**Senior Project Proposal**

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Project Description

This project, when created will be designed to scan for intruders using infrared motion detectors and report this to the end user so that the user can contact someone or choose to enable a recording device. This project is geared towards using what was instructed across the computer science degree in addition to elements that might be found as useful when it comes to finding a job afterwards, in addition to personal interests.

Basic Project Design

The basis for the design of this network is relying on already defined network protocols for Wi-Fi, rather than re-inventing already covered ground as would be necessary if using an RF24L01+ transceiver instead, and thus use a network ‘tree’ where one node may use another node’s connection to the base in order to contact the base unit. Relying on this functionality in modern routing protocols, if a node or multiple nodes go down due to power issues, the entire node network is not lost as long as at least one node has a direct connection to the base. This design also allows the network to span longer distances since not all nodes have to connect the base and also circumvents the limitations of the number of connections a single node can have. The nodes addresses will be assigned in a hierarchical manner where the last three digits will be used to specify generation, parent id, and id respectively. In this sense the node can then check its parent for connection and then if the connection was lost, this structure allows for attempts to connect to other nodes in its parent’s generation upwards until it attempts to connect to the base, and if which fails, the node saves its current detection state (armed/disarmed and triggered/ un-triggered) and shuts down. The base in this scenario acts as a gateway into the internet and to the server which records the data sent from the base into and SQL server which will then be available via web application hosted by the server or the information is requested by an android application.

Project Hardware Features

**Basic Features – 10 Points Each out of 40**

* IR motion detector to detect motion
* Has nodes that send packets to the base via Wi-Fi
* Write a program for Linux to act as the base for the sensor network
* Has a server that displays data via a webpage that can be monitored via the W.W.W.

**Preferred Features 5 Points Each out of 25**

* Motion is for objects taller than 4ft
  + Achieved by calibrating upon install
* Sensor nodes would be easy to conceal to elude the detection of intruders
  + i.e. small, and colored to match surroundings
* Sensor nodes are capable of full duplex communication without multiple transceivers
  + Find an RF chip that supports full duplex or use Wi-Fi or Bluetooth instead
* Sensor nodes have a charging circuit that can be powered from a micro-USB cable
  + Must be able to handle the voltage and amperage differences between different USB types

**Ideal Features 2 Points each out of 6**

* Handle the loss of internet connection on the server and implement a backup battery for the base in the case of power loss
* Implement cameras to record intruders
* Develop board to run the software for the base unit independently

Software Features

**Basic Features 10 Points Each out of 50**

* Use C++ to properly implement the hardware specified in the basic hardware Features i.e. implement:
  + IR motion detector to detect motion
  + Sending packets to the base from the sensor nodes
  + Wi-Fi
  + Facilitate communication via Wi-Fi or Ethernet
* Create and host a web application that displays data via a webpage that can be monitored via the W.W.W.

**Preferred Features 5 Points Each out of 35**

* Use distance from motion to determine height to discriminate between pets and humans
  + i.e. Birds, really short people? crouching?
* create a GUI for the base:
  + Implements a basic user login authentication system (the user is actually logging into the SQL server, and only one administrator account)
    - Too many failed attempts triggers alarm
  + Alarm can only be shut off from the base
* Monitor the voltage and temperature of the internal batteries depending on battery type to measure voltage and translate to a charge percentage.
  + Most likely Lithium-ion
* SQL database must have a valid username and password to have access
* A basic android app that the web application/server can send push notifications to

**Ideal Features 2 Points Each out of 6**

* Implement a method of encrypting the data sent between the nodes and base unit
* SQL supports multiple users with varying levels of accessibility to the system settings
* Implement the software end of a microcontroller and allow for the base unit to support C++ code so that the original program can be run without modifications

Grading

The grading will be determined by the number of points earned. There are a total number of points possible is 162 points and is based upon the importance of the feature to the essence of the entire project. For example, adding a pleasant color scheme isn’t as important as implementing SQL database to access and store the recorded data.

A 🡪 154+ points

A- 🡪 146 – 154 points

B+ 🡪 140 – 146 points

B 🡪 135 – 140 points

B- 🡪 130 – 135 points

C+ 🡪 123 – 130 points

C 🡪 118 – 123 points

C- 🡪 113 – 118 points