ELEE Design Project

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**Problem Statement**

Grove City College has many problems, but one major problem is the scarcity of study spaces for students. Many students waste hours finding a place where they can focus and do their work. In order to maximize student efficiency, we are developing a system that monitors availability of study spaces, mainly classrooms, on campus. The system will collect data on the classrooms currently in use, and whether or not the lights or the projector is on. The system will also maximize projector and light bulb life spans by automatically turning these off when the classroom is not in use. The implementation of this system on Grove City College’s campus will help students save precious time and increase productivity while simultaneously reducing maintenance costs.

**Design Goals**

There are four main design goals that we hope to achieve. The first and most important goal is to be able collect data from individual classrooms and store it in a central location. The second goal is to develop a robust communication protocol using flags in our bit streams, a master clock cycle for the whole system, and room IDs and Hi-Z states for inactive rooms. The third goal is to be able to turn off projectors and lights when the room is not in use. The fourth goal is cost efficiency. This is achieved by polling the data onto a bus minimizing the amount of materials needed for the system.

**Overall Structure**

**Classroom Controller:**

Each classroom has one Classroom Controller that has 7 inputs and 3 outputs.

The 7 inputs of the Classroom Controller are:

* LightsOn
* ProjectorOn
* ClassroomInUse
* RoomID\_Rx0
* RoomID\_Rx1
* Clock\_in

-LightsOn and ProjectorOn are each connected to sensors that output a value of ‘1’ if the lights or projector is on.

-ClassroomInUse is connected to a thermal sensor that outputs a value of ‘1’ if it detects an object with a temperature of at least 90 degrees Fahrenheit.

-RoomID\_Rx0 and RoomID\_Rx1 are inputs for the 2-bit Room ID number. The campus controller will output the Room ID number of the classroom it wants to communicate with and the classroom controller with that Room ID number will come online.

-Clock\_in is the input of the master clock signal.

The 3 outputs of Classroom Controller are:

* Lights\_Enable
* Projector\_Enable
* Tx\_1

-Lights\_Enable enables the lights to be turned on from within the classroom, otherwise it disables the lights, turning them off.

-Projector\_Enable enables the projector to be turned on from within the classroom, otherwise is disables the projector, turning it off.

- Tx\_1 is the serial communication output. Classroom data is communicated to Campus Controller through this output.

**Campus Controller:**

The Campus Controller has 2 inputs and 3 outputs.

The 2 inputs of Campus Controller are:

* Rx\_1
* Clock\_in

-Rx\_1 is the serial communication input. The Campus Controller receives this data from the Classroom Controller.

-Clock\_in is the input of the master clock signal. In this case the master clock signal is generated by an Arduino.

The 3 outputs of Campus Controller are:

* RoomID\_Tx0
* RoomID\_Tx1
* Clock\_out

-RoomID\_Tx0 and RoomID\_Tx1 are the outputs for the 2-bit wide Room ID number. The Campus Controller outputs the Room ID number of the classroom with which it wishes to communicate.

-Clock\_out is the output for the master clock signal to the rest of the system.

The system itself contains 4 Classroom Controllers and 1 Campus Controller.