LoRa Gateway Power Management

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Inherited Kerlink LoRaWan gateway with solar-powered DTN router assembly

Was mounted on roof in TCD from January - September 2017

What Is It?

- LoRaWAN stands for Long Range Wide Area Network, which is a specification used mainly by battery operated devices in the Internet of Things.

- Devices use LoRaWAN to connect to the gateway, and they can then use this connection to remotely report data they have collected

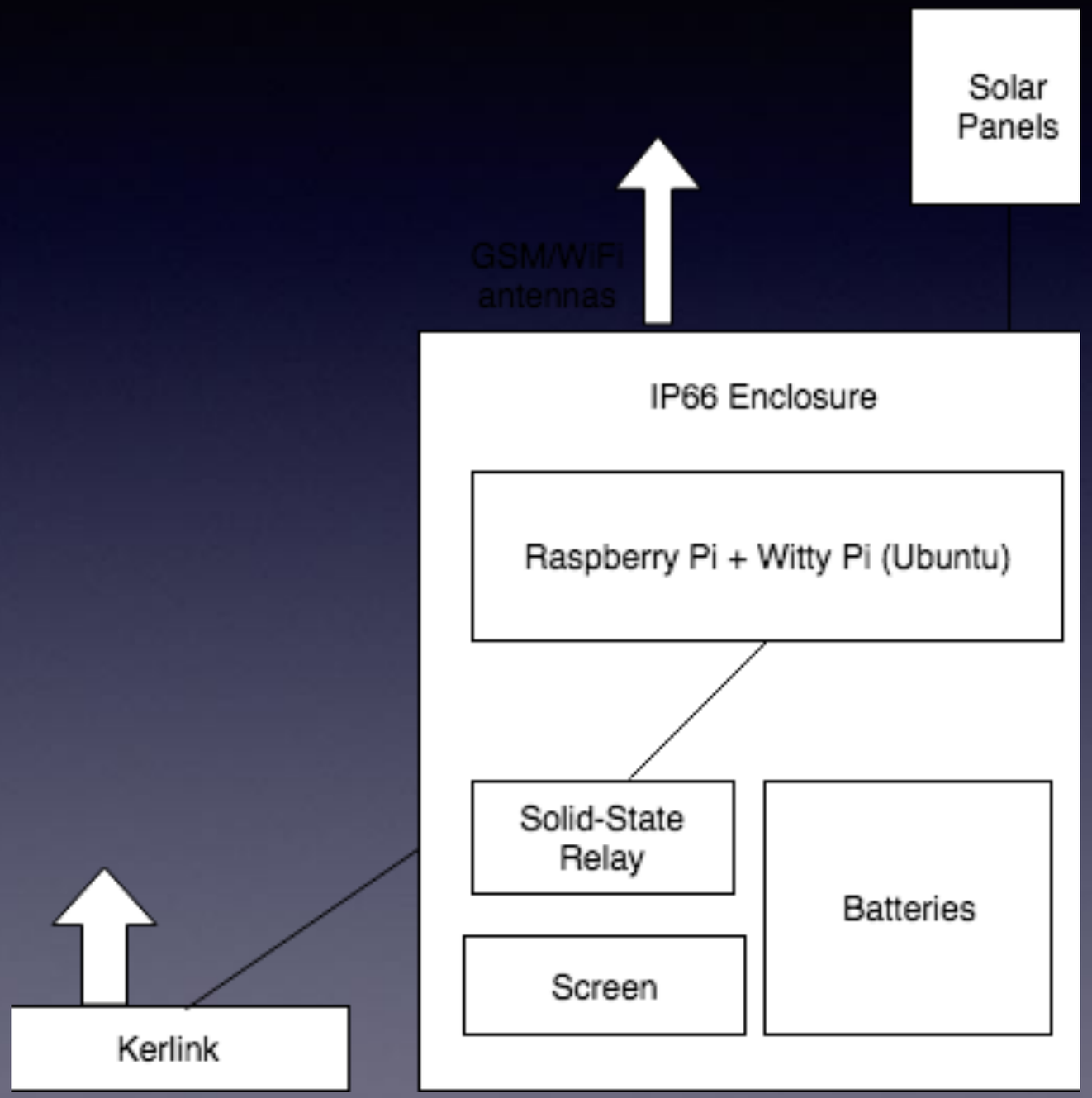
- The gateway is solar-powered, so its operation is dependent on the weather at the time - “Up” state if weather is good, “Low power” or “Sleep” state if weather is poor for extended period of time

Setup

- Previous build used Eurotech Board Controller (which died)

- Replaced Board with Raspberry Pi + Witty Pi for power management and RTC, and Solar Charge Controller

  - See references slide for more details



Goals

- Get old daemon working with new setup - Raspberry Pi, Witty Pi
- Rewrite code power management daemon to make it more clear, maintainable and concise while keeping core functionality intact
- Introduce configuration options to allow for customisation of operation, such as choice of length of time to sleep when down

Power Management

- Power management code rewritten to introduce smarter sleep/wake patterns

- Sleep/turn off at set voltage threshold, low power state (doesn't power gateway) for telemetry purposes

- Sleep modes - greedy, moderate, conservative - impact length of time device is powered off

- Also supports relative sleep patterns eg. Sleep for 10 minutes of every 60 - note that in this case, greedy/moderate/ conservative sleep will still apply when battery is too low

More Power Management

- Logging enabled -> /var/log, can be used to compare statistics for different configurations - determine optimal setup to maximise uptime

- Simulated voltage used for testing purposes in lab development

Demo

- Initial 2 runs won’t update screen after reboot as startup script is not present initially
- First run with Greedy mode configured, and simulated voltage depletion - should wait for voltage to deplete below threshold *1060V,* sleep for short time (1 minute for demo purposes), then wake
- Second run with Greedy mode and relative sleep pattern - stays awake for 1 minute then sleeps for 1 minute
- Third run with Moderate mode enabled and script copied to init.d - should run on startup

Code Rewrite

- Code for power management daemon rewritten based on existing material
- Some files/functions salvaged from old code such as phidget code from phidget library (used to track voltage/current and display status on screen)
- Main rewrite was of pbmd.c, which is the main file for the daemon
- Code repo @ https://github.com/sftcd/loradtn-pi

References

- “An N4C DTN Router Node Design”, Stephen Farrell, Stefan Weber, Alex McMahon, Eoin Meehan and Kerry Hartnett, 1st Extreme Workshop on Communication, Laponia, Sweden, 2009/08/14
- Previous data available at https://basil.dsg.cs.tcd.ie/code/tcd/loradtn
- UUGear Witty-Pi Realtime Clock + Power Management for Raspberry Pi
- Phidgets library @ phidgets.com
- Git Repo @ https://github.com/sftcd/loradtn-pi