McGill

REAL-TIME PET MONITORING

From Scratch

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HELLO!
Who would have thought they will start monitoring me too?

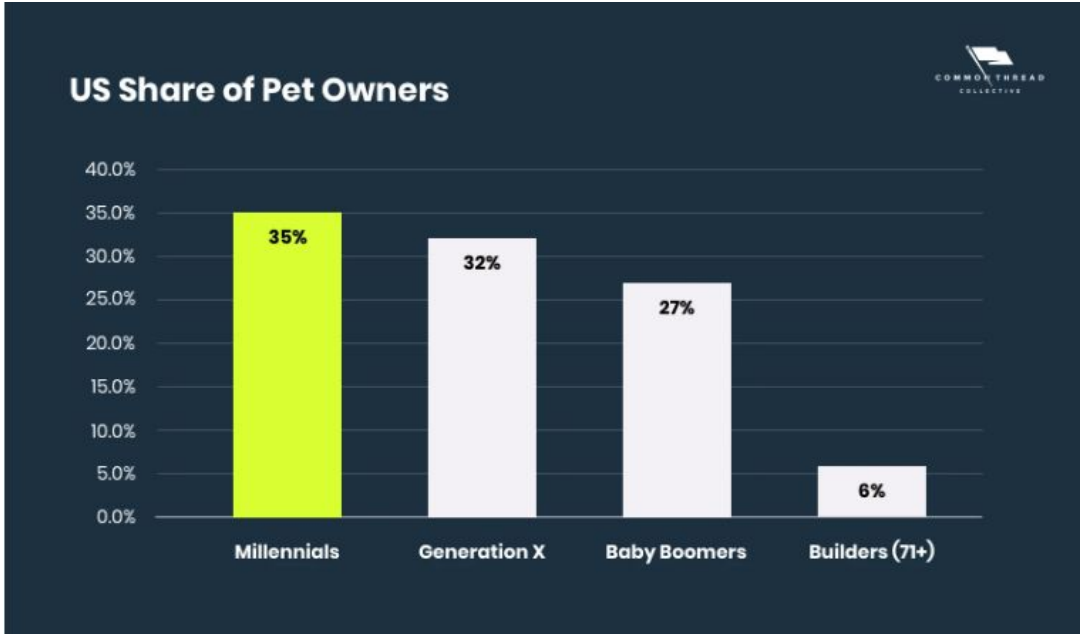
PROBLEM

- 54% of US households own at least one pet, representing 68 million households across the country. In the pandemic, the pet ownership market was projected to grow by 4%.
- Dog and cat owners make up the vast majority (94%) of pet-owning households in the United States.
- The number of new pet adoptions soared during the pandemic.

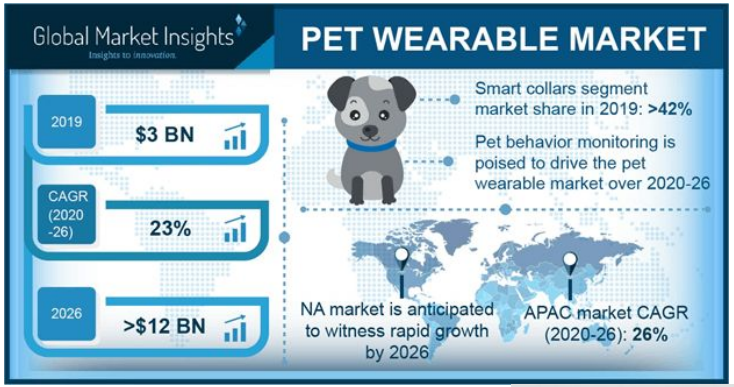
PROBLEM

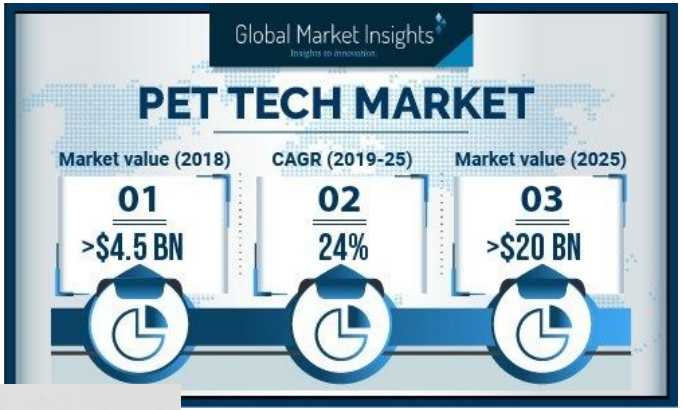
35%

of pet owners are millennials and their affinity for technology and digital spaces explains why they want to track and monitor everything from their devices.



NEED FOR A MARKET SPECIFIC SOLUTION





OUR SOLUTION

01

Real-Time Tracking

We present a real-time monitoring technology for tracking pet's motion and the surroundings

02

System Specific to Each Pet

We have curated the system such that it finds different pets' needs according to their specific weight and age.

03

Secure Data Backup

Secure Data Backup With Firebase Cloud Storage. Logs can be read from the smartphone application itself.

TABLE OF CONTENTS

INTRODUCTION

A High-Level System Overview

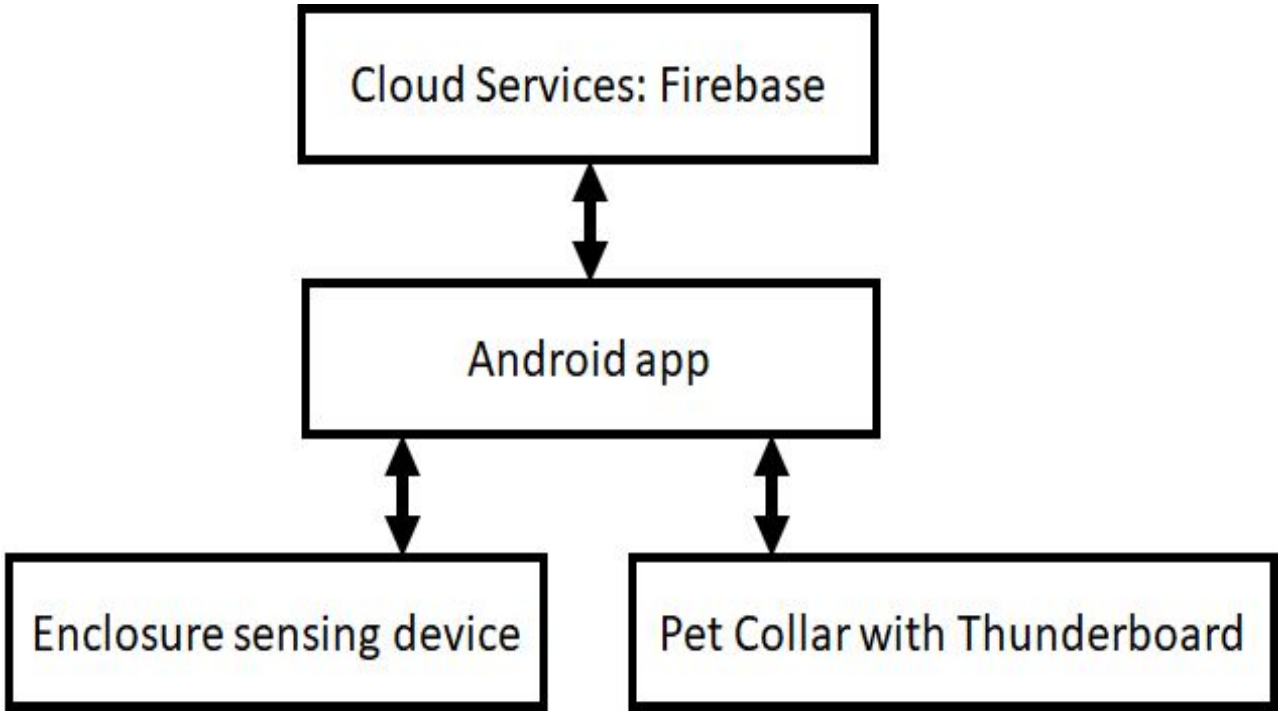
01

SYSTEM OVERVIEW

03

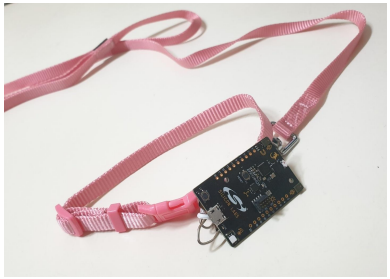
02

01



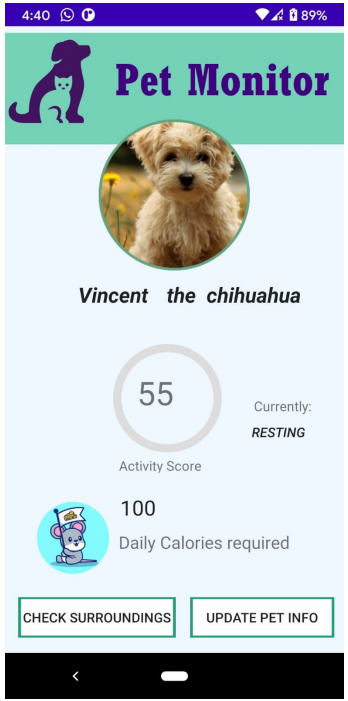
SYSTEM OVERVIEW

01



Dog leash prototype

02

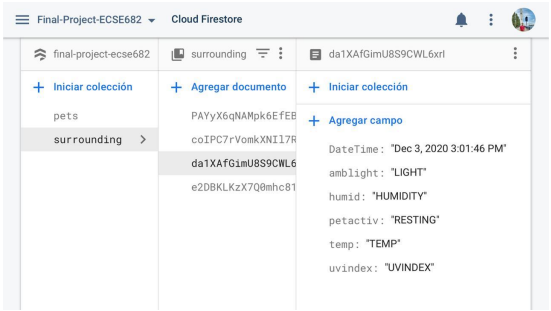


Android application

03

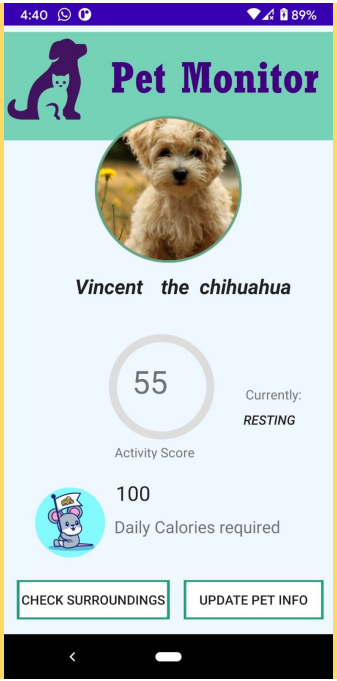
```
FirebaseFirestore db = FirebaseFirestore.getInstance();
private static final String TAG = "MainActivity";

@Override
protected void onCreate(Bundle savedInstanceState) {...}

private void getSurrDocuments (){


    db.collection( collectionPath: "surrounding")
            .orderBy( field: "DateTime", Query.Direction.DESCENDING).get()
            .addOnCompleteListener((task) -> {
                if (task.isSuccessful()) {
                    int i = 0;
                    for (QueryDocumentSnapshot document : task.getResult())
```

Android window

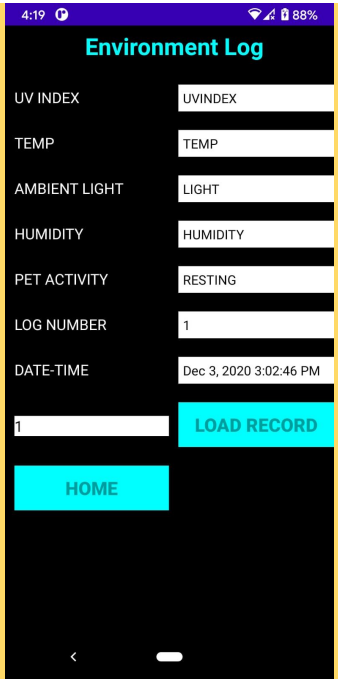


Firebase window

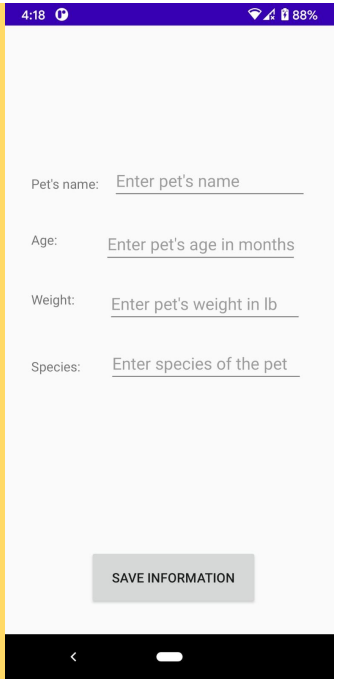
ANDROID APP



A) Main View



B) Environment Log



B) Pet's info input

02

DEMONSTRATION

The Features of Our App

OUR SOLUTION

01

Real-Time Tracking

We present a real-time monitoring technology for tracking pet’s motion and the surroundings

02

System Specific to Pet Species

description

03

Secure Data Backup

Secure Data Backup With Firebase Cloud Storage

REAL-TIME TRACKING

Temperature

We monitor the temperature of the room in °C for some species vulnerable to coldness or warmth

Humidity

We monitor humidity of the room in %

Ambient Light

We notify when the indoor light is on/off or when the pet enters a dark area

UV Index

We measure the level of UV radiation

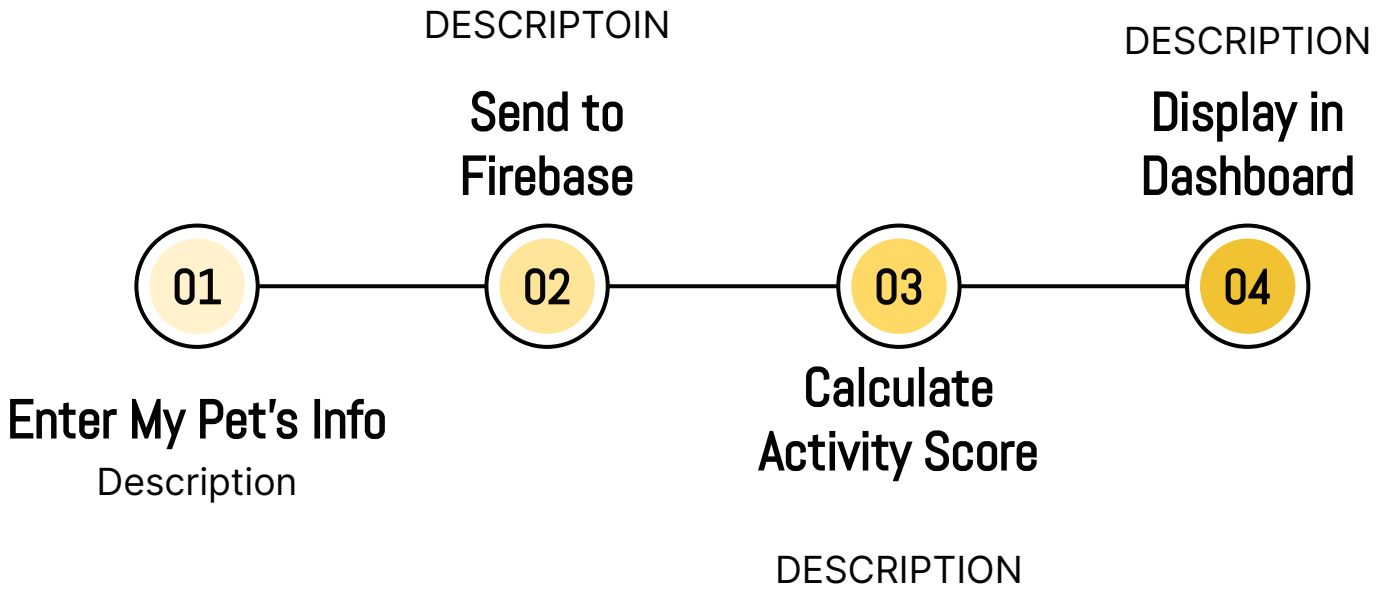
Motion Status

We provide the pet's motion data and display if they are resting or walking

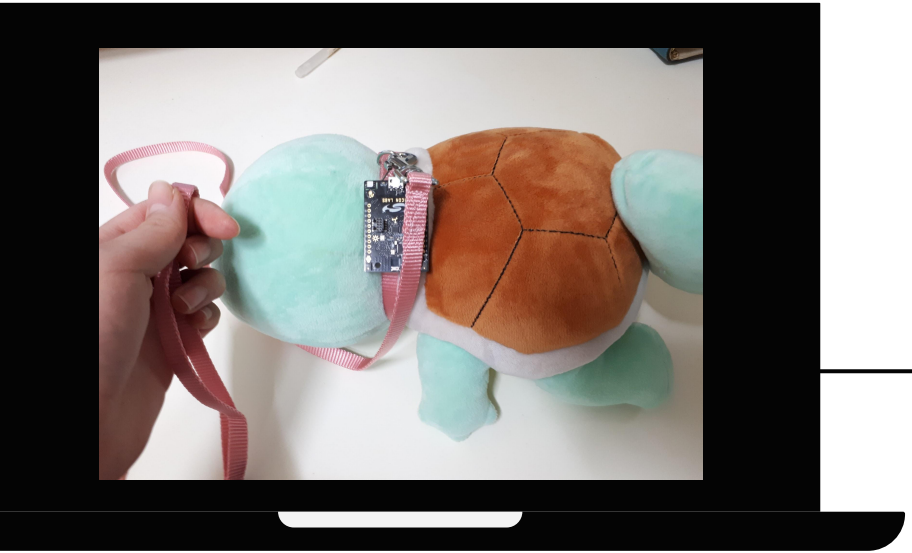
Activity Score

Activity score is calculated per different species, reflecting the ideal condition for them

Specific to your Pet Species

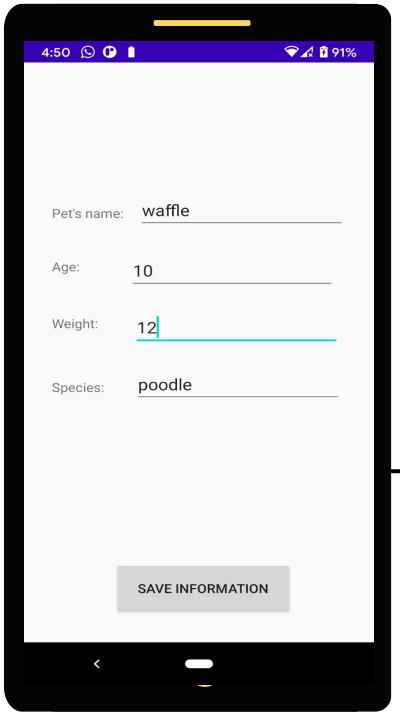


DEMO



Let the pet wear their pet leash !

DEMO



Entering Pet Info

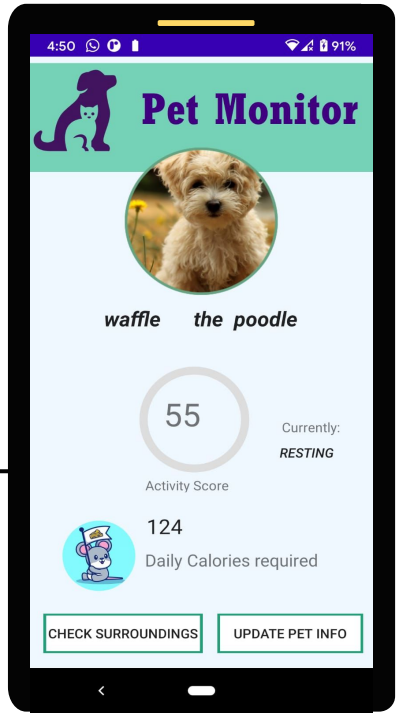
1. Enter pet's name, age, weight

2. Enter pet's species for calculating the activity score and ideal environmental conditions per each species

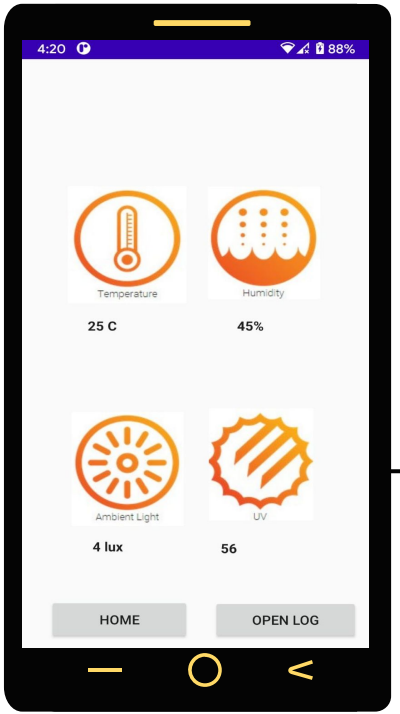
DEMO

Dashboard

Display the pet's activity score and status



DEMO



Surroundings

Display the environmental information i.e. Humidity, Temperature, UV Index, Light

TECHNOLOGY

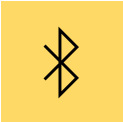
How Did We Implement This?

03

TECHNOLOGY

Android Studio

Android app fo the UI. Communication with BLE, send and receive data from Firebase



Bluetooth Low Energy

Wireless BLE communication between the Android app and Thunderboard

BG22 Thunderboard

EFR32BG22

Thunderboard Kit with

Simplicity Studio

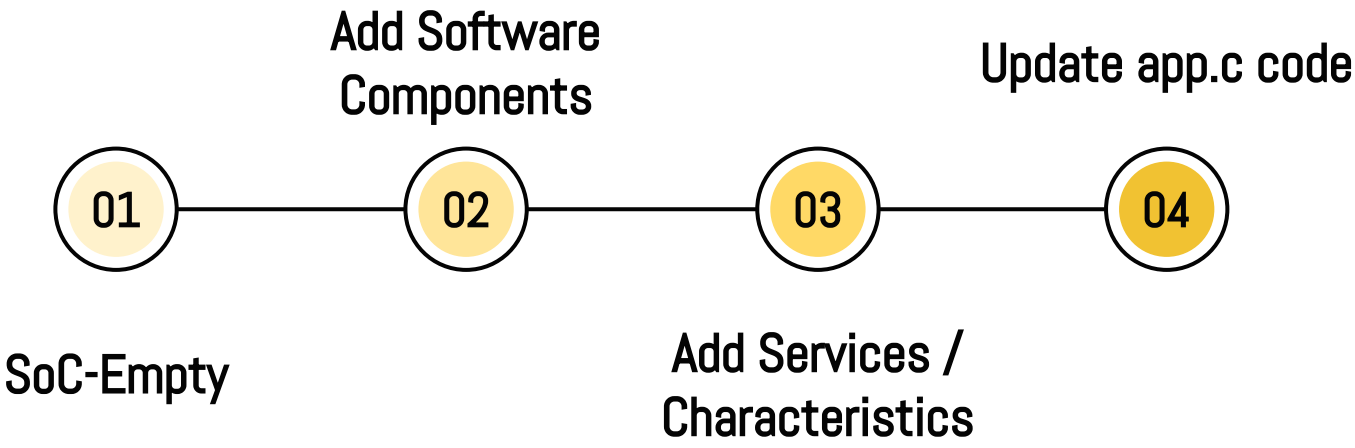
Firebase Cloud Storage

Securely store every data on the server

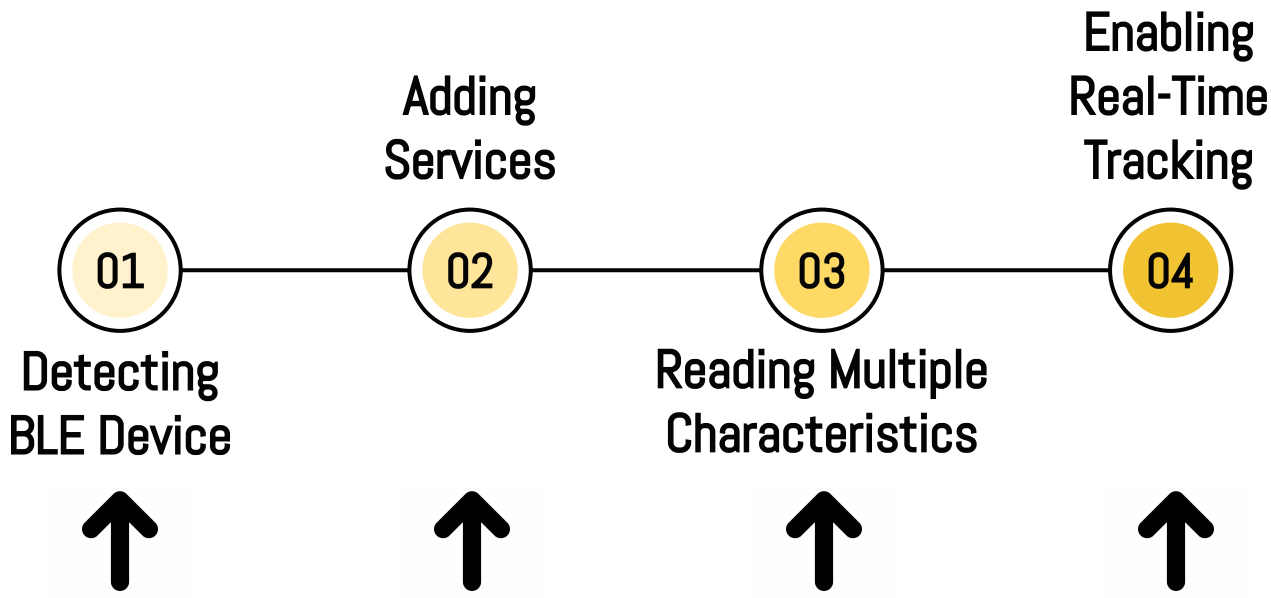
Thunderboard: https://www.silabs.com/development-tools/thunderboard/thunderboard-bg22-kit

Thunderboard as a BLE Server

BG22 Thunderboard Bluetooth API



BLE Communication with Thunderboard



BLE Communication with Thunderboard


```
UUID_SERVICE_ENVIRONMENT_SENSING= fromString("0000181a-0000-1000-8000-00805f9b34fb"),      // Service
UUID_CHARACTERISTIC_UV_INDEX = fromString("00002a76-0000-1000-8000-00805f9b34fb"),
UUID_CHARACTERISTIC_TEMPERATURE = fromString("00002a6e-0000-1000-8000-00805f9b34fb"),
UUID_CHARACTERISTIC_HUMIDITY = fromString("00002a6f-0000-1000-8000-00805f9b34fb"),
UUID_CHARACTERISTIC_AMBIENT_LIGHT_REACT = fromString("c8546913-bfd9-45eb-8dde-9f8754f4a32e"),
UUID_SERVICE_ACCELERATION_ORIENTATION = fromString("a4e649f4-4be5-11e5-885d-feff819cdc9f"),  // Service
UUID_CHARACTERISTIC_ACCELERATION = fromString("c4c1f6e2-4be5-11e5-885d-feff819cdc9f"),
UUID_DESCRIPTOR_CLIENT_CHARACTERISTIC_CONFIGURATION = fromString("00002902-0000-1000-8000-00805f9b34fb");
```

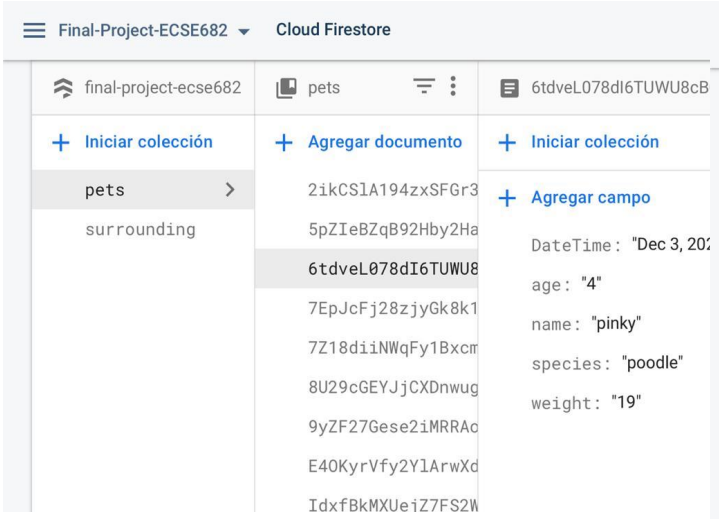
```
2020-12-03 04:43:32.090 11772-11813/com.example.steptracker D/BLE: Acceleration Test : -433 -269 848
2020-12-03 04:43:32.356 11772-11878/com.example.steptracker D/BLE: Ambient Light (lx) : 14465
2020-12-03 04:43:32.358 11772-11878/com.example.steptracker D/BLE: Acceleration Test : -417 -271 853
2020-12-03 04:43:32.402 11772-11878/com.example.steptracker D/BLE: Acceleration Test : -430 -277 871
2020-12-03 04:43:32.447 11772-11878/com.example.steptracker D/BLE: Temperature (Celcius) : 2538
2020-12-03 04:43:32.536 11772-11878/com.example.steptracker D/BLE: Humidity (%) : 2763
2020-12-03 04:43:32.581 11772-11878/com.example.steptracker D/BLE: Acceleration Test : -416 -262 870
2020-12-03 04:43:32.807 11772-11878/com.example.steptracker D/BLE: UV test 0
2020-12-03 04:43:32.814 11772-11878/com.example.steptracker D/BLE: Acceleration Test : -431 -267 862
2020-12-03 04:43:33.077 11772-11813/com.example.steptracker D/BLE: Ambient Light (lx) : 14715
```

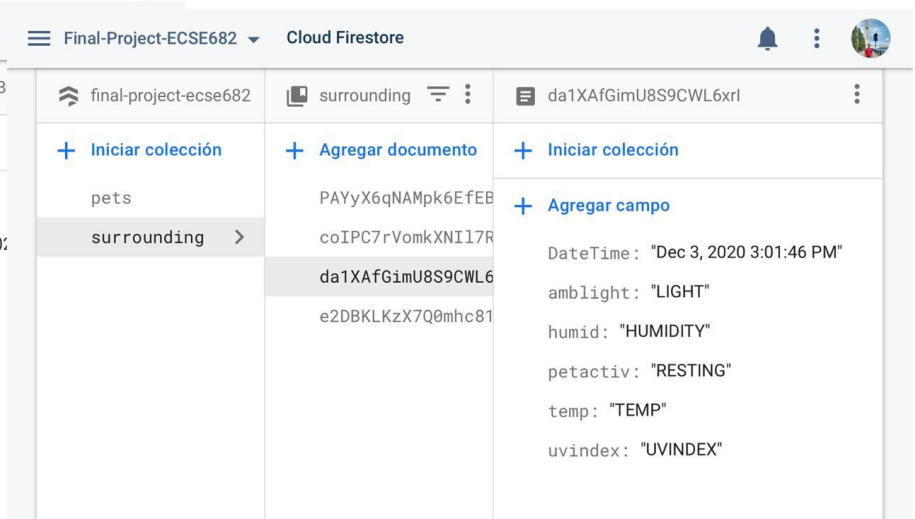
Thunderboard app: https://github.com/SiliconLabs/thunderboard-android
Our Project Github: https://github.com/rhizvo/ECSE_682_Fall2020_Final_Project

FIREBASE CLOUD SERVICE

- Created an account and a project on Firebase
- Registered our app with its package name
- Generated SHA1
- Migrated our app to AndroidX
- Gradle plugin 4.0.1 & Gradle 6.5
- Added dependencies in the app's gradle file

FIREBASE CLOUD SERVICE

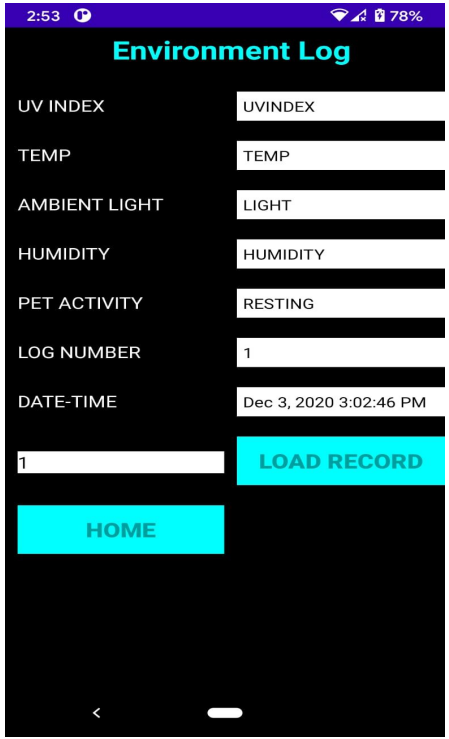


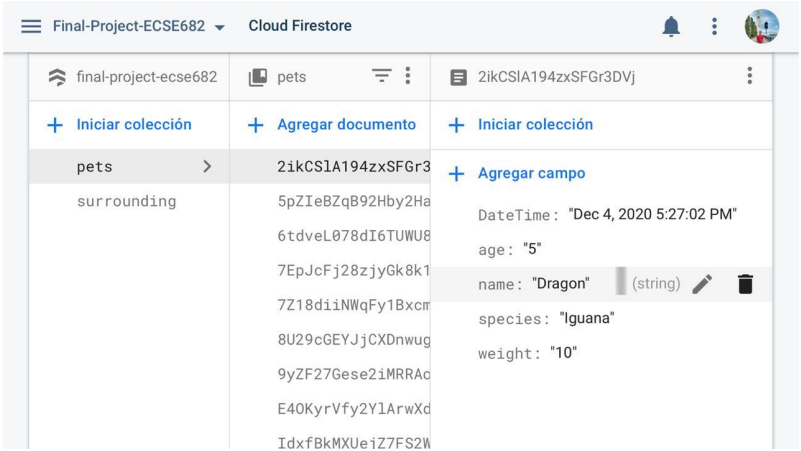


A) Pet Info

B) Surroundings

FIREBASE CLOUD SERVICE





- Retrieved Data from the Android App

04

Final Thoughts

FINAL THOUGHTS

Limitations:

- Absence of accuracy test on real pets [Motion Tracking]
- Lack of pet species data
- Sound Sensor
- Board protection

Future Work:

- Pet's GPS Location Info
- Notification to owner in any abnormal data tracking
- Connect to other devices e.g. humidifier, heater, etc.
- Review power consumption
- Access credentials (Manager, user, view only) for the stored data & application.
- Add features such as showing nearest pet supplies stores

QnA