California State University, Long Beach

CECS 491A, Section 2 - Senior Project I

Feature List

Due: September 25, 2024

Members (5):

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Bluetooth Low Energy Tracker

Overview:

A web application that connects to multiple Bluetooth devices for real-time indoor location tracking. It enables a single user to map the location of tracking devices within the space and store their movement data in a database. The application collects and visualizes movement data providing a view of the device's location on a virtual map.

Features:

Color Key:

Key Features

Unique Features

Minimum Points needed: 2000

Total points from features: 2010

Bluetooth Tracker:

1. Bluetooth device distance tracking/connectivity - 130 points
    a. Implementing the Nordic Distance Toolbox for superior accuracy
    b. Connecting tracker to each triangle point in a pipeline
    c. Maximizing pipeline throughput
2. Finding maximum range of location tracking - 20 points
    a. Important for tracing a map
    b. Testing real-life range of devices so that they maintain sufficient accuracy
3. Dynamic triangle point OpenThread Connectivity - 130 points
    a. Triangle points detect the distance between each other

   b. Sends data to server via Raspberry Pi

4. Location calculations - 100 points:
   a. Done on server-connected Raspberry Pi
   b. Implementing 3D trilateration algorithms, with consideration to several variables:
      i. Margin of error in distance measurements
      ii. Distance of each triangle point from each other
      iii. Distance of each triangle point from the tracking device

5. Connecting nRF devices to website through a server application - 80 points
   a. Usage of Raspberry Pi, web server, and Bluetooth device
6. Securing OpenThread network and server connection to the web server - 80 points
   a. Implementing a PIN code and encryption for the dev board. User will interact with this through a physical pin on the device.

Map Program (built into website):

1. Graphical design - 60 points
   a. Refreshes automatically
   b. Trail mapping
2. One-user-at-a-time usage of map - 60 points
   a. Admins can override the current user
   b. Waiting users will be put in a queue page
   c. Only verified users can queue to use the device
3. Data collection/formatting - 80 points
   a. storing map trails in log files (40 points)

   b. Updating database for new map trail files (40 points)

4. Calculating and recording stats - 80 points
   a. Calculate distance traveled
   b. Time
   c. Display next to map
5. Data Exporting - 80 points
   a. Allow the user to download movement data in different formats (CSV, JSON)
6. Map customization - 130 points
   a. Changing colors, icons, types of trails, what type tracking (trails, point to follow, etc)
   b. Toggleable at any time, switch on web page
   c. Zooming in/out
7. Pausing feature - 60 points
   a. Have users pause time/trail
   b. Can resume at any time
8. Map boundary customization - 80 points
   a. Allow users to set their own boundaries (assuming it's not greater than the max boundary the BLE can handle)
   b. Records and tracks areas the user wants to track

Website:

1. Website UI/design- 140 points
   a. Web development - (100 points)
      i. Backend implementation

        ii. Site routing (Home page, login, account creation)

    b. Responsive/Animated UI - (80 points)

2. Website URL/server creation - 100 points
    a. HTTP/S configuration and other security concerns
    b. Domain name/DNS setup
    c. AWS usage
3. Database design - 130 points
    a. MariaDB
        i. Secret management
    b. Logging tracker trails, usernames, user logging
4. Database Lookups - 60
    a. Search bar, previous records, etc
    b. May require search engine?
    c. Admins only; block other users from viewing page
5. Account creation - 100 points
    a. Account verification via email
    b. Unique username, password security, data security
6. Admin/user account privileges - 100 points
    a. LDAP authentication
    b. Verifying users before accessing Bluetooth devices
    c. Upgrading accounts to admin
7. Email notifications - 100 points
    a. Password changes, unrecognized devices, alerts

   b. Newsletters, changelists notifications

   c. Requires creating an email server

8. User Profile page - 100 points

   a. Fetch routes from the database and display track history

   b. Registered with basic information

9. Sentry Logging System - 10 points

Point key:

Difficulty	Time Needed to Finish
130	4 weeks
100	3 weeks
80	2.5 weeks
60	2 weeks
30	1 week
20	6 hours
10	3 hours

Comparisons:

Features :	BLE Tracker	Bermuda	BLE Indoor Positioning
Database Design	☑	☐	☐
User Lookups	☑	☐	☐
Account Creation	☑	☑	☐
Email notification	☑	☑	☐
Admin/user account privileges	☑	☐	☐
Website UI/design	☑	☑	☐
User Profile Page	☑	☐	☐
Website URL/server design	☑	☑	☐
Sentry Logging System	☑	☐	☐
Connecting nRF device to website	☑	☑	☑
Securing OpenThread network	☑	☐	☐
Bluetooth distance tracking/connectivity	☑	☑	☐
Dynamic OpenThread connectivity	☑	☐	☐
Finding max range	☑	☑	☐
Location calculations	☑	☑	☐

Map graphical design	☑	☐	☑
One-user-at-a-time usage of map	☑	☐	☐
Data collection/formatting	☑	☑	☐
Calculating and recording stats	☑	☑	☐
Data Exporting	☑	☑	☐
Pausing	☑	☑	☐
Boundary customization	☑	☐	☐