ECE 411 FA20 - Team 9: Practicum Ideas

Smart Bird Feeder

A device that hears birds chirping, matches the frequency of chirp to type of bird, then opens the bird feeder to give it the type of food it prefers. Also uses that to count the types and numbers of birds using the feeder. A microphone shall be used as an auditory sensor to receive sound waves in the 20Hz-8000Hz ranges per bird frequencies. Stepper motors shall be used to move the mechanical parts of the bird feeder, e.g. opening the entrance to the bird feeder, and dispensing the bird feed. A speaker will be used to output sound that will mimic the bird sound received. A microcontroller shall be used to process the frequencies received and will output filtered frequencies similar to bird sounds.

Measuring CO_2 Level in Soil

A measurement tool for farmers that biochar want to check CO_2 levels in their tractors and biochar soil input. The purpose of the device is to ensure that farmers are not producing more CO_2 compared to the biochar they are adding in their soil, which absorbs CO_2 from the atmosphere. The device should sense air quality, check against the inputted value for how much biochar they've put in the soil, and inform the user if the CO_2 sensed is more or less than the user's inputted value. Sensors used would be a CO_2 sensor to detect levels of CO_2 and an air flow sensor to quantify the amount of air of which CO_2 is a part of. The controller would be able to quantify the CO2 threshold, i.e. the farmer is putting "x" amount of biochar into soil, which means "y" amount of CO2 is pulled out of the atmosphere. As an actuator, a screen and LEDs would be used to display that the amount of CO2 sensed was above or below the threshold. The threshold for passing is that the amount of CO2 sensed is below this "y" amount.

Puzzle Piece Project

A puzzle made up of pieces that can change which connection they are using with the others and show the new puzzle on a screen on top. Pieces along an edge to be designated as "completion sensors", which would be a resistive sensor that measures the additive resistance of all the pieces between them and the opposite edge. The puzzle would be considered complete when all completion sensors report the right resistance value. Pieces would also need to detect whether or

not they are connected to another piece to prevent damage as they reconfigure. Processing the combinations of resistances and ensuring there is no damage to the pieces would be the work of a microcontroller. The reconfiguration would depend on the orientation of pieces and puts the piece in one of 51 different positions. The actuators to be used would be a stepper motor or servo motor for the rotations of the pieces and small OLED screens to display images. Each piece has four sides, each of which can be extended, half extended (making an edge), or retracted (making a recessed side). The number 51 is because there are 4^3 different configurations, but 13 of them are not used with jigsaw puzzles (see attached image; the bits jutting out can represent an extension or the mating surface). A seamless puzzle is possible, with the sacrifice of being able to see which edges are recessed, or flat (the user would have to look at the underside of the piece).