Politecnico di Milano

Internet of Things

Project

Pedestrian Gate Automation

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1 Abstract

The massive use of IoT systems is becoming more and more integrated in everyday life and can also help to make it easier. To simplify the going in and out of a building (house, apartment block or work building) is possible to develop an automatic pedestrian gate system that allows only authorized people to pass throw it without the use of any 'physical' key. Imagine to give a beacon estimote to every person, who has the permission to access to a predefined building: the person can open the gate just been in the proximity of it by simply keeping the sensor in the bag or in the pocket, thanks to a button that is enabled only when authorized beacons are in its neighborhood.

2 Development

2.1 Reference environment

The reference environment is shown in Figure 1. A receiver has been integrated in the pedestrian gate. Outside the gate has been installed a button that can be enabled in presence of authorized beacons. The list of the authorized beacons is stored on the receiver and can be modified using the dashboard shown in Figure 2.

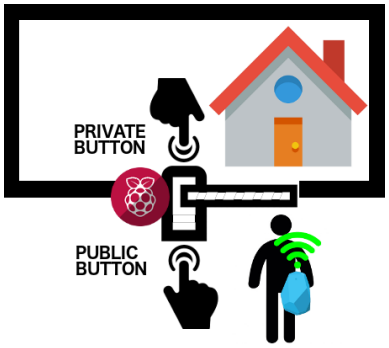


Figure 1: Environment

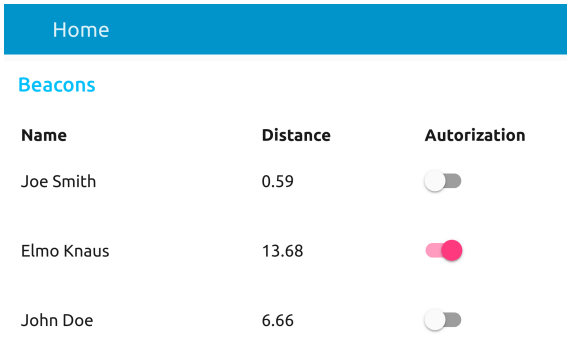


Figure 2: Dashboard

When a certified beacon is close to it and has been recognized by the system, the gate can be open from outside. After a small predefined interval (3 seconds) the button will then be disabled.

2.2 Main components

The main component required for the development of the project are shown in Figure 3. We tried to exploit existing technologies. In particular we have:

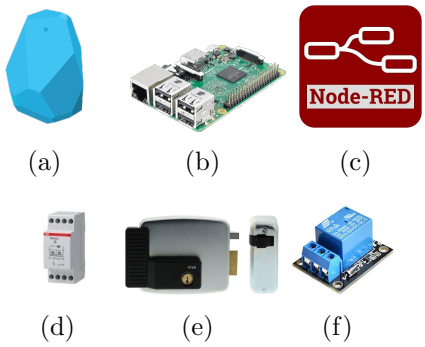


Figure 3: Components

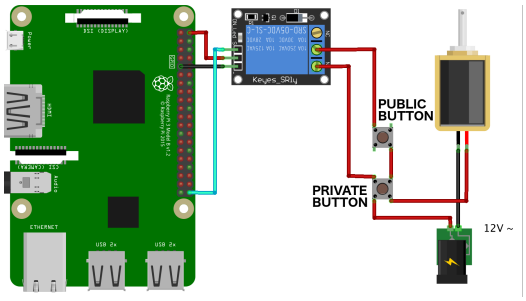


Figure 4: Circuitry

- **Estimote Beacon** is a low power sensor device that broadcast some information via Bluetooth Low Energy. We used the Universally Unique Identifier (UUID) to distinguish one beacon from another.
- **Raspberry PI 3** has a built-in Bluetooth chip. It is used as intermediary between the gate automation system and the beacons: it will read the beacons thanks to a BLE receiver and perform operation on it thanks to its processing power.
- The work-flow is developed using **Node-RED**, a programming tool for wiring together hardware devices, APIs and online services.

The testing phase of the proposed approach required some other hardware components: a power supply, an electromagnetic lock, and a relay. We built a circuitry (Figure 4) in order to allow the raspberry to communicate with the relay. The relay is used to enable and disable the public button.

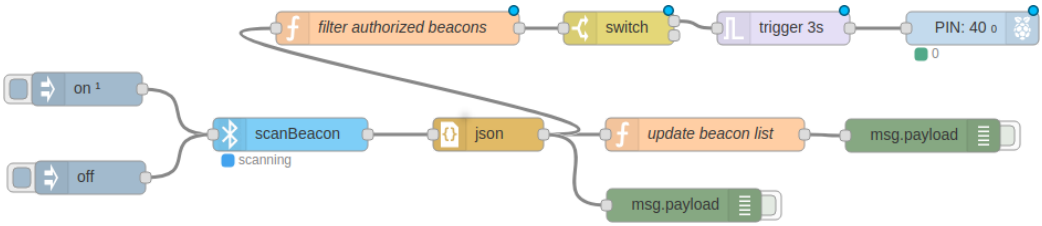
2.3 The Node-RED flow

The Node-RED flow is composed of two sub-flows:

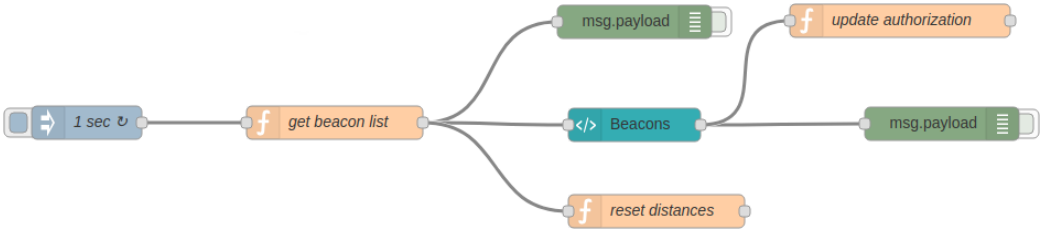
- The first flow, Figure 5(a), enables raspberry to receive blue-tooth packet from the estimote beacons and convert the content in a readable format. Then the list of the recent beacons is updated and the UUID

of the estimote beacon is used to check if the current beacon is authorized. If authorized, a trigger of 3 seconds will be activated, keeping the public button enabled for 3 seconds. The trigger is configured in order to reset the timer when new messages from authorized beacons arrive.

- The second flow, Figure 5(a), enables the creation of the administrative dashboard. Each second the dashboard is updated, displaying the distance of the beacon from the receiver (moving median on the last 15 values) and the authorization status. The dashboard (Figure 2) is built with an Angular JS template that allow the user to easily add and remove authorization for the listed beacons.



(a)



(b)

Figure 5: The node-red flows

3 Conclusion

We built an IoT system that allow the pedestrian gate to be automated using a key-less access. The public button is enabled only when authorized beacons are in range. Future works will require research in the security in order to make this approach more secure. Security issues are highly discussed in the IOT world and are still under study.