Digital boat renting system

Graduate Candidates

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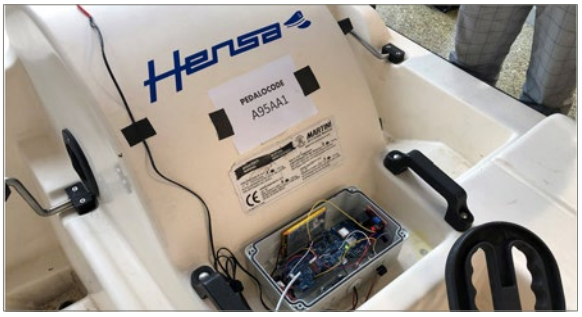
Introduction: Our project partner Schifffahrtsbetrieb Hensa AG operates a pedalo rental at the harbor in Rapperswil. During the high season there are currently around 4 employees managing the departure and return of up to 30 boats. But still there can be waiting times for customers before they get on the lake. The goal of this bachelor thesis was to implement a prototype of a digital renting system for said pedalos. The resulting system should not only reduce the need for employees, but also the waiting time. In addition, a positioning system and an acoustic alarm should warn customers and prevent them from entering forbidden areas like nature reserve zones.

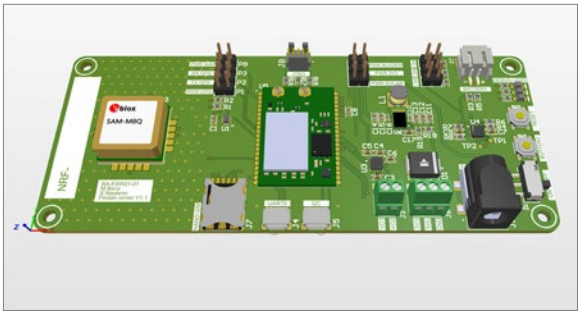
Approach / Technology: To reach this objective, we have adapted the boat rental process so that it is possible to rent a boat with a smartphone. Consequently, we developed a web app based on the MERN software stack using the MQTT protocol to communicate with the microcontroller. For the microcontroller we evaluated the relatively new NRF9160 microcontroller, which features LTE-M connectivity. It runs the real-time operating system zephyr and is optimized for low power IoT applications with security requirements. The system was designed to use minimal power to enable energy-autonomous operation on the boat. A solar cell in combination with a lipo battery as well as the use of features like PSM and eDRX made this possible. A lock with an integrated sensor was used to detect if a boat is used without permission, the alarm for such an event was realized with a piezo electric buzzer. To determine whether a customer is inside a restricted area, we used a GNSS receiver. A custom-made PCB allowed the integration of the sensitive hardware components into an IP67-rated box to protect them against water and physical damage.

Result: By choosing state-of-the-art technology, we were able to demonstrate that a system that satisfies the given requirements is possible. Our project partner should now be able to start a long-term test phase and determine if such a solution should be further explored.

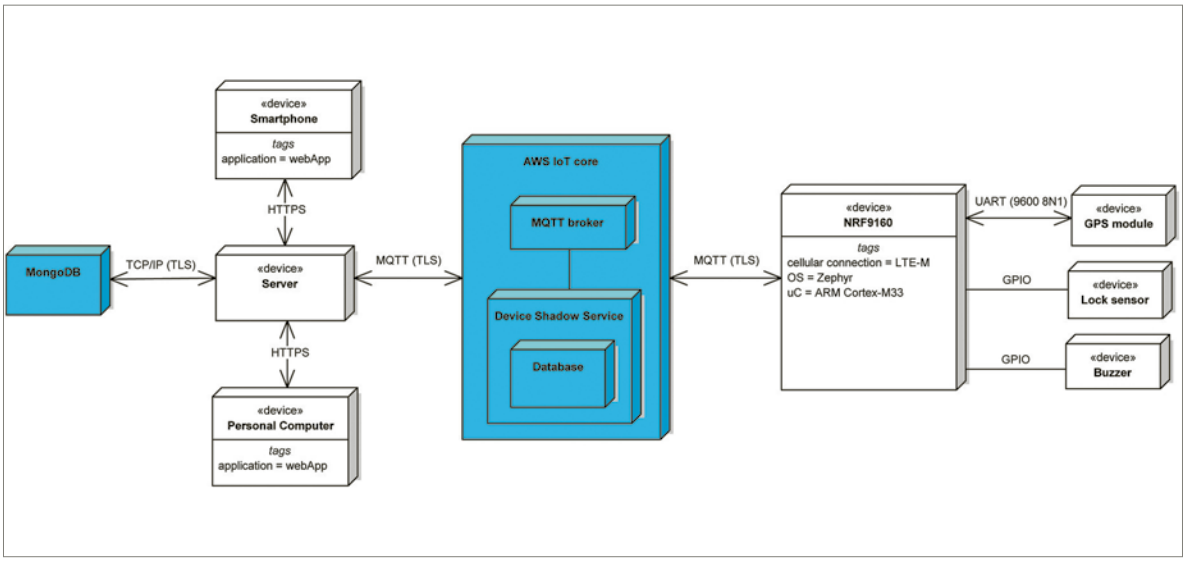
An earlier prototype installed on the pedalo for testing
Own presentment



Custom-made PCB containing the GNSS receiver, the NRF9160 microcontroller and the solar charger hardware
Own presentment



Deployment diagram of the system, the blue components are existing services
Own presentment



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