Internships – Problem Definitions

E&TC Branch

This document outlines the problem definitions for the Internships being conducted at CopperCloud IOTech starting June 2020.

Note: More details on these use cases will be provided once the internship begins, and NDA (non-disclosure agreement) is in place.

Problem Definitions:

#	Problem Space	Solution Space	Expected Learning Outcomes
1	**Domain:** Communication **Problem statement:** Extend range of WiFi-based IoT deployment to 1 KM radius. Solution should work in both LOS (Line of Sight) and NLOS (No Line of Sight) conditions **Business use case:** Deploying IoT Solutions in NLOS (No Line of Sight) conditions, and to cover a very large area	1. Develop a **hybrid IoT network** of Radio Mesh (self-healing network) & WiFi. Radio mesh to **extend range to 1 Km**, and WiFi to provide connectivity to the Cloud. 2. Develop a protocol to bounce **messages around LOS (Line of Sight)** and detect when nodes go offline. 3. Recommended equipment/platforms: • **nRF24L01 with PA LNA** antenna (for extended range) • **ESP8266** for MCU and WiFi connectivity • MySQL Database hosted on AWS Cloud	1. Design of **radio mesh network** 2. Use of the **2.4 GHz 6-channel nRF24L01** radio platform 3. **Design of messaging protocol** on different communication systems 4. Communication protocol between IoT Embedded Device and Cloud using **MQTT and JSON** 5. Basics of **Relational Databases** 6. **Agile methodology** to execute projects

2	**Domain:** Energy **Problem statement:** Power an IoT device off-grid, outdoors. **Business use case:** Deploying IoT Solutions in hard-to-reach terrain, or where AC grid power not easily available	**1. Solar + LIPO battery powered IoT Device** 2. In case of low battery, exception should be logged on **cloud database** 3. Recommended equipment/platforms • ESP8266/NodeMCU • Solar panel 8 to 12V • TP4056 LIPO charge controller • MySQL Database hosted on AWS Cloud	1. Basics of solar power as applied to IoT 2. **Design LIPO battery charging system,** and integrate it with a portable solar generation unit 3. **Power budgeting** and management on embedded platforms 4. Communication protocol between IoT Embedded Device and Cloud using **MQTT and JSON** 5. Basics of **Relational Databases** 6. **Agile methodology** to execute projects

Note: These 2 capabilities are not disjoint from each other. These are meant to be used in conjunction in the following field conditions for deployment:

(a) area of coverage is large (beyond 200 feet radius)
(b) line of sight between devices is not assured
(c) AC grid power is inaccessible
(d) Inaccessible terrain where frequent maintenance is not practicable