

Senior Design Team Submission

Sean Concept:

Attaching sensors to the heating and AC units themselves to minimize the distance that the signals would have to travel in order to be processed and outputted in order to control the temperature in the room.

- Attaching each sensor node to a hvac unit. minimal latency to receiving temperature measure
- Faster readings
- Could be used to diagnose misreadings on the hvac's original system
- Readings could potentially be too high or low due to insufficient distance from the unit

Kolby Concept:

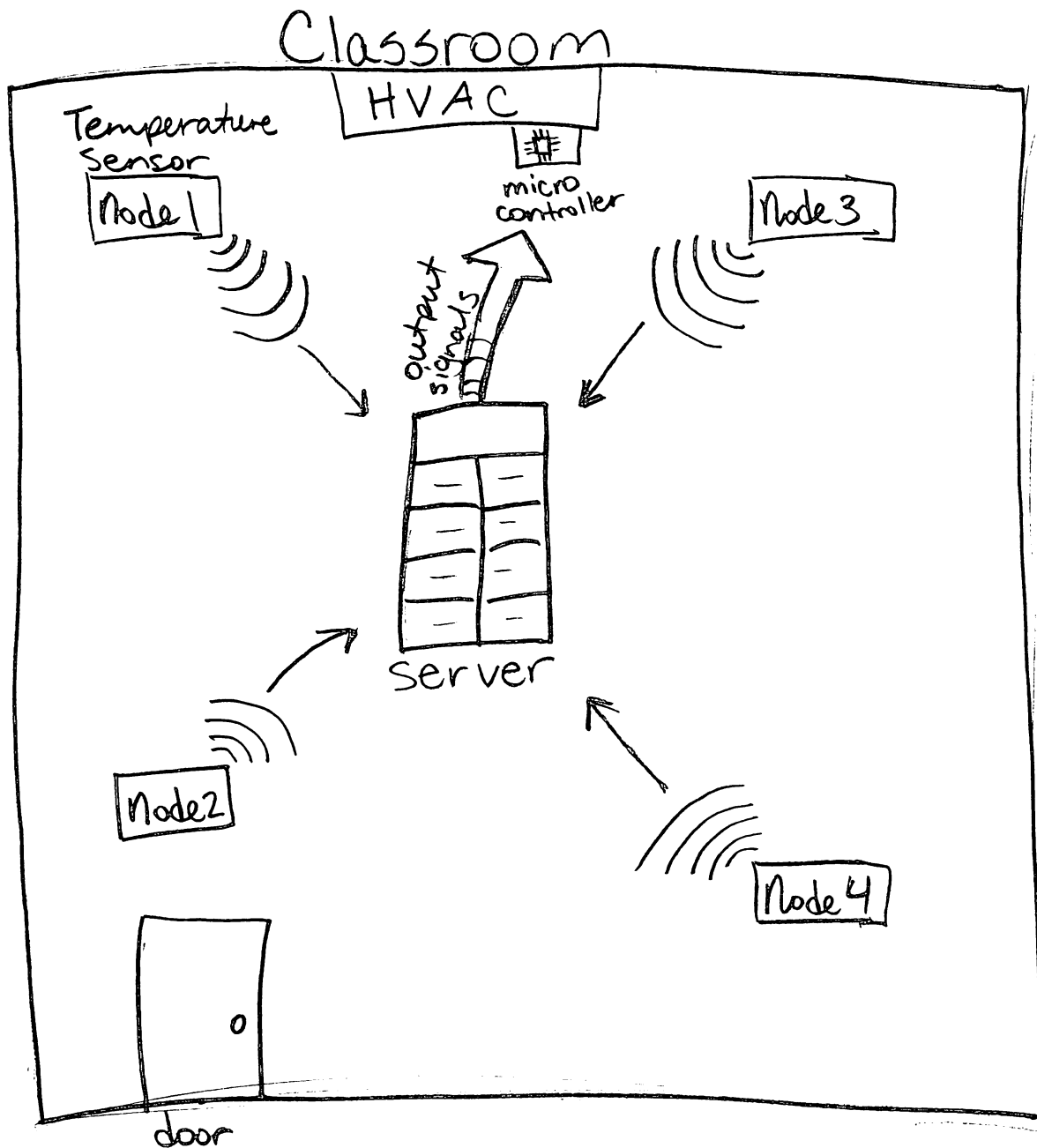
Using an FPGA board to control the input signals from the sensors and the output signals that would control the heater/AC in the room.

- The board would act as the middleman between the sensor and the HVAC.
- Each unit would be individually controlled by a board.
- Easier troubleshooting, minimal latency
- Would not be considered part of a sensor network.

Team Concepts: Realization of the sensor network

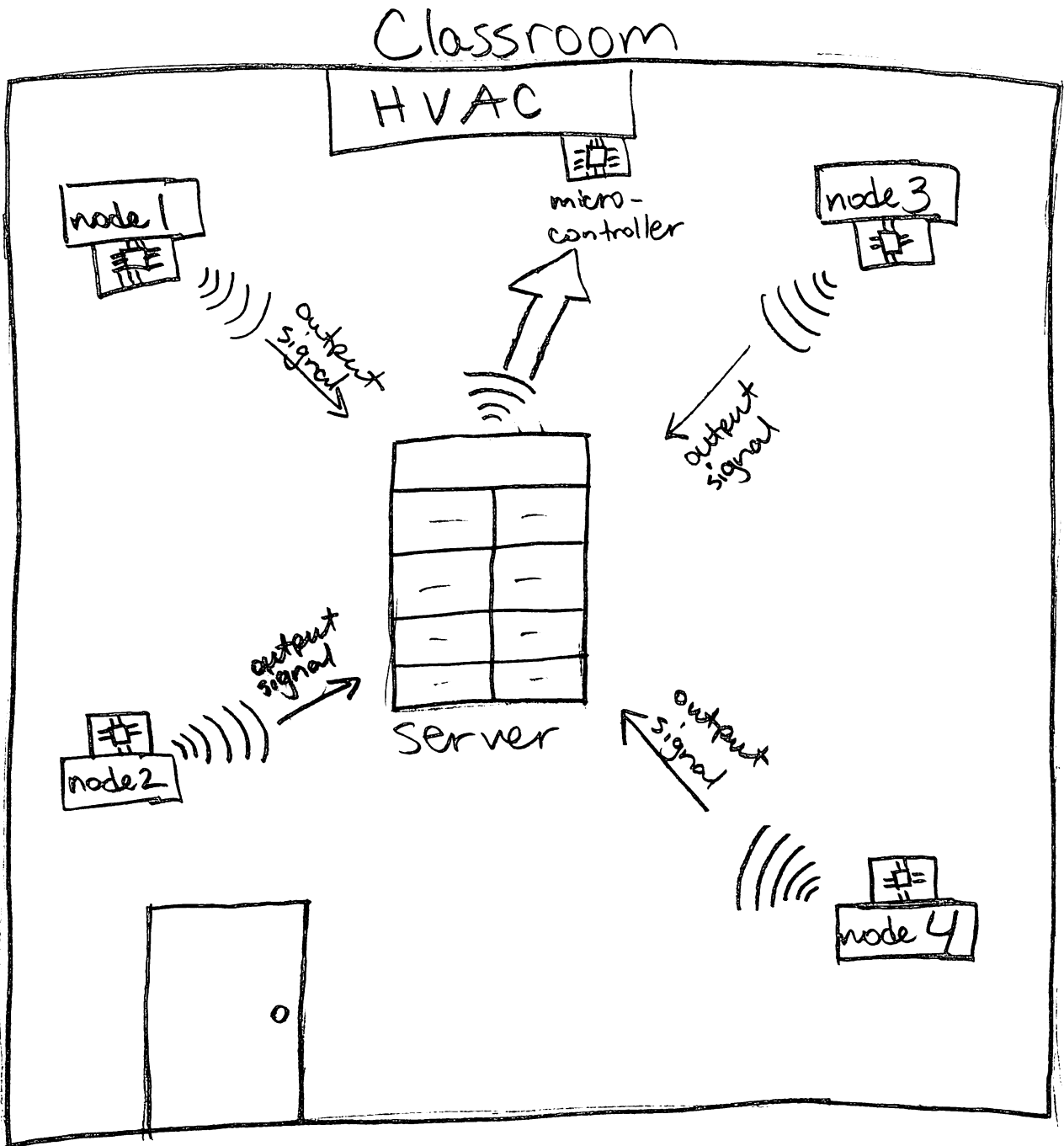
Team Concept 1:

- Having an external server that carries out all of the computations for the signals that will be collected from the temperature sensors. Once the data is sent from the sensor nodes to the database, all signal processing will happen on the database, which will control the heating /cooling unit in the room.
 - o This will use less power from the nodes because the nodes are not performing computations.
 - o Extends node battery life.
 - o Several nodes to diagnose an area, will increase sustainability and help detect malfunction and compromise.



Team Concept 2:

- Having separate processors on the sensor nodes so that once an input data (temperature data) is gathered from the sensor all of the signal processing takes place on that node and then the results are passed to the database and microcontroller that will control the heating/cooling.
 - o This would allow for faster transmission because less information will be sent to the database.
 - o Higher node power usage.
 - o Will use several nodes in an area.



Team Concepts: Final Design of the sensor network

Chosen Design: Concept 1

- **General Idea:** Having an external server that carries out all of the computations for the signals that will be collected from the temperature sensors and then sending output signals to a modified HVAC system to adjust the temperature accordingly.
 - The server will also store usage data from each node in a given room.
 - This allows the server's functionality to be expanded to multiple rooms
 - Server hardware: Raspberry Pi 3
- **Note:** A target temperature that the rooms will want to be kept at will need to be saved on the server beforehand. Having preset desired temperatures for each room will make it possible for the system to automatically adjust the temperature to the desired level based on the temperature sensed by the temperature sensors.
- Once measurements are taken from each node being implemented, they will be encrypted and wirelessly transmitted to the receiver that then passes the signals through buffers to the server.
 - Temperature (node) sensor hardware: Arduino Microcontroller
- The server "observes" the input signals, takes the average of the measurements to get a more accurate reading of the temperature in the room, and then compares that average to the predefined desired temperature for that room.
- The server then wirelessly transmits a bus of output signals to a microcontroller attached to the customized HVAC machine which will then control the temperature of air that the HVAC outputs. At the same time, the server is recording all measurements, processing, and output transmissions that take place.
- This process is then repeated within milliseconds, providing a real time temperature management system.

Decision Matrix :

		5	1
		most feasible	least feasible
	<u>Concept 1</u>	<u>Concept 2</u>	
Cost:	4	3	
Functionality:	5	4	
Efficiency :	3	4	
Reliability:	4	3	
Practicality :	5	3	