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Schafer's Wafers

Senior Design Proposal

Introduction

The College of Engineering is adjusting to the exciting addition of a new class 100 cleanroom. Additions are still being made in order to enhance it. With this purpose and with the users in mind, Professor Seabaugh suggested the idea of creating a system that displays a list of users who are currently working in the cleanroom.

Problem Description

Currently there is no simple way of knowing who is using the cleanroom. Often, professors or students are looking for someone through the glass exterior, but it is hard to identify people while they are wearing the coverall suits. Another problem is that users receive email updates of the functional statuses of the cleanroom equipment, but so many emails are sent that it becomes difficult to keep track of which machines are operational. The cleanroom has a program called CORAL that allows users to log in remotely to schedule the use of different machines and to keep an online record of the functional status of the equipment. This system is still in the process of being implemented, so logging into a machine is done by hand in log books. Once the CORAL system is implemented, there will still be no convenient way to quickly check the status or availability of machines from the lobby of Stinson-Remick or from inside the cleanroom. This problem causes a decrease in efficiency, as the users must spend time every day waiting on machines and constantly going out of their way to see if a desired system is functional.

Proposed Solution

To solve the above problems, we propose to create a display system that provides information about the cleanroom equipment and users. It will take in information from the CORAL and RF ID system and display users currently logged in, the functional status of machines, and whether or not machines are currently in use. The information provided by the system should be visible from the outside of the cleanroom and possibly from the inside as well, so that people working in the lab can benefit from it. While the system would be very useful, it could also serve a recreational purpose. Next to the users' names, the total number of hours as well as the weekly hours worked can be displayed. Machine statistics can also be provided to show the top users of each one. Finally, supplementary information such as current research project descriptions and important achievements attained in the lab can be displayed, impressing visitors and attracting younger students.

Demonstrated Features

The display system will be visible from the main foyer of Stinson-Remick and pending available funding, have a second monitor that is visible from inside the cleanroom. The primary mode of operation will be for the monitor to rotate displays between current users, top users for the week, top users of different machines for the week, availability of machines, and research information and achievements. The display cycle will be able to be modified by an administrator (Mike Thomas) on his personal computer. The administrator should be able to edit display options directly through his computer so that the microcontroller does not have to handle processing the extra information. This would require one administrator computer to interface directly with both the RF ID system and the CORAL system. The administrator can edit display options, and the computer can manage the constant input of data from the CORAL and RF ID systems. This information will be sent wirelessly to the microcontroller, which interfaces to the LCD to display the desired content on the screen.

Available Technologies

The system will require inputs from the RF ID system, the CORAL system, and display options from the administrator's personal computer. This information then needs to be synthesized into a form that is displayable on the LCD. All of these inputs will be put directly through the personal computer to an interface to a Zigbee wireless network. The wireless network will send the information to the microcontroller interfaced to the LCD. This means that the computer will be in constant communication with the microcontroller to update information from the RF ID system and the CORAL system, but the display options will remain the same unless modified by the administrator. This project will require the following:

- 1 (or 2) LCD screens. Quality and quantity of the screens will depend upon additional funding. ~?
- 2 Zigbee Wireless tranceivers (one to encode and transmit, and one to decode and receive signals.) ~$35
- A computer program that extracts and organizes data from the CORAL system and RF ID system, and allows an administrator to change the viewing options. This program can be written in C++, Java, Perl, or another language, depending on which is easiest for our task.
- A microcontroller to interface with the Zigbee receiver chip ~$20 for 2 chips (1 to prototype with and 1 for actual use).
- An interface between the microcontroller and the LCD (I^2C, or something more powerful) ~ $20
- Circuit board ~ $50

Engineering Content

The first step is to figure out how we can access the RF ID and CORAL systems. Most likely, this information is available through the lab manager Mike Thomas's personal computer. It will be necessary to write code that imports the information from these systems and organizes this information according to the administrator's preferences. Also, a user interface for this program is necessary so that the display characteristics can be easily and quickly altered, such as how often the LCD is updated with information and what research information is to be displayed. Finally, the program must convert the information into a format that is compatible with the LCD.

Next, the data needs to be transmitted from the computer to the microcontroller. One possibility is to use a Zigbee wireless network. This is our first choice, but if it is not powerful enough to transmit through the building, we may have to use a wireless Internet connection. Using either medium, it will be necessary to learn the proper syntax that allows data to be sent from the computer to the transmitter and from the receiver to microcontroller. Some sort of physical connection must be established between the computer and transmitter, whether it is through USB or serial port.

The receiver will be located on the circuit board with the microcontroller. Once the data reaches the microcontroller, it must be sent to the LCD for display. An I^2C interface could be used to send data to the LCD if it is compatible with the large display that will be used. If not, an alternative interface will need to be implemented. It will be necessary to write the code for the microcontroller that sends information and ensure that the functions correctly impart the information to the interface. A major concern when selecting microcontroller, interface, and LCD is that all three components can effectively work together, and if there are existing combinations with documented code, this will be very beneficial. Finally, there needs to be a physical connection between LCD and board, which will depend upon the LCD selected.

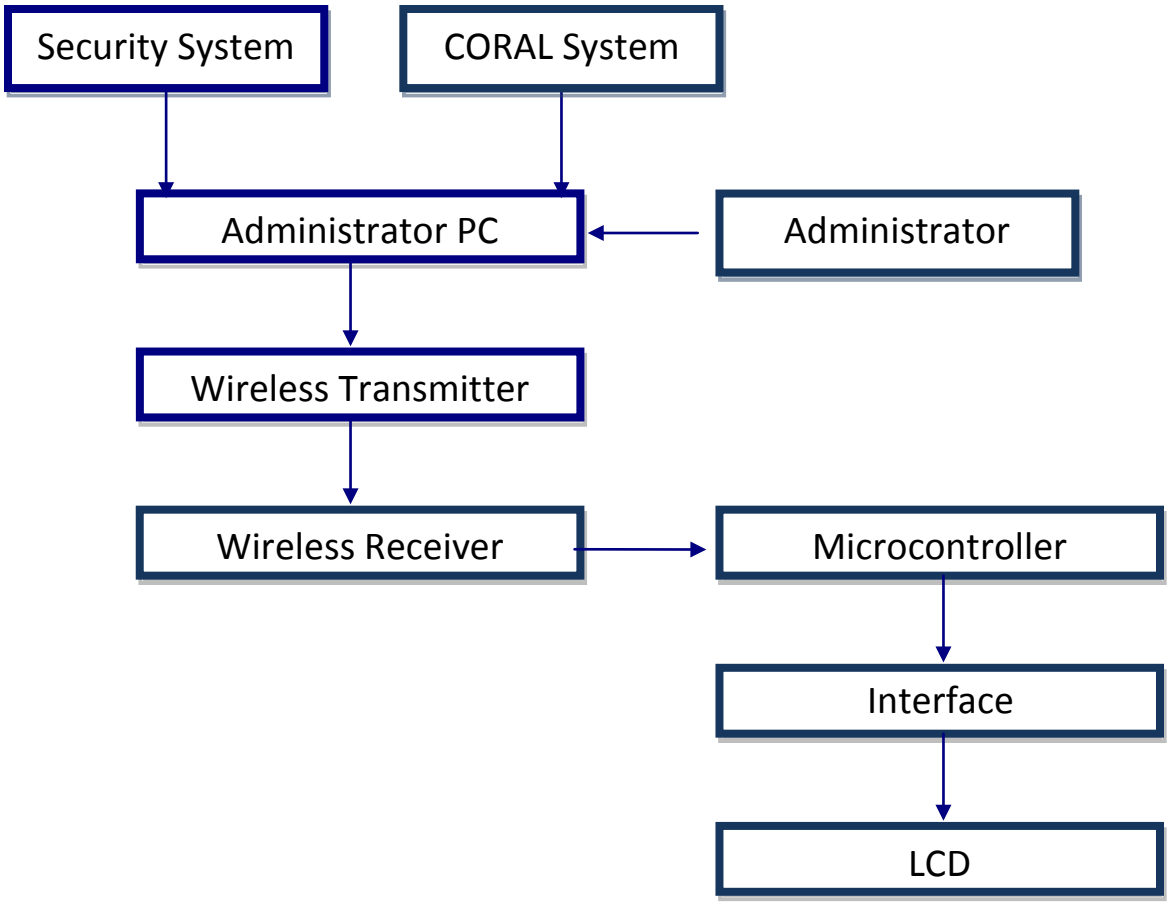

Figure 1. Block Diagram of System

Conclusions

Our plan is to design a system that allows people in the foyer of Stinson-Remick or in the cleanroom to easily see who is currently logged in, which machines are currently available, and who has been using the cleanroom the most in any given week. We believe this will be beneficial to both the cleanroom users and the EE department. However, several design issues are unresolved.

The CORAL system is not yet functional, and if it is not implemented this year, we will not be able to display the statuses of the equipment. We are also not sure if the Zigbee tranceivers are the most effective way to interface the computer and the microcontroller; a wireless internet connection may be preferable. We do not yet know how to provide power for the microcontroller and the LCD, as wires connecting to an outlet would be unsightly and obtrusive, but batteries would be expensive and require more maintenance. Finally, we need to decide upon a method of physically mounting the display and circuit board on the cleanroom glass exterior.

Lastly, we do not know exactly how much the project will cost. The quality and quantity of the LCD's will be determined by how much supplementary funding the EE department offers, and most of the budget will be spent on the LCD. According to preliminary estimates, without funding we will still have about $250 to $300 to spend on an LCD screen. This will be enough to purchase one reasonably-sized screen. To include two screens or a larger screen, funding from the EE department will be necessary.

While several issues remain, we believe that they will be resolved as the design process becomes more focused. The implementation will likely change as the project is constructed and unforeseen difficulties arise, but ultimately, we expect to have a functional system that solves the initially presented problem.