**Motivation**

The Hamburg Port Authority (HPA) is responsible for managing the port area in Hamburg. Measuring the water quality – in terms of temperature, pH number and oxygen – is important to detect and monitor environmental influences of the port area. Manual measurements, however, are costly and time-consuming. The development of smart buoys for measuring and transmitting sensor values autonomously promises to reduce this effort drastically. Unfortunately, either batteries have to be replaced regularly, or oversized solar panels have to be used to enable uninterrupted operation. To overcome these limitations and to enable small and smart buoys, an intelligent use of the harvested energy is desired.

**Work Description**

During this project you will extend a smart LoRa-enabled buoy with an existing solar harvesting system. Additionally, you set up the collection and transmission of sensor data based on the available energy on the sensor node. You will analyze the energy consumption of the system and implement a suitable scheduling algorithm.

In particular, your work will embraces the following steps:

- Setting up a LoRa-Gateway for reception of sensor data
- Integrating the existing harvesting circuit into the buoy
- Evaluating the power consumption per device, especially the radio module with different spreading factors
- Designing a program split into self-contained sub tasks.
- Implementing and evaluating the energy-aware scheduling algorithm

**Prerequisites**

For successful project work completion, you should fulfill the following requirements:

- Practical experience in programming, especially C/C++
- Background knowledge on LoRa and LoRaWAN
- Basic understanding of electrical engineering

Practical experience with soldering and electrical components is beneficial.

*Contact: Jan Heitmann, M.Sc.*

jheitmann@tuhh.de  
Phone: +49 40 / 428 78 – 4885  
Room: Q 1.035