INFS3202

Assignment One
Website Proposal

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Overview

The website chosen to be developed for this assignment is Hub: An Internet of Things (IoT) communication hub that stores data received by web enabled devices, presents this information graphically to the user and facilitates the forwarding of information to other connected devices. Hub is targeted at developers, researchers and hobbyists alike that wish to monitor information that their connected devices collect, create virtual connections between these devices and store their transmitted information in a single, easily accessible location for visualisation and later download.

Deployment Environment

Hub is designed to make information transmitted by IoT devices easily accessible, and as such, will be platform independent and optimised to work on all of the popular modern web browsers. This includes being able to adapt to all display sizes, including mobile and tablet form factors.

Layout

The website will operate by classifying clients into two categories: User and Device.
- A user client is able to access the graphical console that provides management and visualisation of the data sent by their connected devices.
- A device client communicates with the server, sending the data it collects and receiving messages from its associated user client and other virtually connected devices.

To store the data received by device clients, a database will be used. This will ensure that data can be stored safely and well managed.

An overview of the architecture of the web information system is illustrated below in figure 1.
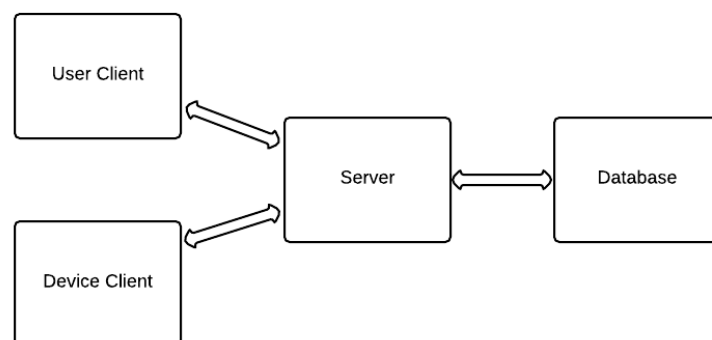

Figure 1: Website Architecture

Technologies

User Client Side

For the user client side of the web system, content will be delivered to the user through the HTTP protocol when they access the home page in their browser. Content and animations will be displayed using HTML, CSS and JavaScript. HTTP, HTML, CSS and JavaScript will be used as they comply with web standards and are widely supported by internet browsers.

Device Client Side

For the device client side of the web system, data will be sent to the server using the HTTP protocol, however it will bind to a different port on the server than the standard "80" or "8080" port used as standard by HTTP and HTTPS respectively. The data will be sent encrypted and in a standardised format within TCP/IP datagrams to ensure that all messages are delivered. All messages will follow a set format to enable ease of communication. HTTP will be used for the same reasons as stated previously.

Server Side

The server will utilise the Apache Tomcat server software as this is the software used by the Student Zones supplied by the course.

As outlined in the device client and user client side technologies, the server will be listening on both the standard HTTP and HTTPS ports ("80" and "8080") for incoming user client requests, and then a different unique port for device client requests.

For user clients, JavaScript, JSON and AJAX will be used to collect data from the database and display it graphically to the user. JSON will be used as it is closely related to JavaScript making it simpler to integrate, and AJAX will be used as you can update a web page without reloading it which reduces data consumption, request and receive data from a server after the page has loaded, and send data to a server in the bacground[1].

For device clients, data received will be interpreted using JSP and then stored in the database using JavaScript, AJAX and JSON. JSP and HTTP will also be used to send data to the devices. These technologies will be used for the same reasons as previously stated. JSP will be used rather than PHP as handling requests by the device clients will entail some complexity. It also has better development tools than PHP, which will be useful in the implementation, will be able to scale more easily as the number of connected devices increases and is more maintainable.

Web Standards

In order to have a successful website, it is imperative that this website is user friendly, reliable, secure and easily adoptable.

For a website to be user friendly, it must be similar to existing websites in terms of navigation skeuomorphism. This can be achieved by developing a website that complies with web standards, as by using the same standard as other websites, it will automatically resemble the same underlying properties of existing websites that users have become adapted to.

The same principle applies to the reliability of a website. The web standards are standard as the are assured to be robust and reliable in a web context given correct implementation. So by using these standards, the website in development can also exhibit these same properties. This also applies to the security of a website as security techniques have been adapted to the web standards, making them more adaptable to sites that meet web standards.

By meeting all the previous criteria, the website will be easily adoptable as it will become user friendly, reliable and secure.

Design

Layout

Navigation
As this website is a productivity tool, the main goal in terms of navigation is to be as simple and as possible without sacrificing efficiency. To accommodate for this, Hub utilises three main types of navigation:

- The top navigation bar, which is always in frame and houses the menu button that opens up the side navigation panel. This can be seen in figure 2.
- The side navigation panel, which is hidden from view unless requested to allow users to focus on the content. This panel provides functionality such as selecting a connected device, returning to the home view or logging out. This can be seen in figure 3.
- Device View tabs, which are present when a device is selected from the side navigation panel. These are used to toggle between the different applets, charts and information views specific to each device. This can also be seen in figure 3.

To ensure that navigation is fast and simple, these three features remain the same (size and location wise) throughout every action performed by the user, and are only visible when needed as to not distract from the content on each page.

Skeuomorphism is also adopted where possible, such as the menu icon and map and chart views so that users can easily locate the information they are looking for.

Content
The way that content is displayed is also kept consistent throughout the site. Overviews keep the same layout (stats on the left, map on the right), device views remain the same for each device in terms of where information is located, and the graphical representations of data remain consistent to allow easy recognition by the user.

Cosmetics

Colour Scheme
As this is a productivity tool, the colour scheme chosen needed to be simple, professional consistent and clear. It was for these reasons that the colour scheme illustrated in figures 2 and 3 was chosen. The dark blue-greys provide professional aesthetic appeal, the consistent light greys provide simple and clear information categorisation, and the contrasting orange buttons make themselves clear and easily locatable by the end user. These colours are also kept consistent throughout the whole site.

Effects

Various effects were used in this site; however, their duration was kept at a minimum to ensure that productivity was the main focus. These effects include:

- Button hover discoloration to provide feedback to the user that they are using a button.
- Side navigation slide out motion to provide the impression that it overlays the underlying content and forms part of the navigation bar.
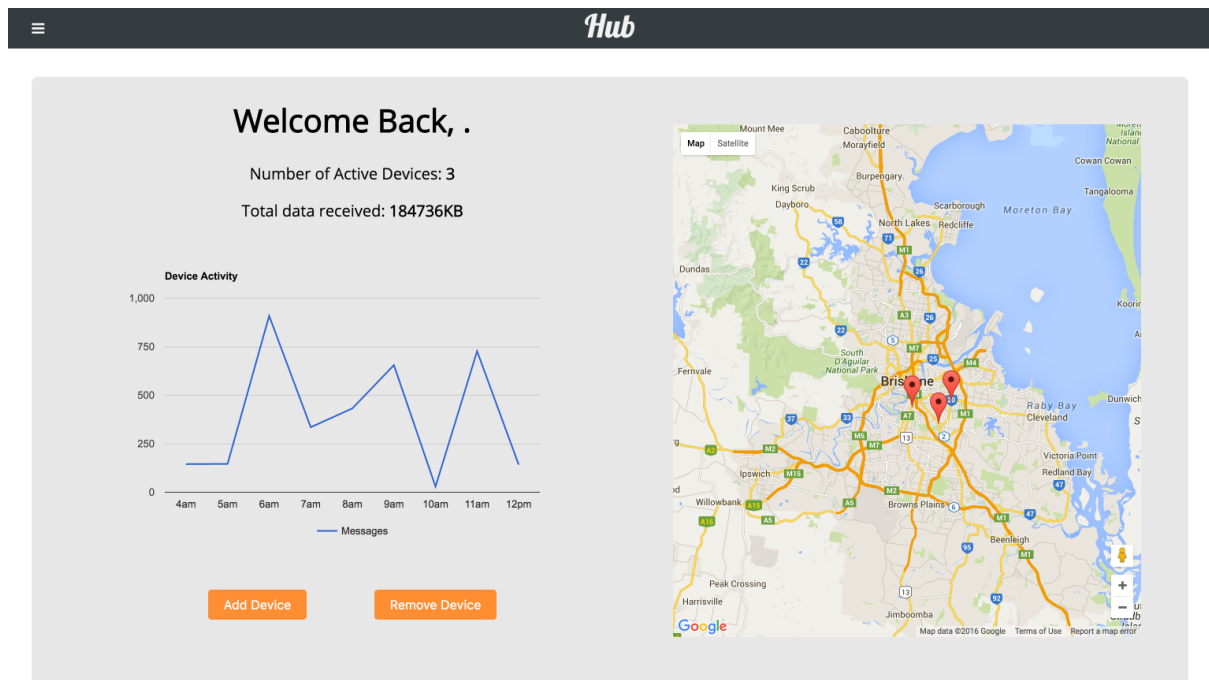
Figure 2: The Home View
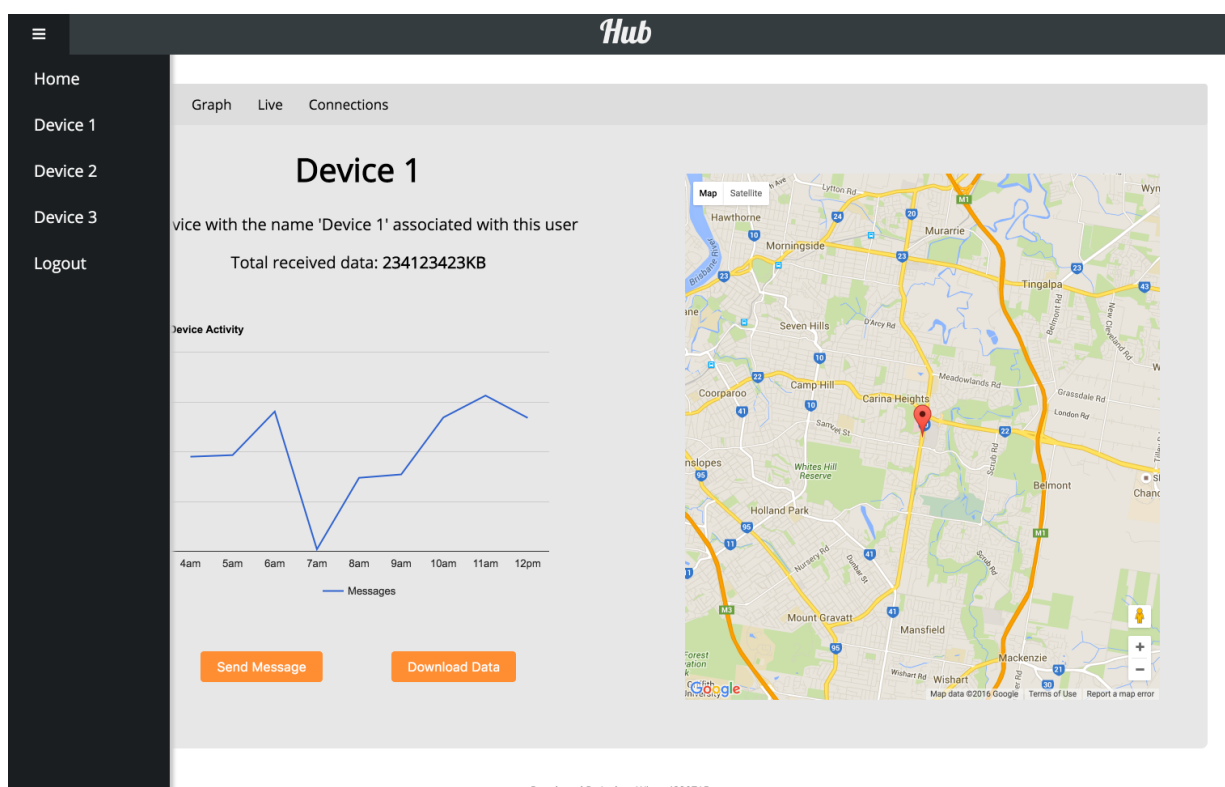
Figure 3: The Device View with Side Navigation Open

Features

Client Server Communication

User Client Communication
Due to the control centre nature of the website, the layout and type of information displayed is consistent for each device, however the fine details such as device name, location and data relevant to that device are different. This means that a unified view for every device can be used, and the data specific to each device loaded when a new device is selected. This means that JavaScript, JSON and AJAX can be used to load the data relevant to each device when a new device is selected without reloading the page and ensuring that the layout of the page remains consistent for all device views.

Device Client Communication
For the device client communication with the server, it is up to the developer to enable it to send and receive messages over HTTP/S with the format specific to the website. The implementation of this does not effect the website.

Unique Feature

The unique feature for this website is the ability to send and receive data to and from a web enabled device or system. JSP will be used to listen for requests on a unique port on the server and interpret data sent by device clients. When a message is received on the port, the message will be extracted and stored in the database.

The second part of the feature is the ability to send messages to these connected devices. Assuming that the device has a known static IP address, a message can be inputted by a user, formatted correctly for the device and then sent to that device via HTTP. This same process can also be used to forward messages from connected devices to other connected devices.

Advanced JavaScript

HTML5 Standard API
The HTML5 standard API that will be used is the Geolocation API. When a message is received by a device client, its geographical location will be stored with the message, and the HTML5 Geolocation API will be used to extract this information.

Third Party Libraries
The first third party library that will be used is the Google Map API, which will be used to display a map indicating the last received the location of a device client. This API will be used as it provides a familiar map interface which is widely used on the web, meaning that it will be more intuitive to the user.

The second third party library that will be used is the Google Charts API. This API will be used to provide the graphical representations of the data received by the device clients. It will be used as it is simple to implement, elegant, intuitive and robust. It also comes with built in AJAX support for dynamic data, and interactive features to help the user interpret the data with ease.

Unique Feature

The unique feature developed using JavaScript will be an applet that displays as a list the messages from a specific connected device as they are received by the server (live). The applet will have features that allow the user to customise how the messages that are being displayed by sorting, categorising, and highlighting when a condition is met. It will also allow the user to change how many messages are displayed and the size of the text.

References

1. w3schools. AJAX Tutorial [Internet]. Refsnes Data; 2016 [cited 18/04/2016]. Available from: http://www.w3schools.com/ajax/