Dynamic Multi-Sensor Fusion through a Low-Power IoT Transducer Network

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Abstract

The project objective is to combine a wireless sensor network with a configurable node with multiple sensors, also known as transducers. With this system, users could collect and analyze various data, such as temperature, humidity, motion detection, illuminance, CO gas, air quality, etc. Each transducer node should ideally have a physical range large enough to cover the span of an average room. With respect to battery life, every module in the system will be low-powered and energy efficient. The data collected will be easily accessible through data logs located in the cloud and the user can access the data from any platform or device. Dependent upon the user's needs, the collected data can be analyzed and filtered at their discretion. Based on the interpretation of the data, notifications may be sent to alert the user or an authorized third-party of a specific concern.

Currently, the project focuses on three main components: the node, the hub, and the cloud. The node consists of sensors connected to an Adafruit Pro Trinket microcontroller. The hub is a Raspberry Pi 2 which is a small Linux-based computer that is capable of connecting to multiple nodes and receiving their transmitted data. The node transmits sensor data to the hub via an nRF24L01+ transceiver in a way that minimizes power consumption. This transceiver operates on a 2.4 GHz license-free Industrial, Scientific, and Medical (ISM) band. A C++ program runs on the hub and sends the data to the cloud in JavaScript Object Notation format through an API web request. The web application uses a PHP backend to process and store data received into a relational MySQL database. Data is then displayed to the user in real-time through a web application.