Cleveland State University WIFI Analyzer

SOFTWARE DESIGN SPECIFICATION

Submitted by

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1.0 Introduction

In recent years, there has been a lot of demand for Wi-Fi hotspots. In this work, we examine the impact of different internal environmental factors on the coverage of Wi-Fi strength across campus building. We see a visual illustration of the wireless signal coverage and strength with the help of Wi-Fi heat map.

With heat map, we can easily identify the specific position with poor signal reception and determine effective router positions.

In large building areas with the help of heat map, we can easily troubleshoot signal fluctuations. Wi-Fi heat maps are considerably useful in revealing potential sources of signal interference, such as walls, furniture, large appliances, and other wireless devices.

Heat maps are quite popular these days. A properly configured Wi-Fi network improves communication between the devices that connect using it, which, in turn, assist productivity in a business. That is why it makes sense to ensure stable, well-built, and protected signal strength across the whole campus or area. One can find multiple Wi-Fi heat map software available on internet e.g. solar winds, Ekahau, Acrylic Wi-Fi etc. Some of them are paid and some are fully free. You can easily install it in your laptop or smart phone and use it. In few easy steps like install app , upload the map of the building or area you want to check then start moving from one location to other to capture the signal strength and see the color coded results.

1.1 Goals and objectives

Building a website, which represent a Wi-Fi access points (APs) coverage map in the city of Cleveland at the periphery of the Cleveland State University.

1.2 Statement of scope

Data collection for input will be done via measuring WIFI signal strength using mobile App around the college building including basement where we have car parking. The smart phone uses application to measure Wi-Fi signal strength at a specific area.

Using this data as Input, we will send to our code. Using logics and functions our code will generate heat map and display through website as output.

We are planning to display heatmap of different floors on the website.

1.3 Software context

Heat map is a color-coded graph, which helps in determining the strength of the signals from high to low at different areas. Visual representation is easy to understand and locate specific area with poor signal strength. Rather than blindly guessing and installing routers at wrong place, heat maps really works efficiently to figure out the specific location.

With our website one can determine and analyze the weakest and strongest Wi-Fi signal reception areas across the Ronald Berkman Hall Building of the Cleveland State University campus.

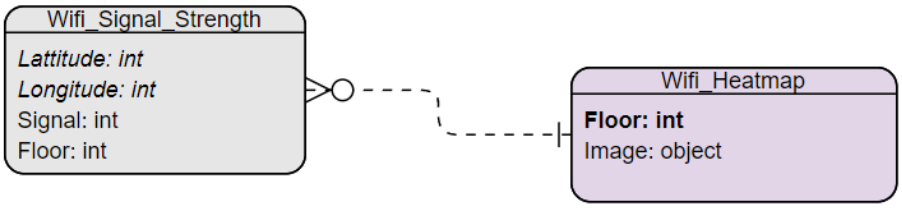
1.4 Major constraints

- With limited time and limited resources , real time signal strength measurement is out of the scope of this project and will not be displayed via website
- Data collection for the entire campus of the Cleveland State University (all the buildings) is not possible with limited resources and it is not in scope of this project, so we are planning to consider one of the buildings of the campus.
- Website will be limited to display heat map of one of the building of Cleveland State University

2.0 Data design

We are planning to capture all the data in a spreadsheet initially, like latitude and longitude along with WIFI signal strength. Then using MATLAB will generate heat map graphs. Based on each floor heat map images will be displayed on the website for the selected floor.

Wi-Fi signal strength is measured in dBm, which stands for decibels relative to a mill watt. We are working in negatives. -30 is a higher signal than -80, because -80 is a much lower number* [1].

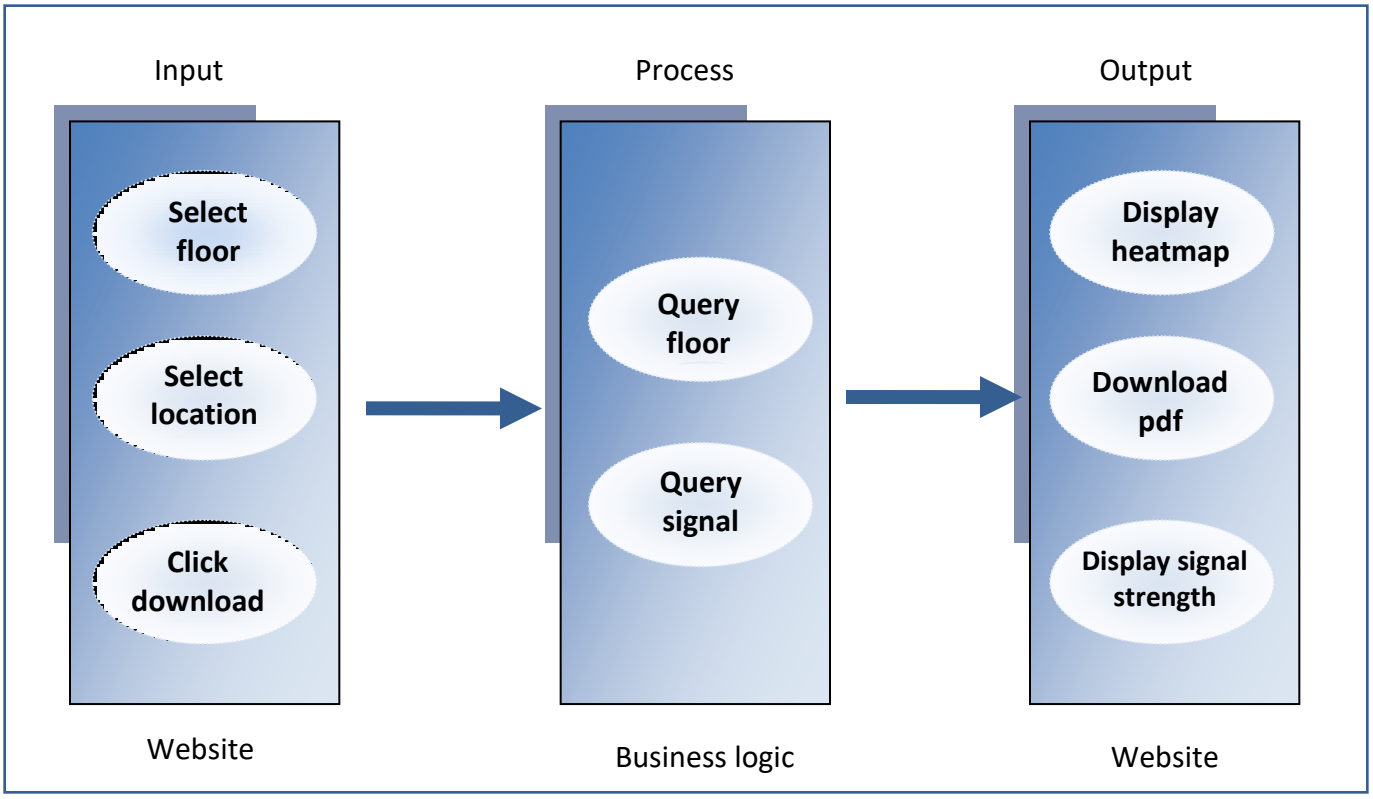


* check appendices section 6.1 for more WIFI signal strength details

3.0 Architectural and component-level design

3.1 Architecture diagrams

A description of the software architecture in terms of process view is presented below -



- **Input:** Input section will be web portal, where a user can access the website link and user will have option to either select the floor, or select the location or else user can click download button.
- **Process:** Process section is only for internal processing of the user requests. , if user has selected the floor or location, system will generate heatmap for the specific floor or system will get the WIFI signal strength of the specific location and send the result to the portal.
- **Output:** Once again this time, frontend web portal will serve as output as it will display the results to the user. If user has requested for the heatmap, it will show heatmap. Else if user has selected the current location, then it will display the real time WIFI signal strength of the heatmap. Or else if user has requested for the download pdf , it will generate pdf and download on the user's machine.

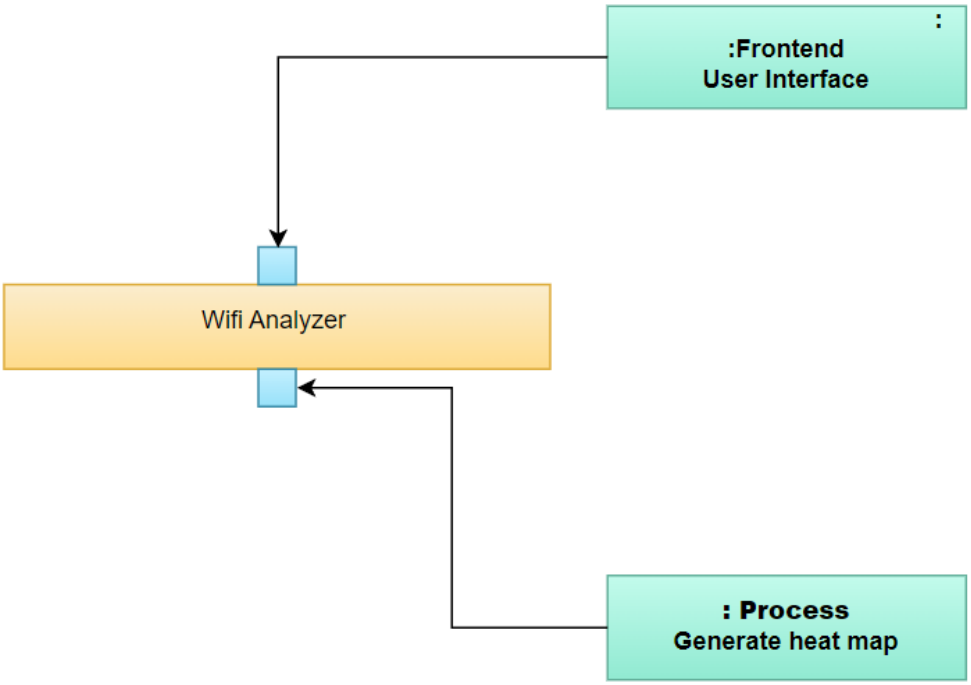
3.2 Description for Components

A description of major software components contained within the architecture is presented. Section 3.2.1 is repeated for each of the components.

3.2.1 Component & description

3.2.1.1 Interface description

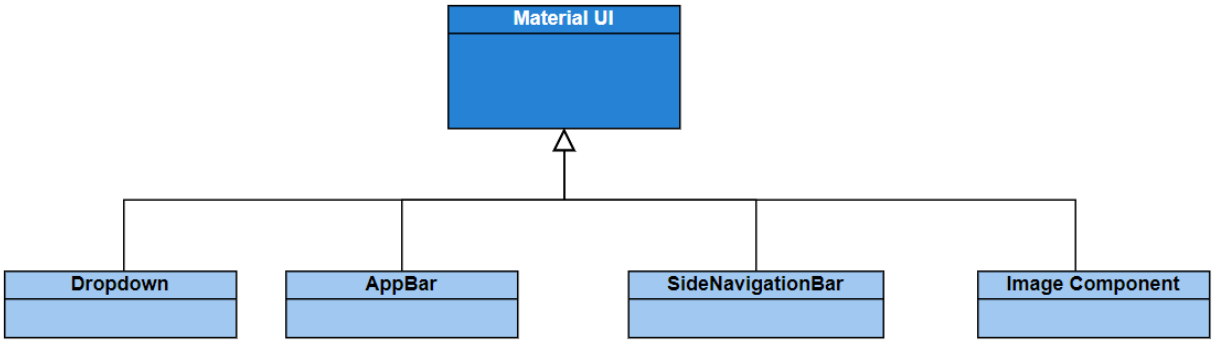
There is user interfaces for the frontend and for generating heatmap backend logical process



3.2.3.2 Static models

We are using Material UI for the component designing and we have segregated our design view in a various functional views. As the application has been developed using React, this follows Functional Component conventions for the front-end. Below are the parts that are involved as reusable functional components which are inherited from Material UI:

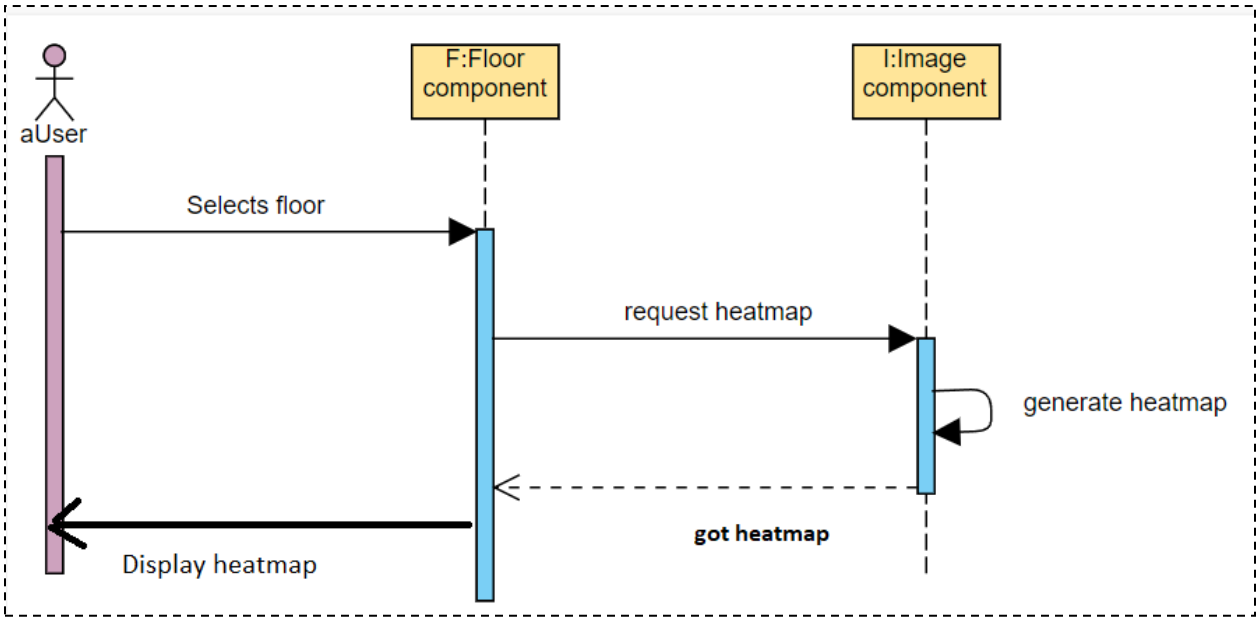
AppBar, SideNavigationBar or Drawer, Dropdown, Image Component



Apart from this every Floor components are inherited from the same class where the values get changed based on the Floor type

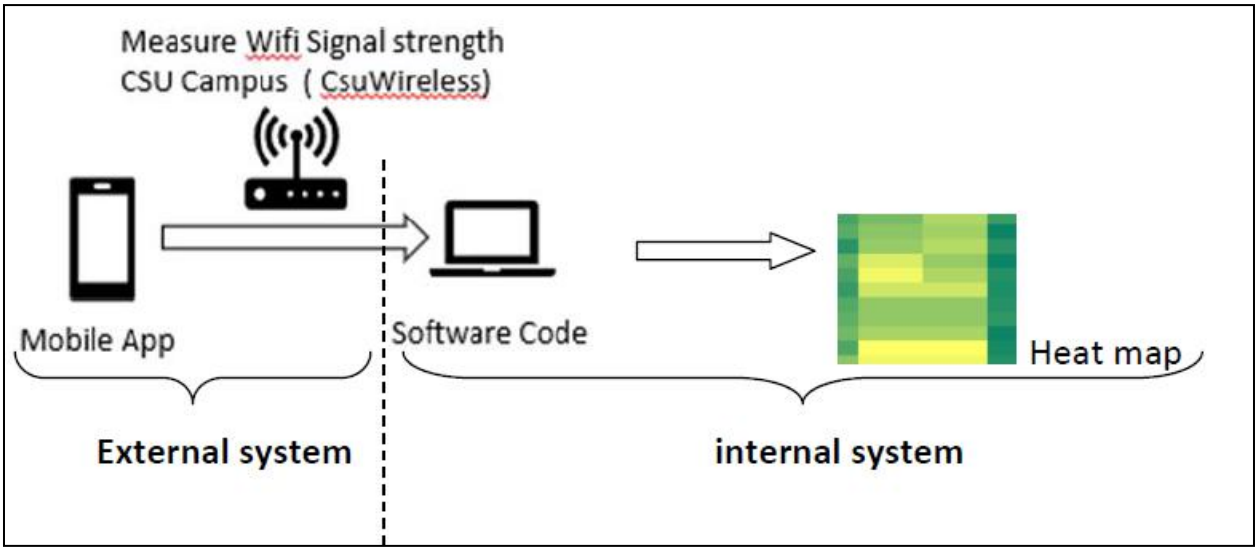
3.2.3.3 Dynamic models

Below is the sequential model for Wi-Fi analyzer for one scenario, where user is requesting for heat map for one of the floor –



3.3 External Interface Description

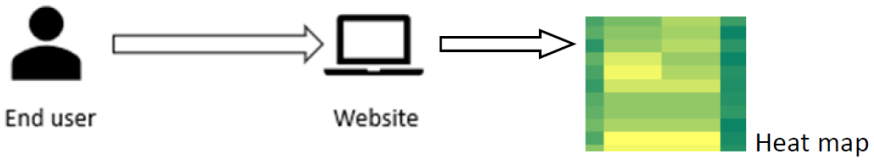
The software's interface(s) to the outside world (other software or hardware systems) are described in below image -



Using mobile /laptop (external systems) we will capture data (WIFI signal strength), this will be fed to our software code as input to generate heat map as output.

4.0 User interface design

End user will click the website the link; website will display WIFI heatmap of the selected floor of the Cleveland State University campus –

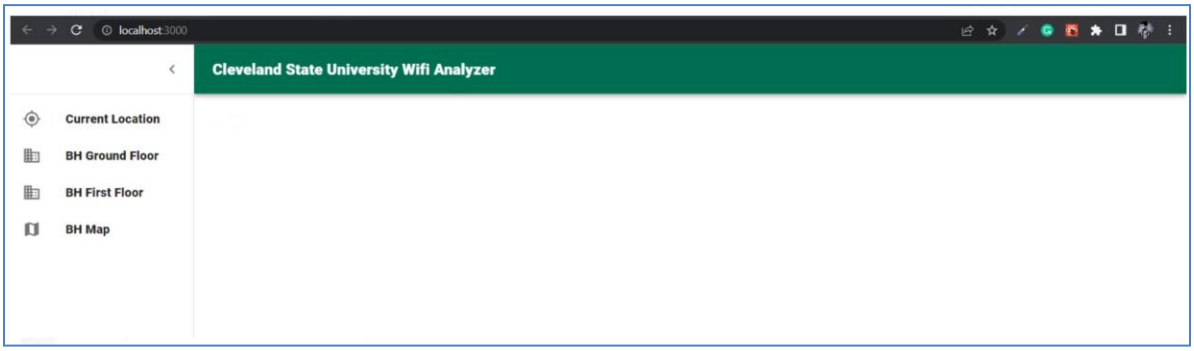


Different color cells represent different signal strength of the WIFI heatmap.

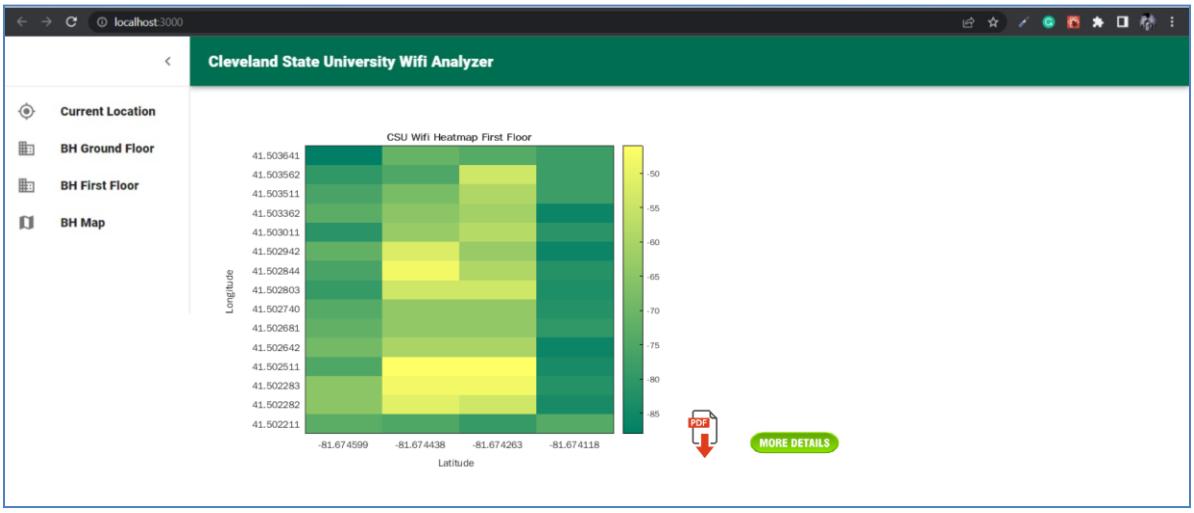
4.1 Description of the user interface

In next section some mock screens are attached for reference purposes only. It displays home page of the portal, heat map for fist floor and other icons.

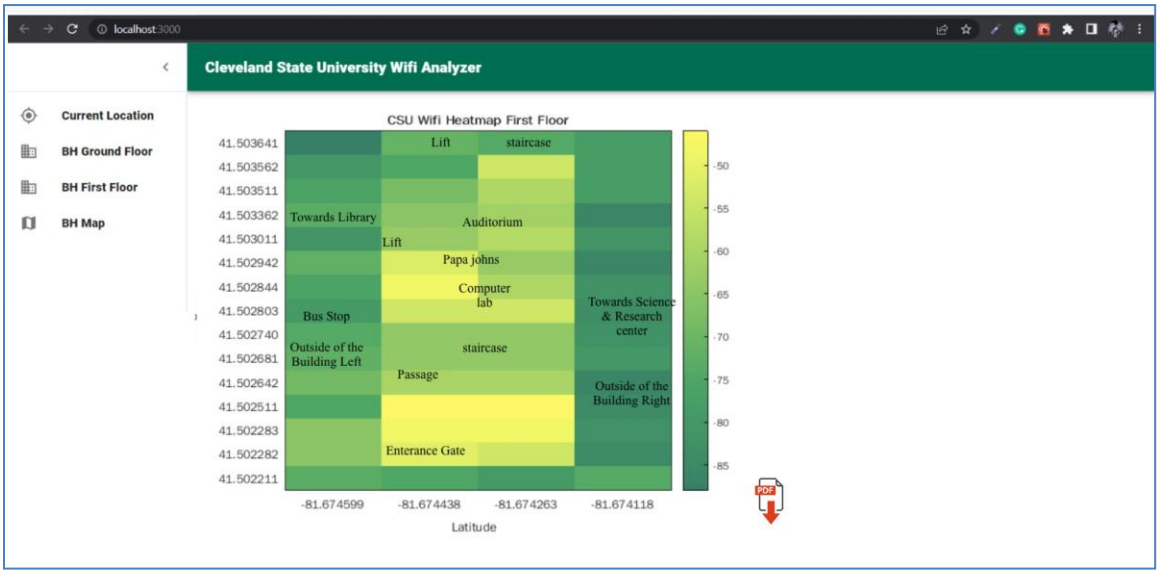
4.1.1 Access web portal link: Main Home Page loads



4.1.2 Side Menu BH First Floor – "On-Click"



4.1.3 Side Menu BH First Floor >> "More Details" – "Button-Click"



4.1.3 Side Menu Current Location – “On-Click”

5.0 Restrictions, limitations, and constraints

- Wi-Fi signal strength will be measured only where we have access.
- Restricted area will not be considered for the signal strength measurement

6.0 Appendices

6.1 Ideal Signal Strength

Below table describes the probable values of the WIFI signal strength

Signal Strength	TL;DR		Required for
-30 dBm	Amazing	Max achievable signal strength. The client can only be a few feet from the AP to achieve this. Not typical or desirable in the real world.	N/A
-67 dBm	Very Good	Minimum signal strength for applications that require very reliable, timely delivery of data packets.	VoIP/VoWi-Fi, streaming video
-70 dBm	Okay	Minimum signal strength for reliable packet delivery.	Email, web
-80 dBm	Not Good	Minimum signal strength for basic connectivity. Packet delivery may be unreliable.	N/A
-90 dBm	Unusable	Approaching or drowning in the noise floor. Any functionality is highly unlikely.	N/A