DALHOUSIE UNIVERSITY
Faculty of Engineering

Smart Battery Monitor

ALTO SOLAR

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Abstract

- The need for clean and renewable sources of energy is increasing exponentially. Solar energy plays a vital role in making renewable resources more sustainable.
- The world is constantly progressing towards a more "smart" environment as IoT (internet of things) models are implemented in day to day life.
- Development projects that engineers implement in rural areas are difficult to track when they leave
- Personal use of solar energy is difficult for the average person

Scope of Work

- Our **SMART BATTERY MONITOR** serves as a bridge between renewable energy storage & IoT applications.
- It monitors and logs the battery's historical data, in local & remote servers that can be accessed using the mobile application.
- It can be used to monitor projects in developing countries by Canadian engineers
- It makes using solar energy for commercial & personal use easier to monitor & understand

System Architecture & Design

Fuel Gauge IC

- Measures parameters such as voltage, current, temperature, capacity and charge percentage
- Can be calibrated to different battery types and sizes
- **Tested** by using adjacent software to verify data

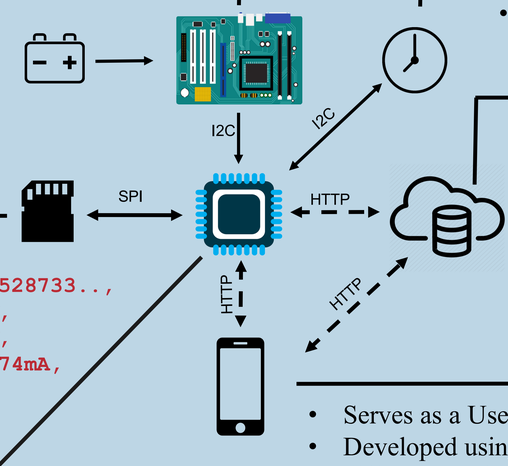
SD Card

- Local storage of battery parameters for user access in the absence of Wi-Fi connectivity
- Data is saved in JSON format for processing by the application

```
{
  "TIMESTAMP":15528733..,
  "VSOC":71.900V,
  "VCELL":4.505V,
  "CURRENT":167.74mA,
  "TEMP":22.77°C
}
```

Microcontroller

- Physical layer that connects all modules and is a user interface.
- Self-generated Wi-Fi used to configure the monitor initially.
- Runs RTOS to allow context switching & avoid data collisions.



Real Time Clock

- Keeps accurate track of time in the absence of power. Uses UNIX Time Standard.

Server

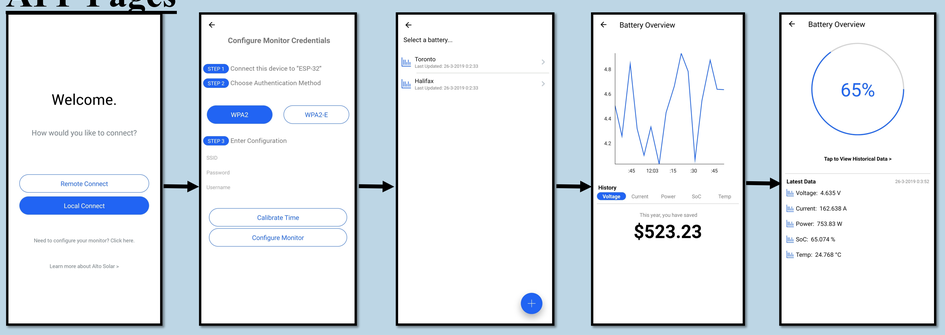
- Server Stack: Node.JS, MySQL, Express.js
- Uses HTTP protocols to handle incoming data from microcontroller and requests from app
- Converts between MySQL and JSON
- **Testing:** Verify data storage with microcontroller and data retrieval with app

Application

- Serves as a User Interface for human – machine interaction
- Developed using React Native (Web Framework) for portability between different platforms
- Uses HTTP protocols to push and pull from processor and server
- **Testing:** Unit test all functionality in application pages
- Verify communications between processor and server

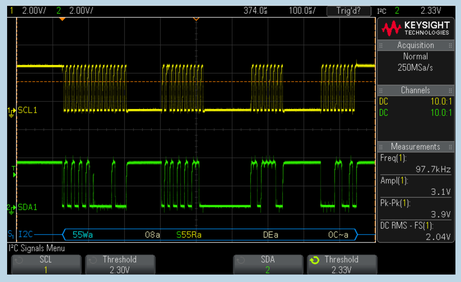
Testing & Results

APP Pages

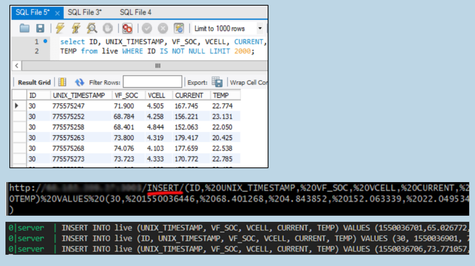


Communications

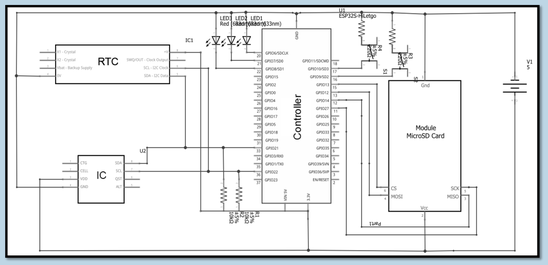
- I2C Testing:



- Server – Processor – App Communication Testing:



Circuit Schematic



Acknowledgments & References

- **Thank you to our professors, lab technicians and client – Tomi Allen – for their non-wavering support and guidance.**

- Boost, M. and Bizourd, J. (2003). REMOTE BATTERY PLANT MONITORING SYSTEM. US6532425B1.

- **DISCLAIMER:** Part numbers & specifications have been redacted due to confidentiality reasons.

Future Steps

- Compatibility with lead acid batteries in addition to the Lithium Ion chemistries.
- Improves app aesthetics and responsiveness
- Synchronization of local and remote storage at all times
- Improve enclosure durability

Conclusion

- A proof of concept of the battery data acquisition via I2C communication was achieved
- The overall system architecture was verified
- The ability to store data remotely and retrieve it using a custom app was confirmed
- The feasibility of the overall system working without internet connection has also been confirmed