Implementing NB-IoT: Communication with a Load Cell

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Abstract

The purpose of this project is to establish a line of communication between a loading cell and the internet. This will be done through the NB-IoT technology, and the data being sent is produced by the loading cell. Using a micro-controller from PyCom and a SIM-card from Telia as the network service provider, [...]

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Chapter 1

Introduction

Vetek is a Swedish scale supplier located in Väddö, situated approx. 100 kilometers north of Stockholm. Vetek constructs their own scales and weighing systems, as well as reselling products from other manufacturers.[3]

Vetek aims to improve their services, and as such are interested in the possible use cases of IoT (Internet of Things) technology, and ultimately see how that can be applied to their own products. In this paper,the term IoT will simply mean "(a) device(s) connected to the internet"[2]. In a pilot project, Vetek wants to see how this connectivity can be implemented in a energy-efficient and effective manner. This would entail investigating factors such as power consumption, range and data rate. NB-IoT (Narrowband-IoT), a new and emerging radio technology, encapsulates some principles suitable for this type of endeavor, such as wide coverage, low power consumption and low complexity.[1] Using some form of NB-IoT compatible microcontroller and hooking it up to a basic load cell should provide sufficient testing grounds to see how this new functionality could improve existing products.

1.1 Purpose and Goals

NB-IoT is a relatively new technology, and as such, implementations and documentations remain sparse. With this in mind, even a small project such as this will serve as a guiding post for future work. The goal of this project is to establish a working internet connection with a load cell through the NB-IoT technology. The data sent from the load cell should be functionally identical to the data produced if the load cell was offline. Disregarding problems due to a internet service provider, data speeds and losses should not be abnormal. Using the same components, replication of the project should be feasible with the documentation provided in this thesis, assuming software and service providers remain.

The end-goal can be divided into two sub-goals.

- Enable internet communication from the microcontroller.
- Enable data transfer from the load cell to the microcontroller.

1.2 Delimitations

The final implementation will not be a functional product ready to be used. Any extra improvements upon a internet-enabled load cell will only be done if time remains after the implementation and the completion of the thesis.

Chapter 2

Theory

2.1 Components

- FiPy: a development board that gives access to all major LPWAN technologies. FiPy is developed by PyCom and equipped with an expansion board to enable integration with other components via GPIO pinouts, as well as an LTE-antenna to enable LTE CAT M1 or NB1. MicroPython is enabled on the board, and as such is programmed via the Python programming language (Version 3.5). The available protocols on the FiPy are:
  - WiFi
  - Bluetooth
  - LoRa
  - SigFox
  - Dual LTE-M (LTE CAT M1 / NB1)
- Tedea Huntleigh - Model 1022: a single point load cell ideally suited for low cost weighing platforms. This specific model has the capacity of 30 kg, which should be more than enough to run tests of data transfer from the load cell via the FiPy.
- HX711: a breakout board that amplifies the signal from a load cell so that the data can be read more easily. Several libraries are readily available online, including some MicroPython variants.

2.2 Applications & Services

Pybytes

Chapter 3

Methodology

3.1 Preparation

Chapter 4

Results

Chapter 5

Discussion

Chapter 6

Threats to Validity

Chapter 7

Conclusions

7.1 Future Work

Bibliography

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[2] Steve Ranger. What is the iot? everything you need to know about the internet of things right now, 2018. URL `https://www.zdnet.com/article/what-is-the-internet-of-things-everything-you-need-to-know-about-the-iot-right-now/`.

[3] Vetek. Om vetek, 2019. URL `https://www.vetek.se/om-vetek/content`.