Introduction

- Contents of your backpack are everything you have
- Forgetting or losing items are constant worries
Features

- Automatically track items in and out of a backpack
- Notify the user when an item the user wants is missing
Battery Subsystem

- Lithium Ion Battery
- Lithium Ion Charging Unit
- LCD Display
- Linear Voltage Regulator
Data Control Subsystem

- RFID Readers
- Microcontroller
- Photoresistor
- Bluetooth module
Mobile Application

- Maintain database of items
- Associate items with calendar events
Battery Subsystem

- 130 mA consumption, 16 hour goal
- Battery, regulator met their constraints
- Regulator difficult to keep in good condition
  - Small footprint
  - Caused problems for voltage sensitive parts
RFID Reader/Photoresistor

- SPI communication
- Problems with initialization, interference
- Photoresistor voltage threshold tuning
- Problems in PCB design
Microcontroller

- Used SPI, I2C, and UART
- Reading photoresistor, battery voltage
- Difficulty reading 2 RFID tags
  - Polling to interrupt driven
- Halting for double-reads from RFID
Bluetooth Module

- Difficult to set up
- SPP vs iAP
- Workaround

RN42-I/RM

RN42-APL
Local Server

mongoDB

node.js
Items Database

- Responsibilities split between server and app
  - Server
    - Connect to bluetooth module and get info
  - App
    - Prompt user with new items
Event Planning

- More limitations of iOS
- Background Fetch
- Push Notifications
Final Product

▪ External power source
▪ Battery display did not read charge
▪ RFID readers, photoresistor, microcontroller, bluetooth worked
▪ Bluetooth to server to application
▪ Application worked
Improving the Hardware

- Voltage regulator tolerance
- RFID readers antennas
  - HF, 13.56 MHz with better antenna for read distance
- Bluetooth module can be generalized
Improving the Software

- Item database is the starting point
- Machine learning
  - Location
  - Time
- Forgotten Items
Product-Market Fit

- Backpacks ignored by IoT community
- Sounds unnecessary -> becomes essential
Thank You.