CS575 Assignment 1 – Build and Describe an Architecture for an IoT device

Background

There is a significant market to create novel Internet of Things (IoT) devices to solve complex problems in the healthcare space. For this assignment you are conceptualize and create a high-level architecture description for a new product that helps people with medication compliance. Medication compliance is a problem that costs Americans hundreds of millions of dollars per year in avoidable hospital stays. Simply stated, people not taking their required medication properly results in hospital visits, serious medical problems, and sometimes even death. Additionally, avoidable hospital readmission is also a big problem. When people are released from the hospital they are often given medications that they need to start taking. Not taking medication properly is a big cause of people needing to go back into the hospital. This adds significant additional expense on the healthcare system. Additionally, many modern medicines are very expensive, so not taking them properly (or at all) not only has health implications, it reduces the effectiveness of these expensive medicines that can cost several thousands of dollars per month.

In order to address this problem, we are going to undertake specifying product requirements and create an architecture description of an IoT device that can help people deal with medication compliance. The three main components of our solution are shown below:

Our solution involves at least 3 components, your design can include additional ones if you want. They are:

- A “smart” pill vial. This pill vial holds the medication
- A hub that bridges the pill vial to a local wifi or cellular connection
- An app that captures data and can provide reminders about when and how much medication to take

Actors

- The patient – the person who takes the medication
- The clinical team (dr/nurse) who can monitor how and when medication is being taken
- The caregiver – a family member that can check in on the patient

Technical Considerations

- The pill vial will be equipped with several sensors and a timer (you get to pick)
- The pill vial will have an embedded battery, but this battery will not have the capability to connect to a wifi or cell network
    - Investigate common solutions to this problem like zwave or Bluetooth
- The hub needs to be able to be setup easily considering the patient might not have any technical skills (pairing to the pill vial(s), connecting to the network)

Non-Technical considerations

- Given we need to market this solution, considering additional consumer features, for example the hub can double as a night light and/or as an air freshener.

Assignment Objectives

You have 2 objectives for this assignment:

1. List / devise (and be creative) 5 features that this IoT solution must have to make it valuable to patients, doctors and care givers. Remember that individuals using this solution might have very limited technical skills so your features should not require complex technical knowledge or setup.

   Feature 1: The pill vial will have an integrated clock that is updated automatically over the network so that time sensitive medicines can be managed with the solution

2. Develop an architectural description of the system that shows how the architecture supports the features that you identified for the product. Your architecture description should include a high-level picture describing the architecture of the product and a writeup showing how the architecture supports the product feature requirements. You are free to pick the notation that you want to use from the ones we talk about in class (informal line and box, UML, C4) as I care more about your ability to communicate an architecture well versus using a specific notation. Don't forget to think this through, the solution must be realistic and take into consideration things like:
    a. Connecting to a wifi network securely
    b. Power management for pill vial
    c. Security for all of the various actors and devices that interact with each other
    d. Simple setup and configuration of the various components of the system.