OFF-GRID POWER SYSTEM FOR INTELLIRED™

AN AUTONOMOUS LEAK DETECTION SYSTEM

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Introduction

The InteliRed™ system by Providence Photonics is an autonomous gas leak detection system. Using an infrared camera and computer vision algorithms, the InteliRed™ system can be used to prevent disasters like the Aliso Canyon gas leak that dumped an estimated 97,100 tones of methane into the atmosphere.

Objective

The goal of our project is to provide off grid power for the InteliRed™ system. We decided to do this with a Solar panel and charge controller as well as a custom Li-ion battery pack and battery management system

Design Objectives.

- Power Intelired System for 24hrs
- Send wireless communications

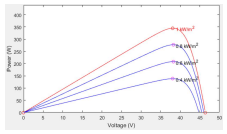
Solar Panel

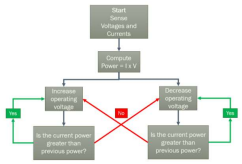
LG Neon®2 335N1C-A5

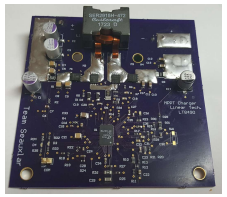
- 335 Watt, 19.6% Module efficient
- 6 x 10 Cell, Monocrystalline / N-Type
- Maximum Power (Pmax) = 335W
- MPP Voltage = 34.1V
- MPP Current = 9.83V

MPPT Charger

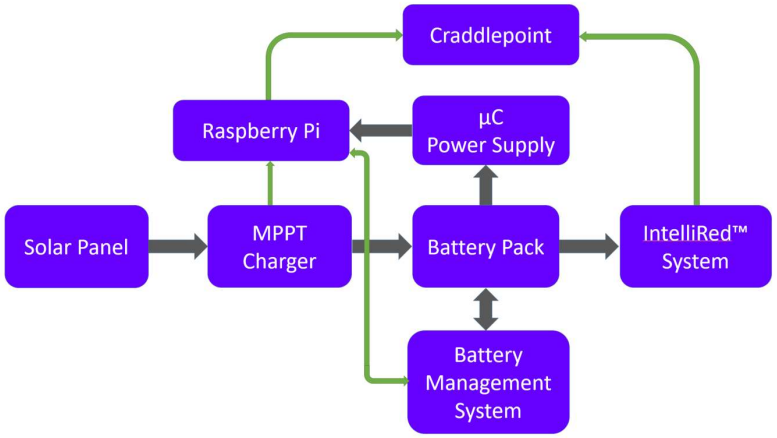
Maximum power point tracking charger track and operate at the maximum possible power output of the solar panel at any given time.

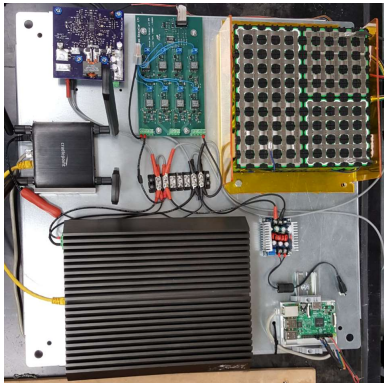






- Linear Tech. LT8490 IC
- Perturb and Observe tracking algorithm
- 60V Max. panel voltage
- 10A Max. input current
- 16V Max. charging voltage
- 16.6A Max charging current





Battery Pack

- 100 LG MJ1 chemistry 18650 cells (3.6, 3.5Ah)
- 4 x 25-parallel in series
- Pack specification: 14.4V, 87.5 Ah, 12.6kWh
- Note: Battery cell voltage adds in series, capacity adds in parallel

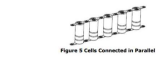


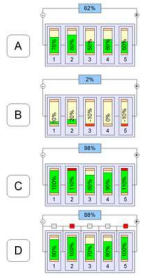
Figure 3 Cells Connected in Parallel
Two cells in parallel: 2 x 2.5Ah = 5Ah (nominal for 26650 cells)
Three cells in parallel: 3 x 2.5Ah = 7.5Ah (nominal for 26650 cells)

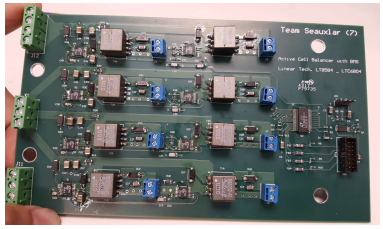

Figure 4 Cells Connected in Series
Two cells in series: 2 x 3.3V = 6.6V (nominal)
Three cells in series: 3 x 3.3V = 9.9V (nominal)

Battery Management System

- Active Cell Balancer
- Based on Linear Tech. LT8584 and LTC6803-1
- Monitor voltage, current, temperature, and state-of-charge
- Communicates via SPI

- Note: Active call balancing is when a battery pack equalizes the voltages between the series cells by distributing the charge of the most charged cells to the less charged cells.





Results

- Solar panel applied appropriate power to the MPPT
- MPPT supply sufficient voltage and current to the MPPT charger
- Battery pack is large enough to power the system
- The battery management system was not able to communicate with the Raspberry pi through SPI, therefore it can not be use at this point.

Microcontroller

- Receives statues/fault through UART from the MPPT charger
- Receives battery cells parameters from the battery management system.
- Command the BMS to discharge/balance cell.

Wireless Communication

- Craddlepoint Router
- Verizon 4G LTE
- Download rates: LTE 50Mbps
- Upload rates: LTE 50Mbps

Special thanks

- Jon Morris / Photonic
- Dr. Jin-Woo Choi
- John Scalzo
- Chris O'Loughflin
- Trey Cozic
- SUNPRO Solar