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Midterm Report - Group 23

- **Team management and structure (leadership and roles, project management tools):**
  - Equal contribution and leadership roles for everyone in the group
    - Group contributions and everyone is held to the same standard
  - GitHub repository for code: Link
  - Google Calendar to show meetings and project deadlines: Link

- **Problem statement (including any revisions):**

  Day-to-day operation for nurses and doctors at Children's Healthcare of Atlanta is very important and worrying about the location and state of their equipment should not be high on that list.

  Employees of the hospital should be able to see if a ventilator is in use, needs maintenance or repair, and where it is in the hospital all in a way that is easy and efficient, so not to distract them from there more important tasks. The added equipment that gives this functionality should be small, unnoticeable, and removable so that rented ventilators are not permanently modified. It should also be very simple. The point of this modification is to make equipment use more ubiquitous across the hospital and it should not create more issues than it solves.

  However, the current equipment management at Children's is inefficient and wastes the hospitals time and resources, not to mention the patients. By not having this information at employee's fingertips we waste their time and efforts searching for equipment like ventilators rather than treating their patients. Because of this, the patients of Children's will have a less than perfect and optimized experience and potentially decrease the company image.

- **Background research on the problem and domain:**

  We have looked at a similar product called 'Tile' to investigate how it uses bluetooth proximity and last known locations to track devices. While we wanted to make a similar size device, we wanted to include live tracking through not just bluetooth but wifi as well as a way to signal when it is and is not in use. We also researched the existing Children's Healthcare of Atlanta application for a better idea of the layout of the wing of the hospital that we would be tracking the ventilators in for our own layout.

We have looked on Amazon as well as Adafruit for the possible necessary hardware like the Raspberry Pi Zero W which includes the official case and power supply, the different possible types of programmable RFID tags that use built in wifi and bluetooth, RFID tags than can be programmed with bluetooth and wifi chips which we needed to look for as well, power switches/buttons, 9V batteries with battery plugs, and arduinos. Besides researching these parts for a budget idea we researched RFID tags and which ones we could use in the design we were proposing.

- **Problem Analysis (Breakdown into subproblems of various complexity, technical requirements):**

  A breakdown of the problems we are running into are as follows:

  1. We would need to design an employee login in the software and to do so would need access to employee ID numbers or another valid form of identification from the hospital
  2. decide on using both bluetooth and wifi on an RFID tag or using a microcontroller like an arduino with a bluetooth and wifi transceiver which would be costly, we would need the IP and MAC addresses of the routers on the floors of the wings that the ventilators would need to be tracked on which we would need to get from the hospital as well
  3. Learning swift more proficiently.

  Other technical requirements would include soldering the devices together that would be put on the ventilators being tracked, using a 3D printer to create an enclosure that would fit everything, and signing up for an apple developer license to put our application on the app store.

- **Preliminary design proposal(s):**

  Since we were given the choice of developing for iOS, where doctors and Nurses could use their personal iPhones, or for Android, which they use on their work cell phones, we chose to strictly develop for iOS. Even though we are not as familiar with Swift as much as programming languages like Java, we are unsure of the operating system used by the work phones and if our application would be compatible. We also would not be able to test our application on their work phones since we would not have access to one; however, we do have access to iPhones and Xcode for testing and development on macOS. These factors make an iOS application the more preferable and suitable choice. When it comes to the hardware side, we first thought we would need to use a

Raspberry Pi Zero W on each ventilator with a button and LED light to inform the application if it was in use as well as track its location. Even though this would work and be a very accurate option, it would be costly.

So instead we proposed the idea of using one centrally located Raspberry Pi Zero W in its original case for protection and RFID tags on each of the ventilator devices. We proposed a scannable RFID tag through the app but questioned the convenience of having to open the app and scan the tag every time a machine is taken for use or put back in storage. This instead gave us another idea of scanning the RFID with their identification badge and associating their ID badge with their login in the application. RFID tags that use wifi or bluetooth would also need a separate power supply meaning we would need to include one for each RFID tag, or we would have to draw power from the ventilator, which isn't ideal. That gave us the idea to use an RFID tag attached to a button and an LED to indicate use with a 9 V power supply which would be contained in a 3D printed enclosure. To use an even more suitable design, our most recent proposal includes an arduino attached to a button with a light indicating whether the module is in "in use" or "available for use".

From the software perspective, the user of the iOS app, after logging in, will be able to see all the locations of the respiratory systems and whether they are in use from an aerial view of the hospital. Colors on each dot indicating the location of a ventilator system will correspond to green if available and red if in use.