Rehab Tracker

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Outline

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- Introduction of Rehab Tracker
  - Overview
  - Components
- Progress From Last Year
- What I have Done
  - Documentation
  - Arduino
- Difficulties
- What I Would Do Differently

Overview

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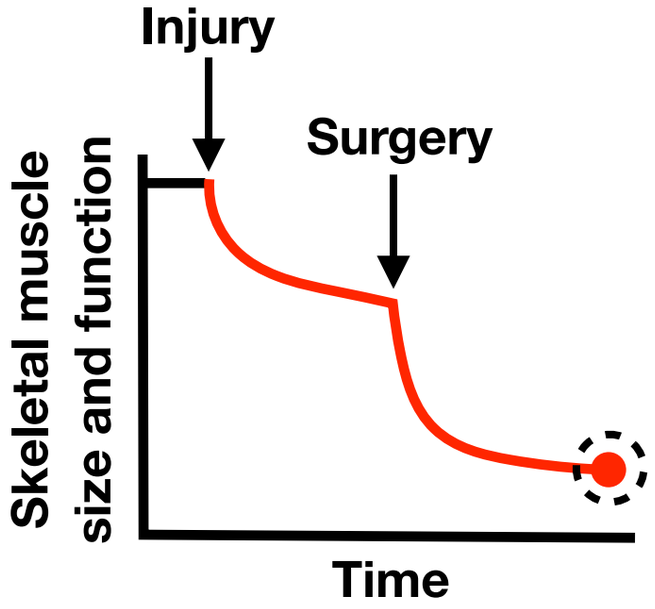
- Target - Patients with ACL injuries
- Clinical Problem - Skeletal muscle deteriorates after injury and surgery
- NMES - Neuromuscular electrical stimulation is FDA-approved for the prevention of skeletal muscle atrophy after orthopedic injury/surgery



RehabTracker: Improving Muscular Rehabilitation Compliance
Michael Toth, PhD (Larner College of Medicine)
Christian Skalka, PhD (Computer Science)
University of Vermont

Overview

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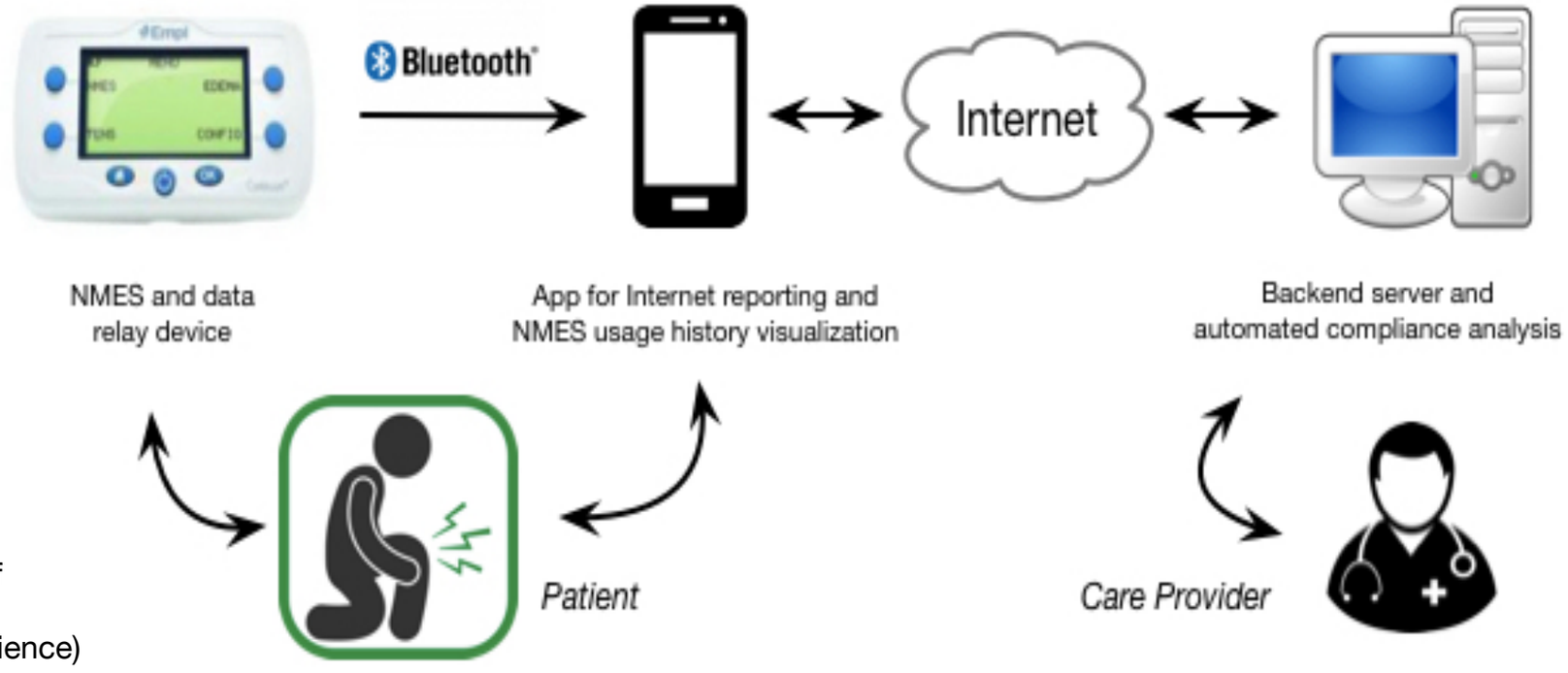
- Problem - Home-based rehabilitation causes very low compliance rate
- Solution - Increase monitoring and interaction between patients and clinicians



RehabTracker: Improving Muscular Rehabilitation Compliance
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Components

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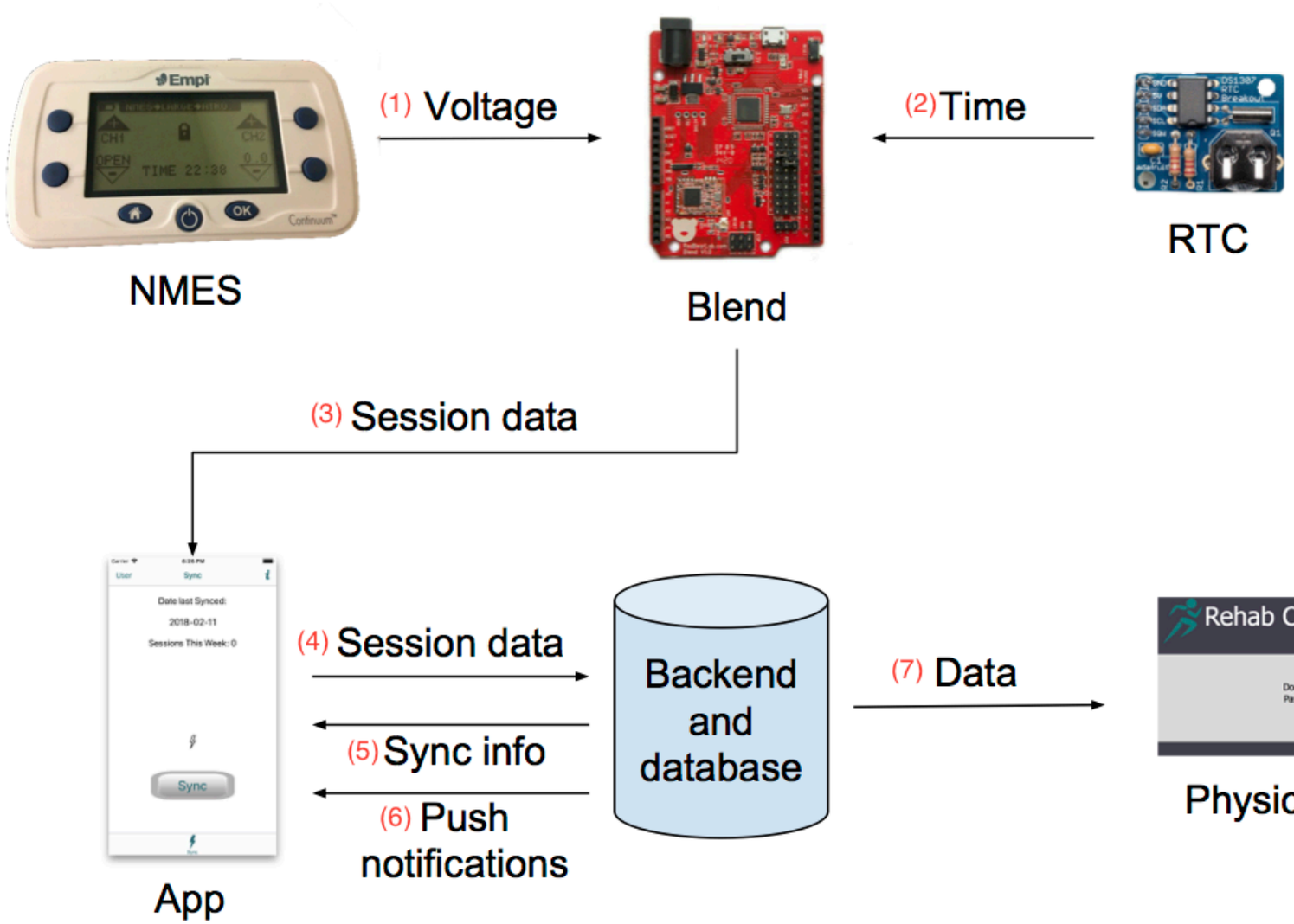

Progress

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- Porting to LCOM server platform
- Push notifications
- Improving the app’s usability
- Integration of real-time clock on device
- Pulling data from the device
- Documentation
  - http://www.uvm.edu/~cchao/html_doxygen/index.html

Documentation

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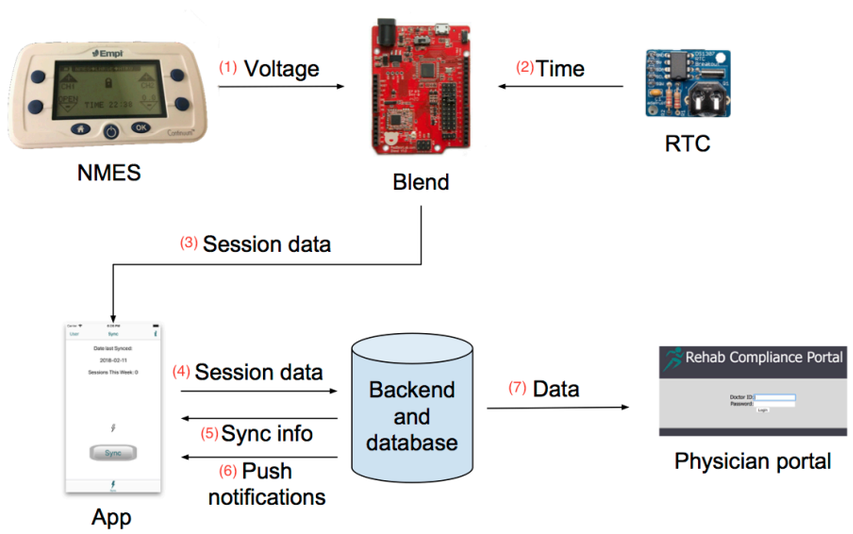
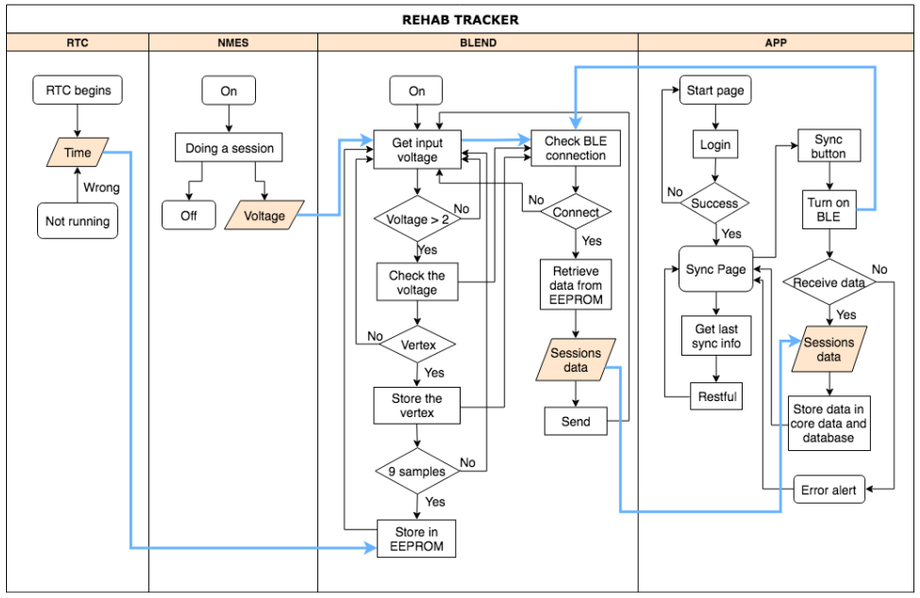
- Created figures of components and flow chart
  - http://www.uvm.edu/~cchao/html_doxygen/index.html
- Provided tutorials for installing Arduino and using documentation tools
  - http://www.uvm.edu/~cchao/html_doxygen/install_arduino.html
  - http://www.uvm.edu/~cchao/html_doxygen/ducumentation_tutorial.html





Documentation — Tools

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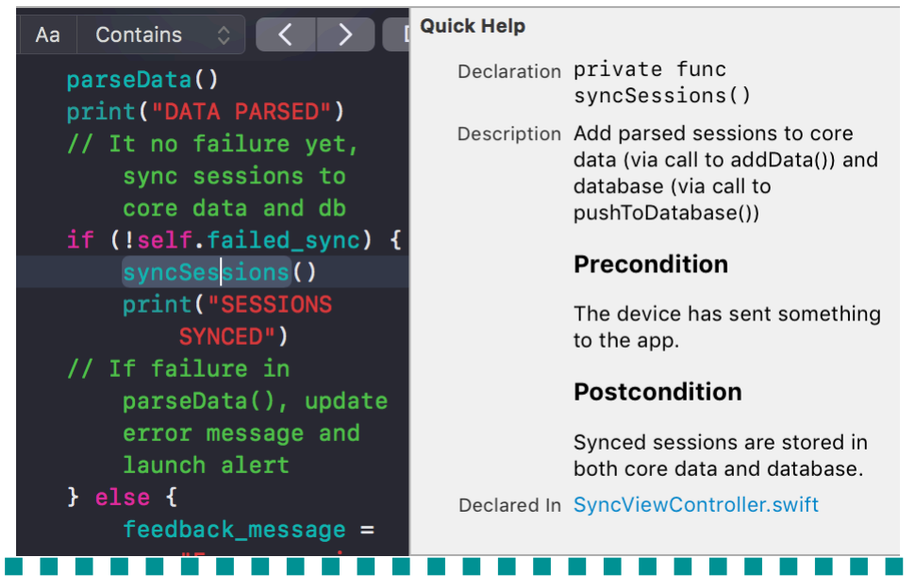
- Added comments in more detail and followed the documenting rule provided by Doxygen
  - http://www.uvm.edu/~cchao/html_doxygen/index.html
- Figured out purpose of each Swift file and documented functions and variables using Jazzy
  - http://www.uvm.edu/~cchao/jazzy/index.html



Documentation — Github

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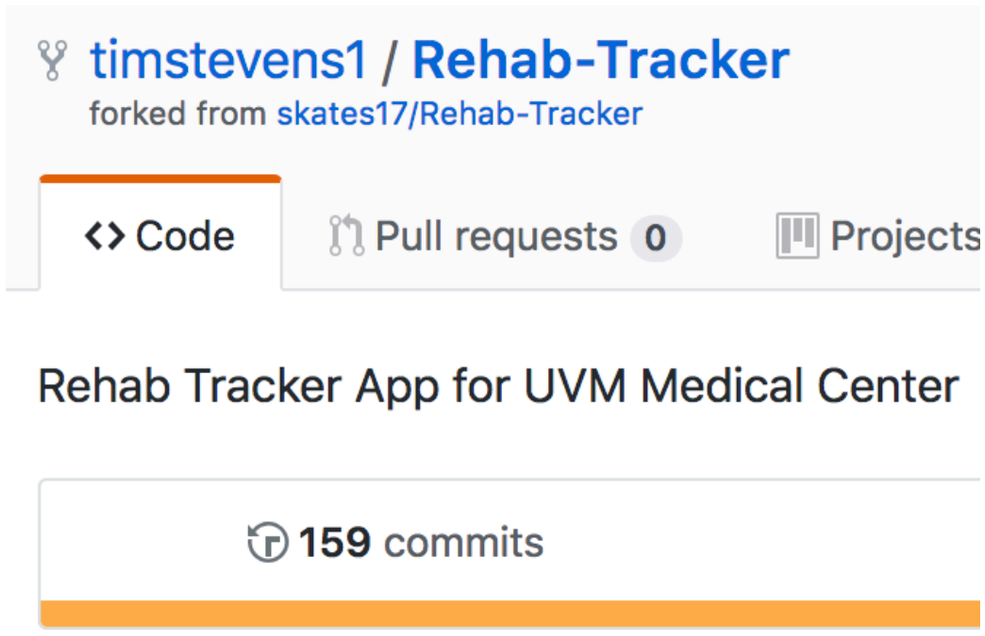
- Edited README files on Github and used them in the documentation
- Cleaned Github by removing unused files to avoid confusing future developers
  - https://github.com/timstevens1/Rehab-Tracker



Arduino — General

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- Recreated the environment and fixed broken code
- Adjusted intensity value based on input sensor value
  - Intensity = Input voltage / 10
  - http://www.uvm.edu/~cchao/html_doxygen/_arduino_8ino.html#a992780a393bb17ed9c6f96a1822808fa
- Reduced memory usage to prevent unstable result
  - Sketch uses 23920 bytes (83%) of program storage space. Maximum is 28672 bytes.
  - Global variables use 1411 bytes (55%) of dynamic memory, leaving 1149 bytes for local variables. Maximum is 2560 bytes.

Arduino — EEPROM

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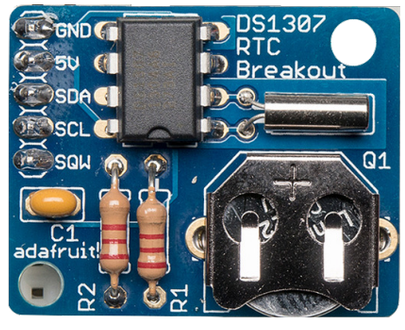
- Installed real time clock and stored Unix Timestamp in EEPROM
- Changed the way of storing data in EEPROM and reading data for multiple sessions
  - http://www.uvm.edu/~cchao/html_doxygen/_arduino_8ino.html#ae938d2541a15a3cec4e6c47b92795112
  - total session count: int 2 bytes
  - current session number: int 2 bytes
  - array average 1 & array average 2: float 4 bytes each
  - session compliance: float 4 bytes
  - start time & end time: long 4 bytes each



Arduino — Pull Protocol

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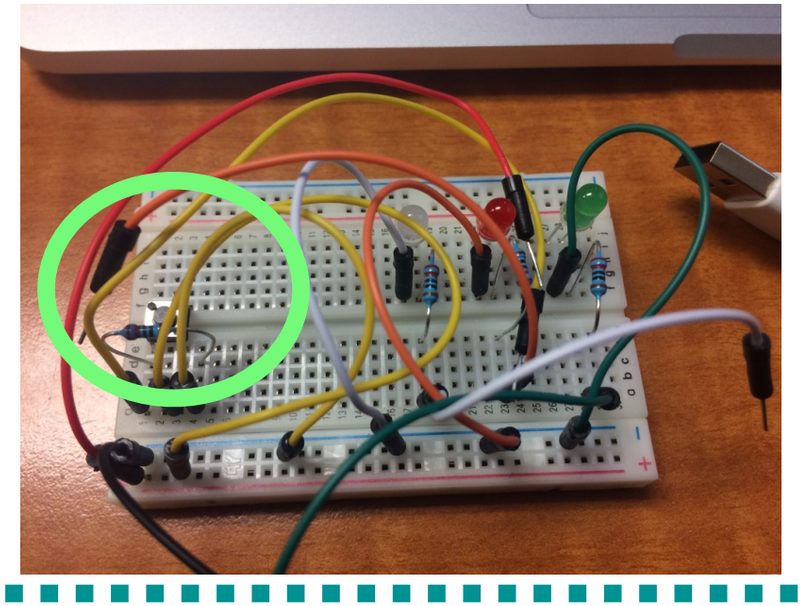
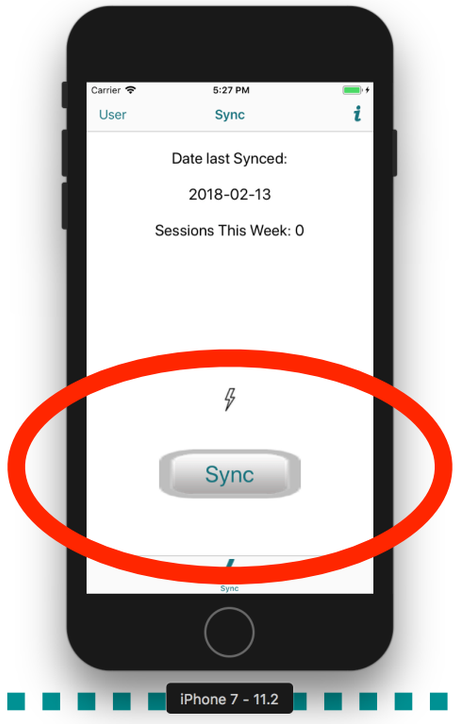
- Rewrote Swift code for bluetooth connection and data transmission
- Changed the pull protocol to start transmission via pressing the button in the app instead of on the Blend board
  - http://www.uvm.edu/~cchao/html_doxygen/_arduino_8ino.html#a52573902bb826815aa77a3d47254c860





Difficulties

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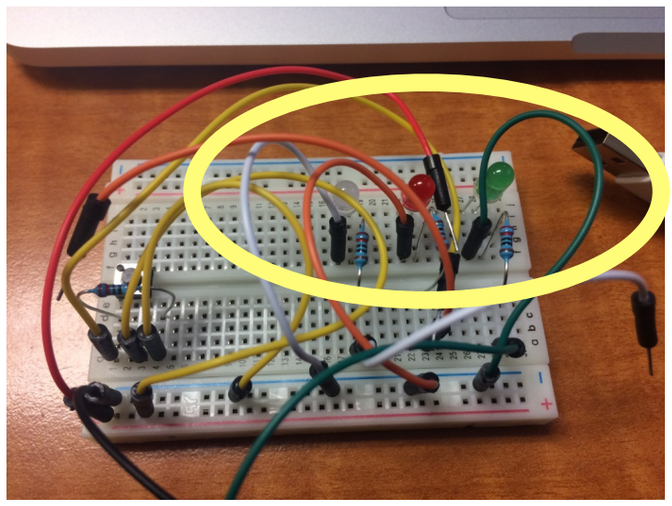
- Arduino
  - Understanding code with too few comments
  - Unstable board caused by using too much memory
  - Failure in transmitting data to the app (Swift updated)
  - LED Relay interfering with RTC Data
- Swift
  - Swift is updated every year



Difficulties

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- Documentation
  - Documenting files without description of their purposes
  - Doxygen is not friendly to PHP (Doxygen requires that all PHP statements is wrapped in a functions/methods, otherwise you may run into parse problems.)
  - http://www.uvm.edu/~cchao/html_doxygen/files.html
- Jazzy doesn’t give detailed instructions of the configuration

What I would do differently

- Follow the rule provided by documentation tools and write comments from the beginning
- Name every project and file without space
- Keep notes for problem-solution and process to follow
- For a development board, keep everything simple

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Q&A