# Research Outline

## Research Topics

All of the following aspects must be decided before designing so that we can create a design with each aspect in mind.

* Motors/Wheels
  + Need to decide what motors we will use
    - Relatively quiet
      * Noise will be generated from other sources, not just the motors. I.e. gears and bearings.
    - Not necessarily fast but strong motors to handle terrain ranging from flat surfaces to carpet.
      * Both of these concerns could be accomplished using gears
    - Wheel size and layout
      * Wheels need to be able to handle carpet
      * Wheel layout will need to be able to handle awkward terrain change (think coming onto a raised carpet at a non-perpendicular angle)
      * 2 drive wheels with a caster wheel in back? 2 caster wheels in back? Etc.
      * Ground clearance (for carpet)
      * Relatively grippy tires
    - Motors will need to have motor controllers, motor controllers will need to be compatible with other electronics (talk with the person handling Core Electronics)
    - What kind of motor?
      * Stepper motor? Brushed vs brushless?
* Core Electronics
  + What electronics do we need?
    - Arduino? What type?
    - Will we need a more powerful processor like a Navida jetson?
  + What programming software/language will we be using
    - ROS?
    - Staying in Arduino IDE? (preferably)
  + All sensors and other electronics must be compatible (talk with Drive Base and Sensors)
  + Power supply **TBD**
    - How many volts for each electronic?
    - Rechargeable or not?
    - Most likely determined by motors’ needs
  + Will need many inputs and outputs for all the sensors and other electronics **TBD**
* Sensors
  + Sensors for security
    - What type of sensors will be suitable and be able to work on a moving platform?
      * Passive IR?
        + What is their range?
        + Do they need to be somewhat high above the ground to effectively see the IR signature of a person? (feet and legs might not be that warm)
      * Sound?
        + Need to decide what sound volume or frequency we will be listening for

Right now we are aiming for broken glass sounds but are there other frequencies/sound volumes that would work too?

* + - * + Need to not mistake other sounds as threats

Normal nighttime sounds (broad)

Robot’s own movement (talk with Drive Base)

* + Sensors for navigation
    - Most likely a few ultrasonic sensors
      * Need ones at different heights
  + All sensors must be compatible with the core electronics (you know who to talk to)
* Navigation Algorithm
  + Navigate through a room without hitting anything
  + Needs to travel through a room in a way that the entire room is scanned.
    - Can't just go around the outside of a large room, it needs to do the center of the room as well.
  + Relatively efficient
    - Don't want to go over areas we’ve already been in without doing the whole room first.
  + Depending on how the sensors work especially the passive IR sensor we may need to stop periodically to take a capture of a room, then another some time later to see if there was movement/change in IR.
* Other
  + Lights and alarm (for alerting)
  + Remote control
    - There needs to be communication to the robot (no need to have communication from the robot). The aim is to have an on/off for the robot and perhaps an on/off for the alarm.
    - How will we communicate with the robot?
      * Radio? Bluetooth?
        + It shouldn’t interfere with the ultrasonic sensors, right?
      * Look into how TV remotes work
      * Need an emitter on the remote and a receiver on the robot
    - Remote will need its own power source
    - Will also need its own core electronic to handle inputs and outputs
    - Buttons for each function
    - A light to indicate that a button was successfully pressed and has sent a signal
    - on/off switch for the remote
    - Accessible battery compartment
      * Will probably be using non-rechargeable batteries like AA or AAA
  + General Assembly
    - Nuts and bolts
    - Kit parts as a chassis (to support a 3D printed or laser cut frame) (Talk with Drive Base, perhaps there is a kit with suitable motors)
* Programming
  + PWM
    - Needs to be PWM control to fully utilize the range of the motors. PWM is NESSECARY for low speed operation
      * Which means Arduino-Matlab communication