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Office Message Board

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The Office Message Board Design and Implementation

Abstract

This project aims to provide faculty at ONU with an efficient tool to communicate changes in availability to students. Changes in availability can cause confusion between students and faculty. Our design will provide students with up-to-date information on their professors' whereabouts, letting them know when their professors are in their offices, at meetings, teaching classes, or unavailable.

Stakeholders for this project include the university faculty, as they will use the product to update students on their availability. Students are another primary stakeholder, as they need a user-friendly, accessible method to view professors' office information. Another stakeholder is the IT department, as they will play a role by providing necessary network access. Lastly, the university administration provides funding and supplies.

The design constraints and evaluation metrics were determined through ideation and the use of surveys that we created for some of our stakeholders, including faculty and students. The major constraints that were determined are price, size, security, and remote configurability. Based on the survey, remote configurability was very important to the faculty members, so our design will allow faculty to update their locations remotely and in real-time through a web interface. The major evaluation metrics include price, power consumption, and usability. The decision to include each of these metrics was based on the stakeholders and their needs.

In the ideation phase, our group came up with three designs for the device. The designs were made with general price points in mind, we wanted to see how cheap or expensive we could feasibly make the design. All three designs had to have some method of displaying information and a method of updating the information. We started with a design that was moderate in price components that would allow for the features that were requested by the faculty and students. Then we designed a less expensive design, and a more expensive design. Using a gantt chart we weighted how effective each design was at displaying information and updating that information, while keeping the cost of the designs as another weighted factor. These weights were based on the estimated quality of the components and the potential user experience of the design as a whole. We ultimately chose the higher quality design, as we felt the design was still adequately priced and would provide a good user experience.

Once a design was chosen we needed to mount the device behind a glass window in order to be seen by the students and used by the faculty. We came up with several different solutions, but ultimately decided to choose hooks with suction cups. Suctioned to the glass, these hooks

would provide ample support for the device, as seen through their rated maximum weight capacity and a simple weight test conducted on the suction cups.

With these decisions made, we further developed other aspects of the design such as the website layout, screen sleep cost options, dimension specifications, manufacturing details, database information, and more. After all these decisions were made, we have the designs for a product that will adequately meet the needs of our clients and stakeholders at a cost of $142.30 per unit.

Introduction and Stakeholders

The main objective of this project is to provide faculty at university with an efficient tool to communicate changes in availability to students. Changes in availability can cause confusion between students and faculty. Our design will allow faculty to provide their students with up-to-date information on their professors' whereabouts, allowing them to know when their professors are in their offices, at meetings, teaching classes, or unavailable due to any other reason. The secondary objective of this project is to give students more timely and accurate information on their professors' status outside of classes. This eases the stress of trying to find and meet up with professors.

The students and faculty are obvious stakeholders, but another, less obvious stakeholder, is the university's IT department. The office message board device requires the use of a network in order to function correctly. There needs to be a server hosting the back end of the device. The back end is simple, being made up of a database and a program that handles authentication. This simplicity means that any IT department should be able to host the required back end easily on their own network.

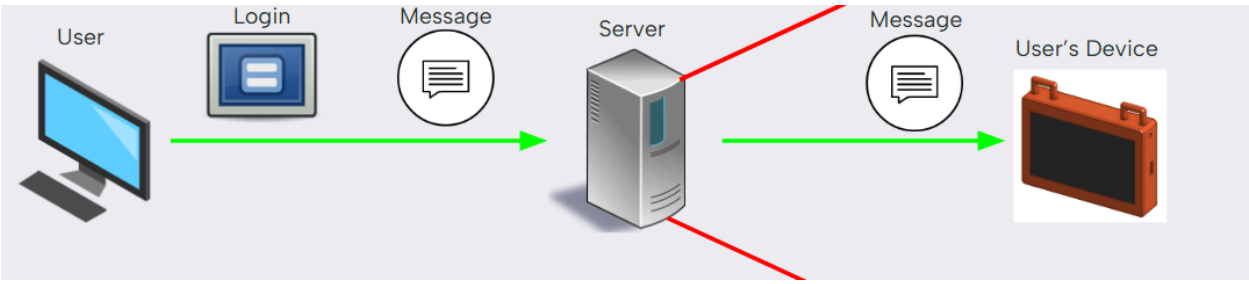

Figure 1: Server Diagram

Data Collection

In order to gather important information from our stakeholders, our group decided to hold surveys for the faculty and students at our university. This was done to ensure that our designs will support the wants and needs of the stakeholders effectively and accurately. We held these

surveys as anonymous as we did not need to collect any information on the participants of the surveys and made sure the surveys were compliant with our universities' Institutional Review Board standards. We came up with different surveys befitting the faculty and students and then distributed our surveys to those groups. The responses we received were invaluable to our ideation phase of this project. From the faculty we noted that they wanted a low maintenance device that was easy to update from not just their office. While the students wanted a more reliable and standard means of receiving updates on faculty's office hours. These responses allowed us to better design our product.

Ideation and Design

Possible solutions have been proposed as ways that faculty can communicate with students. The first design concept is our most basic design. Centered around an LED display system with pre-programmed switches corresponding to a few preset messages. The second design incorporates an E-Ink display that is updated via a keyboard and mouse, powered by a Raspberry Pi 3 Model B+. The third design concept features an LCD screen that can be wirelessly updated using a website. The device runs on a Raspberry Pi 3 Model B+. The display will be clear and readable to the students, while also allowing for quick updates. All of the design concepts will need to have a plastic casing. The casing is designed to be 3D printed with PLA filament. After considering the information from our surveys, research, constraints, and metrics, our team found that our third design concept would satisfy the needs of the client and stakeholders the best.

Figure 2: Selected Device Design

With the design of the product chosen, the next step we decided upon was to test the mounting method. The device is intended to be displayed inside a professor's office on one side

of a glass window. In order to display the device, our group decided that an effective mounting mechanism would be hooks that are suction cupped to the glass. The device would rest on these two hooks from mounts at the top of the device. We made this decision because the weight of the device is light and is well within the weight capacity of the hooks.

In order to test the mounts, we calculated the expected weight of the device as roughly five pounds. We then attached a five-pound weight to two suction cups and then attached a twelve-pound weight to another two suction cups. The twelve-pound weight is the rated maximum capacity for the suction cups. These suction cups were hung on a glass window for fourteen days, neither of the weights fell during these fourteen days. We concluded that, while we would have liked to have tested for longer, we believe that this mounting method will allow for the device to be suspended from the glass for a significant amount of time.

While finalizing the physical aspects of the device we were also working on the software portion for a hardware-software codesigned product. So as we figured out which controller to use and which screen to use we made sure everything was optimized for those parts on the software side. Our front-end is web-based so everything is run through a web server that is hosted by Microsoft Azure. When you first visit the site you're able to create a new account or login to an existing account, this will send a query to the MySQL database, also hosted by Microsoft Azure, and verify the given credentials. Once you're logged into the website, you're able to view the current display on the hardware as well as update the current display for your account and device. This display can be any string up to 250 characters in up to four fonts or even display an image. Finally, The entire website is all displayed in pleasant-to-view pages that are coded in php, html, and css.

Meanwhile, in the back-end all of the information such as usernames, passwords, salts, current displays, and settings are all hosting within our MySQL database. Our passwords are salted and hashed using the SHA256 algorithm for maximum security, we never pass unhashed passwords over the network. Our passwords are also required to be a minimum of 12 characters, contain an uppercase and a lower case letter, a number, and a special character. These are all in line with NIST's newest publication of 800-83. Any of the other stored information, such as the current displayed text, user settings, or image location, are pulled by simple SQL injection resistance queries to the database.

Our largest software hurdle was deciding how many features to implement, as we pitched the idea to more and more people we got more and more ideas of message types to display to users so as we have been developing the software we have been adding the most likely to be used features first. In the future, We want to include features such as custom preset messages, an improved UI design, timed messages, more account management, and sleep and power settings. Ultimately our time to work on this project is the limiter on how many features we can add to the

device, but we believe that these features will provide an adequate user experience for the product.

Conclusion

We started this project with the goal of designing and manufacturing a product that will allow faculty to better communicate changes to office hours to their students. We went through many stages of development in order to gather information on our stakeholders, identify design metrics and constraints, create possible designs for our device, and choose the best design. We believe that our group has developed a product that can help improve the daily lives of faculty and students in university.

Currently we are still finishing the development of the product by implementing cost saving measures of the housing of the device. We plan to have three message board devices to be completed that will allow us to complete various test plans. The future test plans include a durability test where we will research the durability of the components to see if they will be able to withstand the shock of the product being dropped. Once we are confident that the components and the housing are durable we can perform a drop test to see if our findings are accurate. The second test we plan to implement is to have multiple devices running on the server at once to ensure there are no software bugs that will affect the functionality of the device. The final test we are planning to perform is to have new users complete common tasks on the device. This test allows us to test the usability ensuring the device is as easy to use as possible.