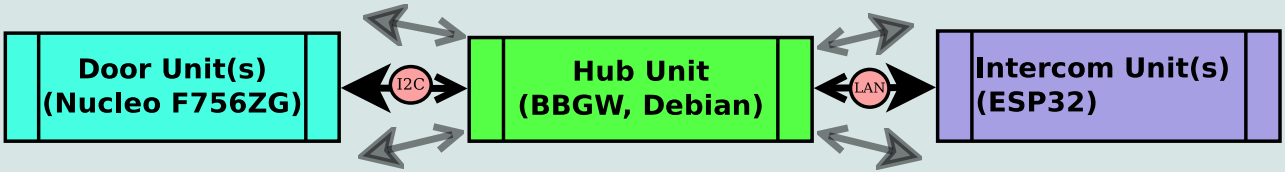
"DOORS"

a local, centralized system
for controlling and administrating
a set of automatic doors

a prescriptive design document

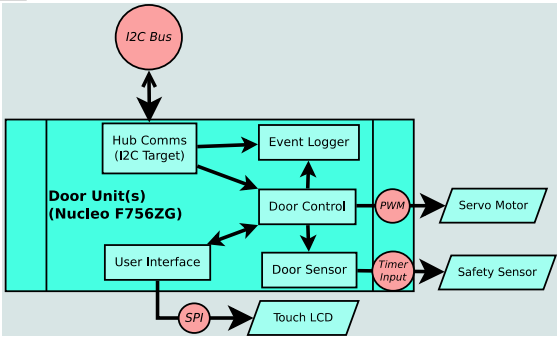
1. Overview

The "*Doors*" system aims to elegantly fulfill a set of requirements common to most apartment buildings and many other facilities: management and monitoring of multiple physical entry-points (*Door* units), and serving of common intercom features to an arbitrary number of clients (*Intercom* units), all coordinated through a central (*Hub)* unit.



2. The *Door Unit*

The *Door Unit* consists of:
- an STM32 **Nucleo-F756ZG** board;
- a **servo-motor**, controlling an automatic door;
- an additional **power supply** unit for the servo;
- a **safety sensor**, to detect blockage and avoid accidents;
- a **touch display** for passcode entry & "bell" functions;
- a small QVGA **camera**, mainly for *Intercom* functions.



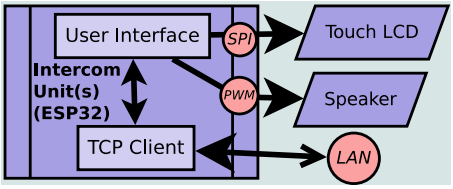
Each *Door* shares an **I2C bus** with the *Hub* and all other *Door* units, and participates in the bus passively as an I2C Target.

Internally, the *Door* is a FreeRTOS based system, consisting of the following tasks:
- **User Interface**, operating the touch display and processing its inputs;
- **Hub Comms,** handling inputs from the *Hub* over the I2C bus;
- **Door Sensor**, continuously reading inputs from the safety sensor into a circular buffer;
- **Door Controller**, accepting input from **all above tasks** to safely fulfill user demands;
- **Camera ?** [unimplemented feature, architecture TBD]

[TODO: I2C registers – Event Count, Event Queue, Hub Command, Data ...]

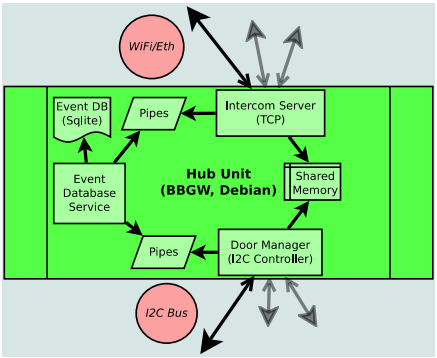
3. The *Intercom Unit*

The *Intercom Unit* consists of:
- an **ESP32 WROOM-32** board;
- a **touch display** for door information & control;
- a **speaker** for the "bell" function.



Each *Intercom* unit is connected to a **local network**, and functions as a client, interacting with the singular *Hub* unit's server process to facilitate indirect communications with the *Door* layer. Internally, the *Intercom* is a simple FreeRTOS based system, with its two primary tasks being operating the user interface and communicating with the *Hub*.

4. The *Hub Unit*



The *Hub Unit* consists of a single **Beaglebone Green** board. The board is physically connected to an **I2C bus** it shares with all *Door* units, and functions as the one and only I2C Controller of this bus. Some additional hardware, not covered here, is likely necessary for this bus to function over application-useful distances.

The *Hub* is also connected to a **local network**, where it functions as a server with all local *Intercom* units as its clients.

Internally, the *Hub* is a Debian Linux system continuously running multiple processes:
- "Door Manager", handling I2C communication with the *Door* units;
- "Intercom Server", handling socket communication with the *Intercom* units;
- "Event Database Service", wrapping a local Sqlite database for access by other processes.

5. Extended Overview