**Master thesis**: NarrowBand Internet of Things (NB-IoT) for Smart Parking

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The concept of Internet of Things (IoT) appeared a decade ago and it has been becoming a key enabling technology for the development of a sustainable society. With IoT technology, all things/devices/terminals are connected and information can be accessed and shared in a real-time manner. However, a sign­ificant challenge of IoT is to connect a huge number of devices. Recently, NarrowBand IoT (NB-IoT) is standardized for applications where bandwidth is not heavily demanded and devices can run for at least 10 years without replacing a battery.

In Norway, Telenor, Huawei and Q-Free are cooperating to deploy a large-scale NB-IoT for smart parking services. The NB-IoT enabled devices operate much like 4G, but consuming very low power and at most bandwidth of 250kbps. The communications is over licensed spectrum, currently owned by Telenor. The devices have SIM cards, very much like a cellular phone.

In this thesis, we will study the performance of these parking sensors and the platform. The main goal is to make parking more cost-efficient. This will include the usage of sensors, communications over NB-IoT and hopefully make a big leap into efficient sensor devices. The thesis will investigate and verify the promised properties, e.g., power usage, bandwidth, communication range, and the feasibility to create nationwide coverage. Some interesting questions can be: 1) are the “paper-specifications” as promising as they sound?; 2) will such a sensor device be able to operate for 10 years?; and 3) is latency important in the smart parking services? If yes, how to reduce the communications latency?