FETLab Public Information: Simple Access and Visualization

Abstract

This document proposes a solution to solve a communication problem in the FETLab. The solution considers building a device to facilitate the interaction of the user and a web based content service that displays personalized information in a public display at the lab. The objective is to simplify the access of the user to the meaningful and general information related to the lab (classes and projects), and to help the user of the lab improve awareness and opportunity to respond to lab's requirements.

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Introduction

Communication and tasks in a collaborative environment present a number of challenges that affect the effectiveness and alter the simplicity of the process to achieve the objectives or in some cases affect drastically the level of performance of the members of the group. This process increases in complexity when the numbers of members in that collaborative environment increase or when the members are a temporary part of the collaborative process and a changing population of members makes the organization more dynamic. This is the case for laboratories in educational institutions where not only members of the laboratory have access to the resources, also students and other members of the institution. This situation makes the access to the resources more limited and sometimes the schedules simply collapse.

Our chosen collaborative environment is the FETLab. Due to the limited resources and time, the 3D printer and Laser Cutter have online reservation based schedules. However, these schedules are not displayed anywhere in the lab and by the nature of the information any displays created must be dynamic in order to be effective. Furthermore, individuals must gather information from multiple online collaboration sources in order to have access to all updates, revisions, and task lists. The whole information a user needs to handle is distributed on those sources without a standard.

Proposed Solution

We propose a solution consisting of two parts: a web-based content service (WBCS) and an interactive RFID-base device. The web-based content service will capture and aggregate meaningful information coming from diverse sources. The information will be general public information grouped by user (students associated with the lab) rendered in a public display located inside the lab (Figure 1). The interaction with public displays has been explored showing positive reaction from the user of the particular information rendered on those displays [1][2]. The information will be presented according to its nature by categories in one or more pages depending on its use (pending evaluation of priority).

Categories of information

- Schedules (Organization for tool and machinery use)
- General communication (articles suggested for reading, news, lab's rules, list of people authorized to use equipment, etc)
- Class related information (cancellations, make ups, due dates, etc)
- Projects (projects assigned, future projects in the lab, etc)

Some identified sources of information

- Schedules of 3D printers and the Laser cutter that currently exist in the lab but almost nobody can access them.
- Class web site (communications generated in the web site dedicate for specific classes related to the lab, for example: HCIN720).
- Transfer information from physical communication like messages on the wall to digital representation (Lab's rules)
- Slack (Team communication application). Communication generated in general and random channels.

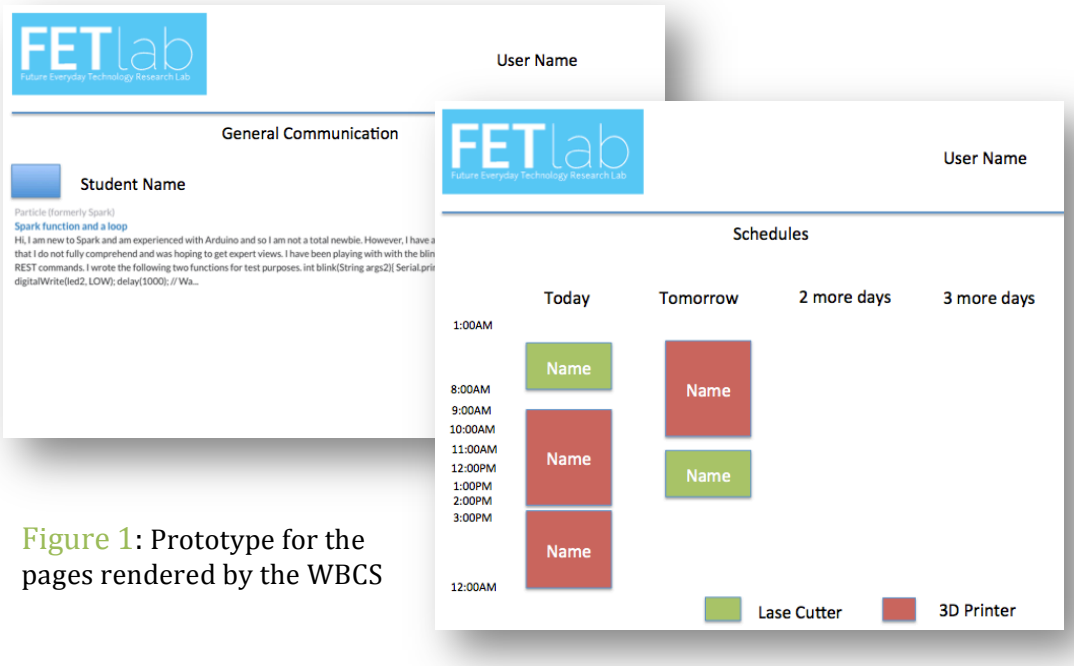

Figure 1: Prototype for the pages rendered by the WBCS

The interactive RFID-base device will be the point of interaction between the user and the system. In this device we will concentrate functions like authentication and navigation. This device will enclose a RFID reader to detect user proximity and activate the system according with the user identification (Figure 2). The objective is to simplify the process of authentication trying to transform this process into a more natural and invisible interaction [3] supported by RFID technology to create an invisible path between the user and the digital system [4][5]. A set of infrared lights (IRL) together with Infrared sensors (IRS) will serve the purpose of the navigation interaction (Figure 3 and 4).

Interaction Scenario

The RFID tag could be enclosed in diverse types of forms. For the purposes of this project this RFID tag component will be in the form of a key chain. The RFID reader will be enclosed inside of a device that will be hanging on the wall close to the display. A hook in the middle of the device will serve to hang the key chain containing the RFID tag, this way the RFID tag will be close to the RFID reader. The function of these components of the system is to capture the first and the final interaction with the user (turn on/off the system). In the same device two indentations with finger shapes will have the IRL and IRS. These elements are in charge of the navigation interaction.

Standard flow of interaction

- First, the system will be inactive until a user decides to activate it. Inactive status means no interactivity with a user but the system will be displaying general information in the meantime (time, day or a pre-defined message).

- Once a user decides to use the system, the user will hang his/her key chain and the system will be activated for this particular user.

- Activation means automatic authentication and rendition of the information associated with this particular user. The RFID reader will send the ID to the microprocessor that will send the ID to the WBCS. The WBCS will process the request and it will render (send the specific pages to the display) the information.

- The user will decide if the information provided is what he/she needs. If the user needs to see other information (contained in another page), he/she will initiate the navigation.
- Navigation process is the interaction with the system in order to explore the content. The two indentations with finger shape are the media for this process. One indentation on the left will trigger backward navigation (moving pages in backward fashion) and the indentation on the right will trigger forward navigation.

- Once the user decides to log off the system he/she will take the key chain separating it from the device. With enough separation and associated with a pre-defined period of time, the system will return to the inactive status and the cycle of interaction for that user will be end.

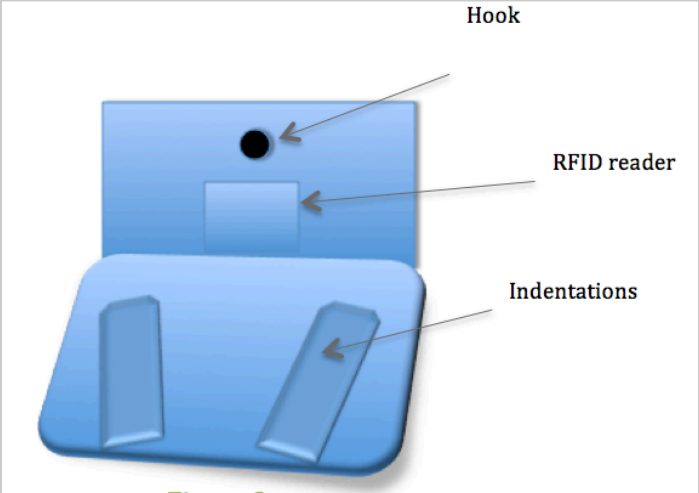

Figure 2

Figure 2 describes the proposed design for the device showing the areas of interaction with the system.
Figure 3 and ***4*** describe the sensors that will control the navigation interaction using IR system.

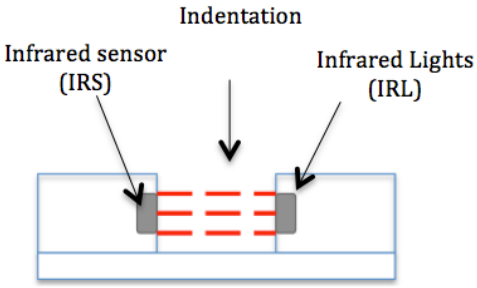

Figure 3 System flowing (No interaction)

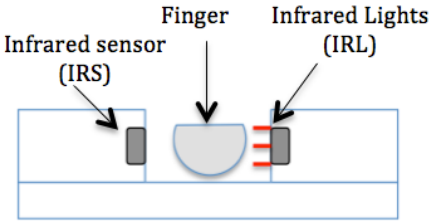

Figure 4 System flow interrupted (interaction)

Development Process

This list of activities could change at the time to start the project according to the needs of it.

1. Acquire the materials (RFIDs, sensors, microprocessor, etc)
2. Design the logic of the content service
3. Coding the algorithm of the content service
4. Coding the algorithm of the microprocessor
5. Design container for the device.
6. Build prototype of the device using simply materials (example: cardboard or paper)
7. Build a container for the device (3D printed or laser cut)
8. Build the circuit connecting the sensors to the microprocessor
9. Coding the communication between microprocessor and content service
10. Testing individual component and the integration of them
11. Generate a demo

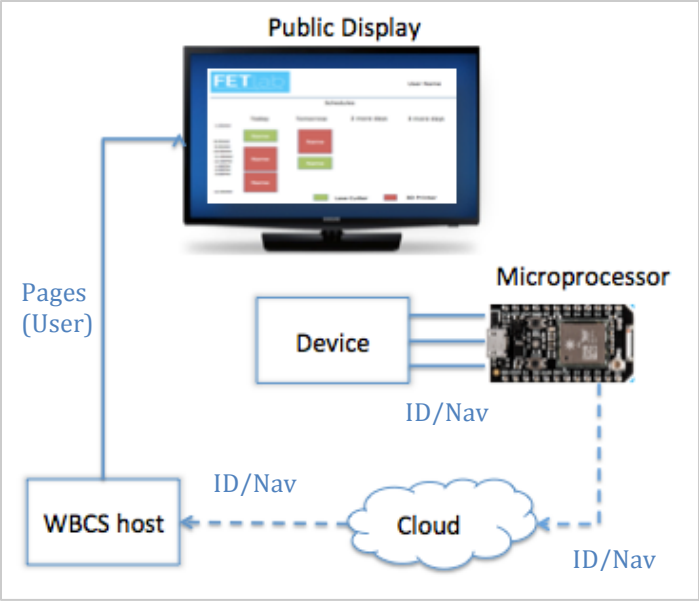

Figure 5

Figure 5 describes the basic architecture for the implementation of the solution. The device or point of interaction with the user, the microprocessor controlling the flow of information and request coming from the sensors in the device, the cloud as intermediary to communicate the microprocessor with the WBCS, and the WBCS capturing the requests and rendering the information on the public display

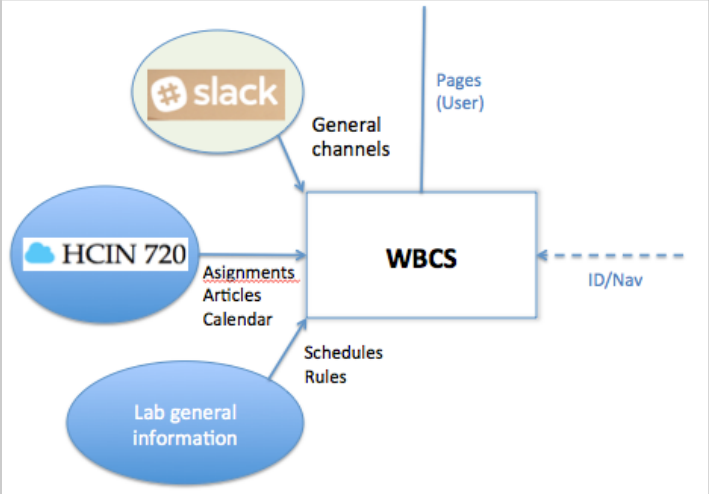

Figure 6

Figure 6 is showing the source of information that will feed the WBCS

Materials Required

1. RFID Tags (3)
2. RFID Reader
3. Infrared lights (6 units)
4. Infrared sensors (6 units)
5. Arduino
6. Photons (2)
7. Display Screen
8. 3D Printed or Laser Cut Case for RFID tags
9. Buttons (4)
10. Wires

Acknowledgements

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