CS4222/CS5422

Project

AY 2020/2021 SEM 2

DUE: April 23th (Friday) 23:59

1. **This is a group assignment.**
2. **Total Marks: 50.**
3. **This assignment carries 25% weightage to your final grade.**
4. **There is a 20% penalty per-day for late submission.**
5. **For any clarification on this assignment, post your queries through email the lecturer.**

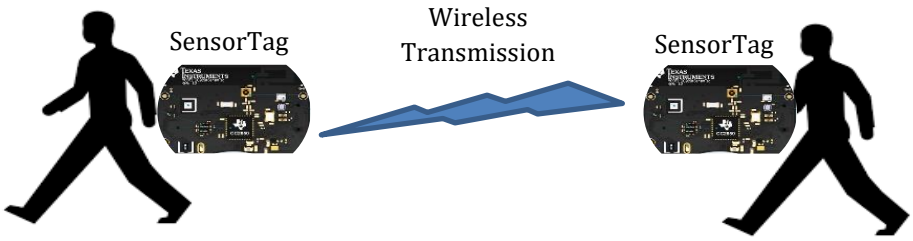
1. OVERVIEW

TraceTogether is a smartphone app released by the Singaporean Government that allows for contact tracing using the BLE radio. In this assignment, you are tasked to design a similar tracing application to run on the TI SensorTag using the IEEE 802.15.4 (ZigBee) radio.

In previous assignments, you have learned the following:

- Use of RSSI to detect proximity.
- Design and implement energy efficient discovery protocol that can discover nearby nodes.

In this assignment, you are tasked to put the pieces together to build your own "TraceTogether" token. Each token is supposed to "listen" for beacons from nearby tokens, as shown in the figure below:



2. Task

The objective is to design a system that is able to detect the duration(s) in which two devices are "in-proximity". You can think of **proximity as a distance within 3m**.

Specifically, your system should:

- discover pair of devices in proximity with contact times of 30s or more with high probability
- be able to estimate the total duration in which two nodes are in proximity
- discover that a node in proximity has moved away for 30s or more with high probability
- reduce power consumption as much as possible.

You can consider the following:

- Use different transmission powers and RSSI threshold(s) in different environments to determine if two devices are sufficiently (physically) close.
- You can complement your decision logic with other factors/measurements/devices and sensor readings.

Your code should output (write to stdout using printf) the time a device first detects another device in the following format:

Timestamp (in seconds) DETECT nodeID

DETECT is a keyword that is always printed for detection of a node. The fields are separated by a single whitespace. For example

123 DETECT 34567

Therefore, at the 123 seconds, node with ID 34567 is detected. When a node is determined to have moved away, print the information using the following format

Timestamp (in seconds) LEAVE nodeID

For example,

345 LEAVE 34567

means at the 345 seconds, node with ID 34567 (that was previously in proximity) moves away.

Note that there can be more than one node in proximity.

We will evaluate your system in our own using different scenarios based on the following metric:

- Detection accuracy. Accuracy includes detection of new node moving near, existing node moving away, and the times it take to detect these events.
- Energy consumption.

3. Submission

Submit a single zip file named project-GroupNumber.zip to Luminus (project-submission directory) with the following files:

1. A single pdf file (report.pdf) of 12 pages or less
    - The neighbor discovery protocol you have implemented to "duty-cycle" your radio in order to reduce power consumption.
    - The logic that you have implemented for proximity detection.
    - Results showing evaluation of your system, including the radio energy consumption using Cooja.
    - Summary of what you have learnt and discussion on the challenges you have faced in the project.
    - A breakdown of work done and contribution of each member of the group.
2. A directory named source-code with all your source code files:
    a. Your code must be able to compile to run on both the SensorTag as well as on Cooja.
    b. A README file to compile and execute your program(s).

4. Grading

1. (25 marks) Report
2. (25 marks) System Evaluation