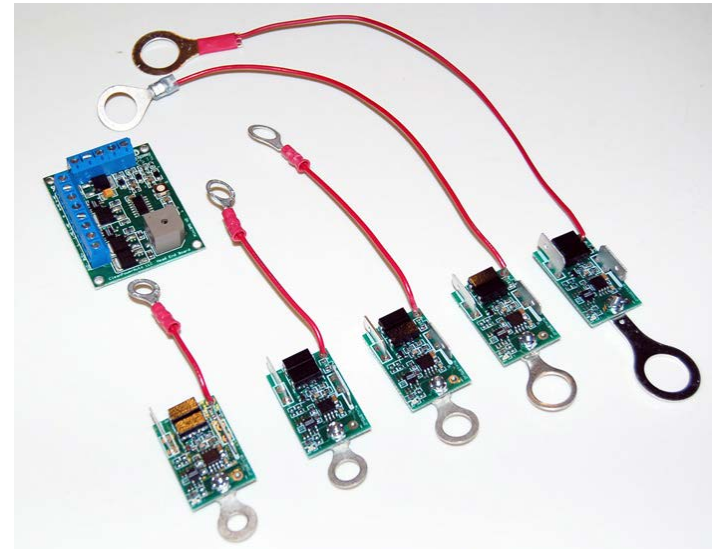


# Cell Voltage Balancing

- Battery Management System (BMS)

by CleanPowerAuto LLC

- Monitor cell V individually
- Limits throttle for low V
- Stops charging for high V



[cleanpowerauto.com](http://cleanpowerauto.com)



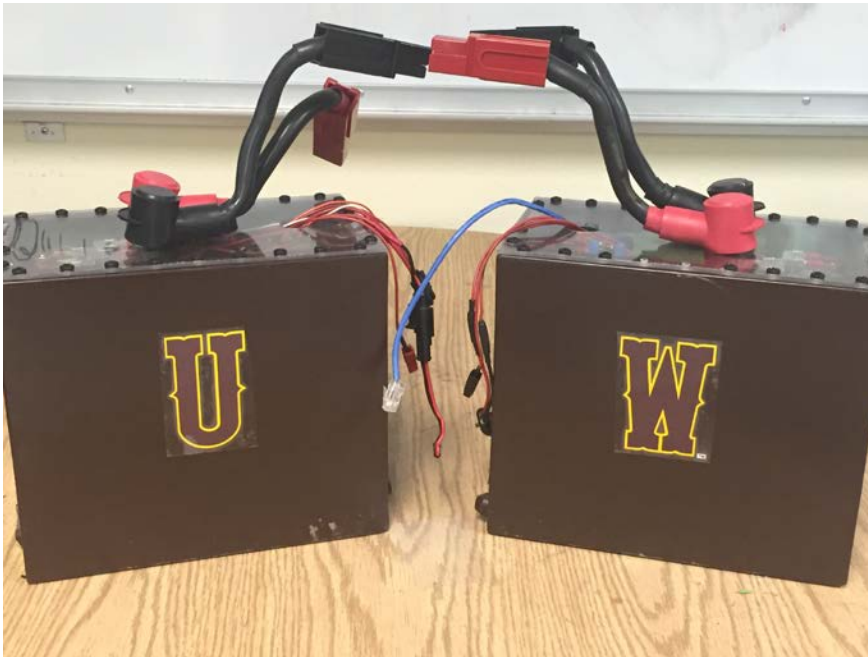
# Charging

- Charge time is limited by charger
- Current charger runs at 1.3 kW
- Charge time of 2 hours



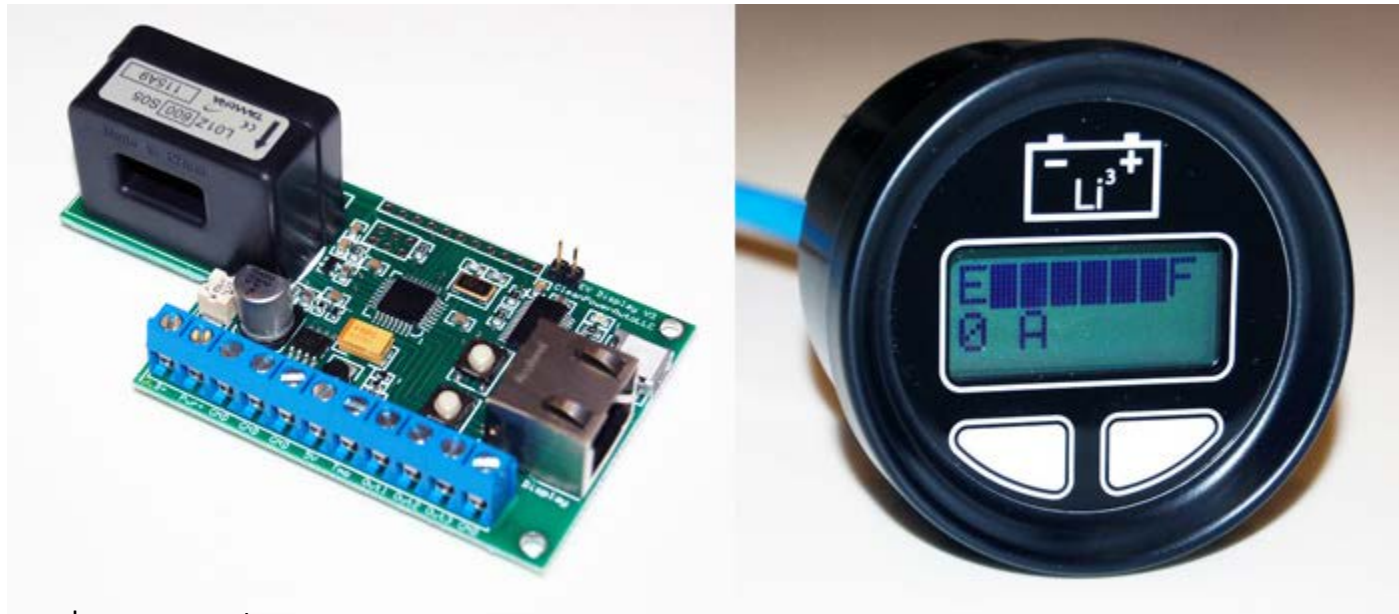
# Interchangeable Packs

- Break each 52V pack into two 26V banks



# Fuel Gauge

- EV Display by CleanPowerAuto LLC



cleanpowerauto.com



# Expenses

Item	Description	Company	Qty.	Unit Price	Shipping	Total Price
1	Batteries	New Energy	32	91.25	0	2920
2	Charger	Electric Car Pars	1	525	0	525
3	BMS head boards	MiniBMS	2	252	0	504
4	Battery display	MiniBMS	2	115	0	230



# Design Results

- 128% increase in usable energy
- Unlimited operating time with enough packs
- Decreased total vehicle mass by 200 lbm
- 52V or 104V operating voltage



# Design Results

- Single user battery exchange system
- User required to lift 36lbs
- BMS prevents over/undercharge
- Implemented fuel gauge display
- Solved frame issues





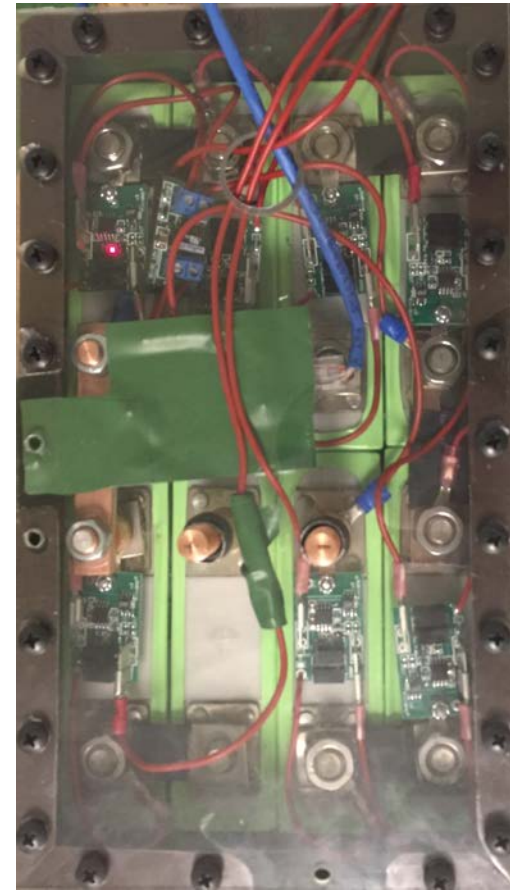
# Design Results

- Unable to exchange pack in 60 sec
- Non-permanent motor controller container
- Problems keeping battery voltages level
- Connections are all red to black



# Failure Modes Analysis

- Improperly wired batteries
  - Consistent wiring
- Batteries overheating
  - Temperature monitor
- Battery box dropped or overturned
  - Metal box with heavy foam securing batteries



# Questions?

