Find My Place

Software Design Document

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1. INTRODUCTION

1.1 Purpose

The purpose of this SDD is to provide a detailed description of the architecture and design of a system for measuring the density of people in a given place by analyzing Wi-Fi and Bluetooth signals and updating a live application that lets customers know in advance if the place is crowded or not. The intended audience is developers, stakeholders, and anyone who needs to understand the technical implementation of the system.

1.2 Scope

The system will be able to measure the density of people in a given place by analyzing Wi-Fi and Bluetooth signals around by a Raspberry Pi device and updating the application live. The application, "Find My Place," will be intended for use in places such as libraries, malls, supermarkets, and public transportation stations. The system will provide a way for customers to know if a place is crowded before they go there and make decisions accordingly. The product will be global and not specific for one kind of places.

1.3 Overview

This document provides an overview of the system design and architecture, including the system overview, system architecture, data design, component design, and human interface design. The document concludes with a requirements matrix and appendices.

1.4 Reference Material

The IEEE Recommended Practice for Software Design Descriptions (IEEE Std 1016-1998) was used as a reference for this document.

1.5 Definitions and Acronyms

Raspberry Pi: A low-cost, credit-card-sized computer that plugs into a computer - .monitor or TV, and uses a standard keyboard and mouse

Wi-Fi: A wireless networking technology that uses radio waves to provide wireless - .high-speed Internet and network connections

Bluetooth: A wireless technology standard for exchanging data over short - .distances

Owner: A person or organization that controls and maintains a specific place, such - .as a business owner or a university administrator

Client: A person who uses the system to access information about a place, such as - .a customer or a student

Permission: The authorization for a user to perform certain actions, such as editing - .the settings of a place or viewing details about a place

2. SYSTEM OVERVIEW

The system, "Find My Place," is designed to measure the density of people in a given place by analyzing Wi-Fi and Bluetooth signals around by a Raspberry Pi device and updating the application live. The system will use the Raspberry Pi to collect Wi-Fi and Bluetooth signal data from the surrounding area, and use this data to estimate the number of people present in that area. The system will then update a live application with the estimated number of people present in a given place, which will be accessible through a web browser or mobile application. This information will be useful for customers in places such as libraries, malls, supermarkets, and public transportation stations to make decisions about whether or not to visit that place. The system will have two types of users: owners, who can edit the settings of a place and manage the system, and clients, who can view details about a place and access the live application.

2.1 User Needs

The main user needs of the system are:

- Customers, such as students, who want to know if a place is crowded before they go there, in order to optimize their time and find a good, free place to.

- Owners, such as business owners or university administrators, who want to know the amount of people in their place, in order to make strategic decisions about managing their place.

2.2 Assumptions and Dependencies

- The system assumes that all customers and owners have an Android device and that the application will be downloaded on it.

- The system also assumes that all customers in a given place, such as a library, have at least two devices connected to the Wi-Fi network.

3. SYSTEM ARCHITECTURE

3.1 Architectural Design

The system architecture consists of several modules that work together to collect, process, and display data on the density of people in a given place. The main modules of the system include:

- Raspberry Pi: The main data collection device, which collects Wi-Fi and Bluetooth signal data from the surrounding area.

- Data Analysis Algorithms: The algorithms used to process the Wi-Fi and Bluetooth signal data and estimate the number of people present in the area.

- Web Server: The server that hosts the live application and provides a user interface for customers to access the estimated number of people present in a given place.

3.2 Decomposition Description

The system is decomposed into these modules for ease of maintenance and expansion in the future. Each module is responsible for a specific task and will work in coordination with one another. The Raspberry Pi module will collect Wi-Fi and Bluetooth signal data and send it to the data analysis algorithms module. The data analysis algorithms module will process the data and provide an estimation of the number of people present in the area. The Web server will handle the communication between the data collection and processing module and the live application.

3.3 Design Rationale

The system was designed to use a Raspberry Pi as the main data collection device due to its low cost and small form factor. The system was also designed to use Wi-Fi and Bluetooth signals as a way of estimating the number of people present in a given area as these signals are readily available in most places and provide a good way to estimate the number of people present. The system was decomposed into modules to make it easy to maintain and expand the system in the future.

DATA DESIGN

4.1 Data Description

The system will collect and process the following data: Wi-Fi and Bluetooth signal strength data, MAC addresses of nearby Wi-Fi and Bluetooth devices, timestamp of the data collection, and estimated number of people present in the area.

4.2 Data Dictionary

- Wi-Fi and Bluetooth signal strength data: Data representing the strength of Wi-Fi and Bluetooth signals in the surrounding area, measured in dBm.
- MAC addresses of nearby Wi-Fi and Bluetooth devices: A unique identifier for nearby Wi-Fi and Bluetooth devices, used to identify devices and estimate the number of people present in the area.
- Timestamp of the data collection: The date and time at which the data was collected.
- Estimated number of people present in the area: The estimated number of people present in the area based on the Wi-Fi and Bluetooth signal data collected and processed by the system.

5. COMPONENT DESIGN

5.1 Raspberry Pi

The Raspberry Pi will be responsible for collecting Wi-Fi and Bluetooth signal data from the surrounding area using a wireless adapter and sending the data to the data analysis algorithms module for processing. The Raspberry Pi will also be responsible for handling communication between the data analysis algorithms module and the web server.

5.2 Data Analysis Algorithms

The data analysis algorithms module will be responsible for processing the Wi-Fi and Bluetooth signal data collected by the Raspberry Pi and estimating the number of people present in the area. This module will use a combination of signal strength data and the MAC addresses of nearby devices to estimate the number of people present.

5.3 Web Server

The web server will be responsible for hosting the live application and providing a user interface for customers to access the estimated number of people present in a given place. The web server will also handle communication between the Raspberry Pi module and the live application.

6. HUMAN INTERFACE DESIGN

6.1 Overview of User Interface

The user interface will consist of a live application, which can be accessed through a web browser or mobile application, that displays the estimated number of people present in a given place. The interface will be simple and easy to use, providing customers with real-time information about the density of people in a place.

6.2 Screen Images

The live application will have several screens that users can access, including:

A login screen for owners and clients to log in and access the application.

A screen for owners to edit the settings of a place, such as the capacity of the place.

A screen for clients to view the details about a place and see the estimated number of people present.

6.3 Screen Objects and Actions

Login Screen: Users can log in using their username and password.

Owner's Edit Screen: Owners can edit the settings of a place, such as the capacity of the place.

Client's View Screen: Clients can view the details about a place, such as the name and address, and see the estimated number of people present.

7. REQUIREMENTS MATRIX

ID	Description	Permission	Type	Priority	Comments
1	Edit the capacity of a place	Owner	functional	High	
2	Clearly display of the free places	User	functional	High	
3	Count the signals around the Raspberry pi for accurately	Owner	functional	High	
4	Send the data to the broker Raspberry pi	Owner	functional	High	
5	Write all the data to a Database	Owner	functional	High	

8. APPENDICES

The source code for the project will be written in Python.