**GNG1103 Project**

Group A12

Professor David Knox

Deliverable D

October 7, 2018

Tarek Bedair

Benton Qiu

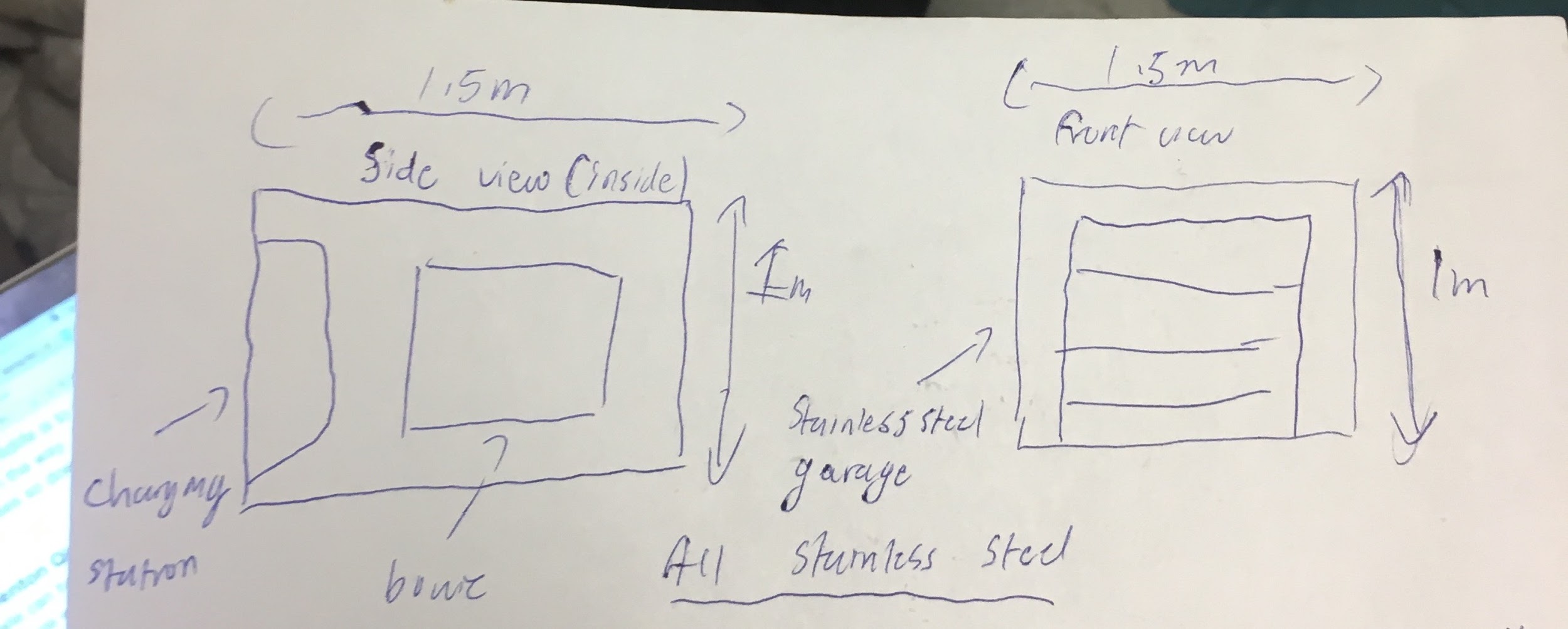
Mashiyat Islam

Joshua Lai

Ali Zaidi

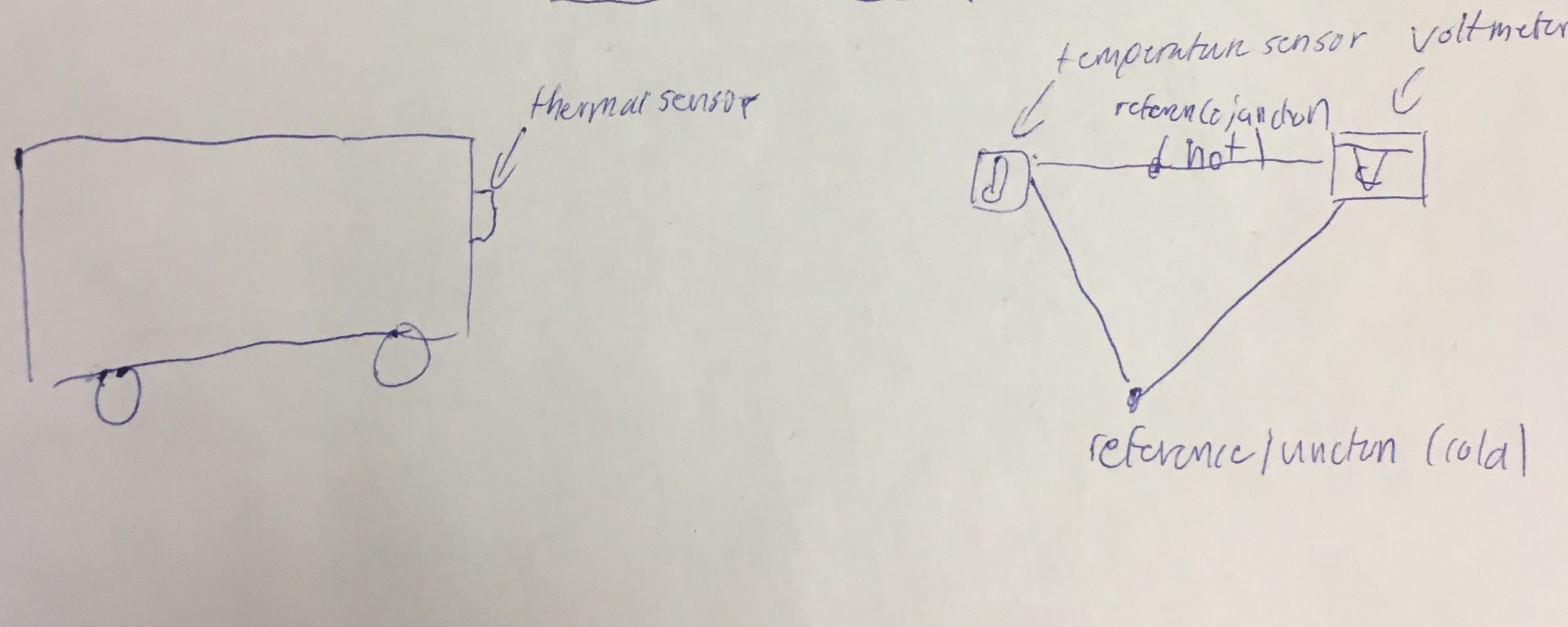
**Place For Bowie to Stay Overnight:(benton Qiu)**

The place that Bowie can stay overnight can be a rectangular box with dimensions of 1m x 1.5m. The box will have a charging system for the robot that the robot can automatically plug itself into. The charging system will work by charing Bowie every night from 9pm-8am, this way it will avoid the need for a sensor to be able to detect the battery life and whether or not it is fully charged or not. The box will be made of stainless steel so that the weather (snow,rain hail or sun) will not be able to damage it or rust it. The box will have a stainless steel door that can can sense Bowie's presence so it can easily get in. The door will automatically lock when closed to prevent any tamper.



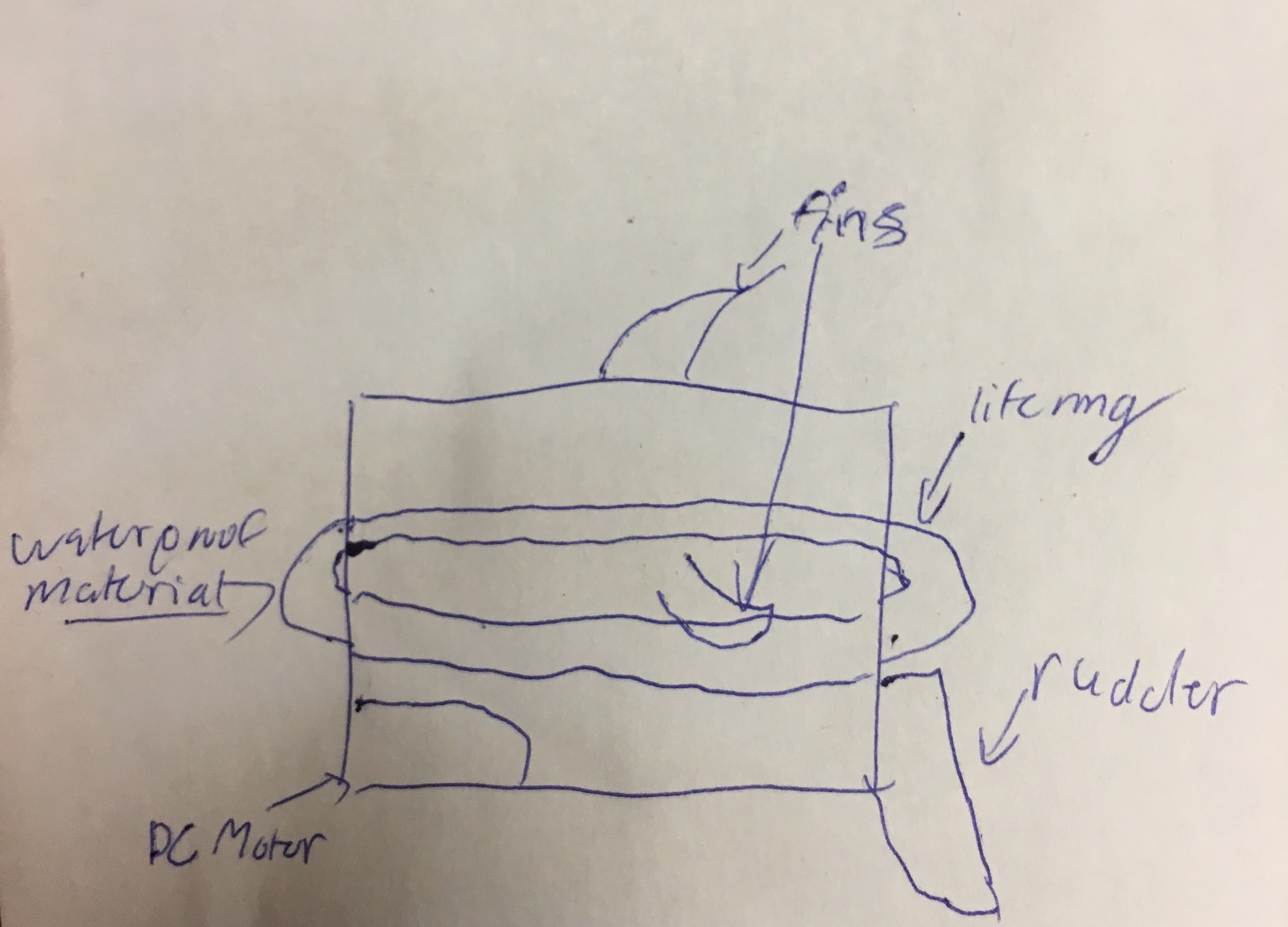
**Bowie is Able to Safely Interact with Wildlife (Benton Qiu):**

In order for Bowie to be able to safely interact with wildlife is to install a thermal sensor. This way Bowie can detect animals or living creatures in the way. The thermal sensor works by using a voltmeter. When the temperature increases so does the voltage and when the temperature decreases so does the voltage.



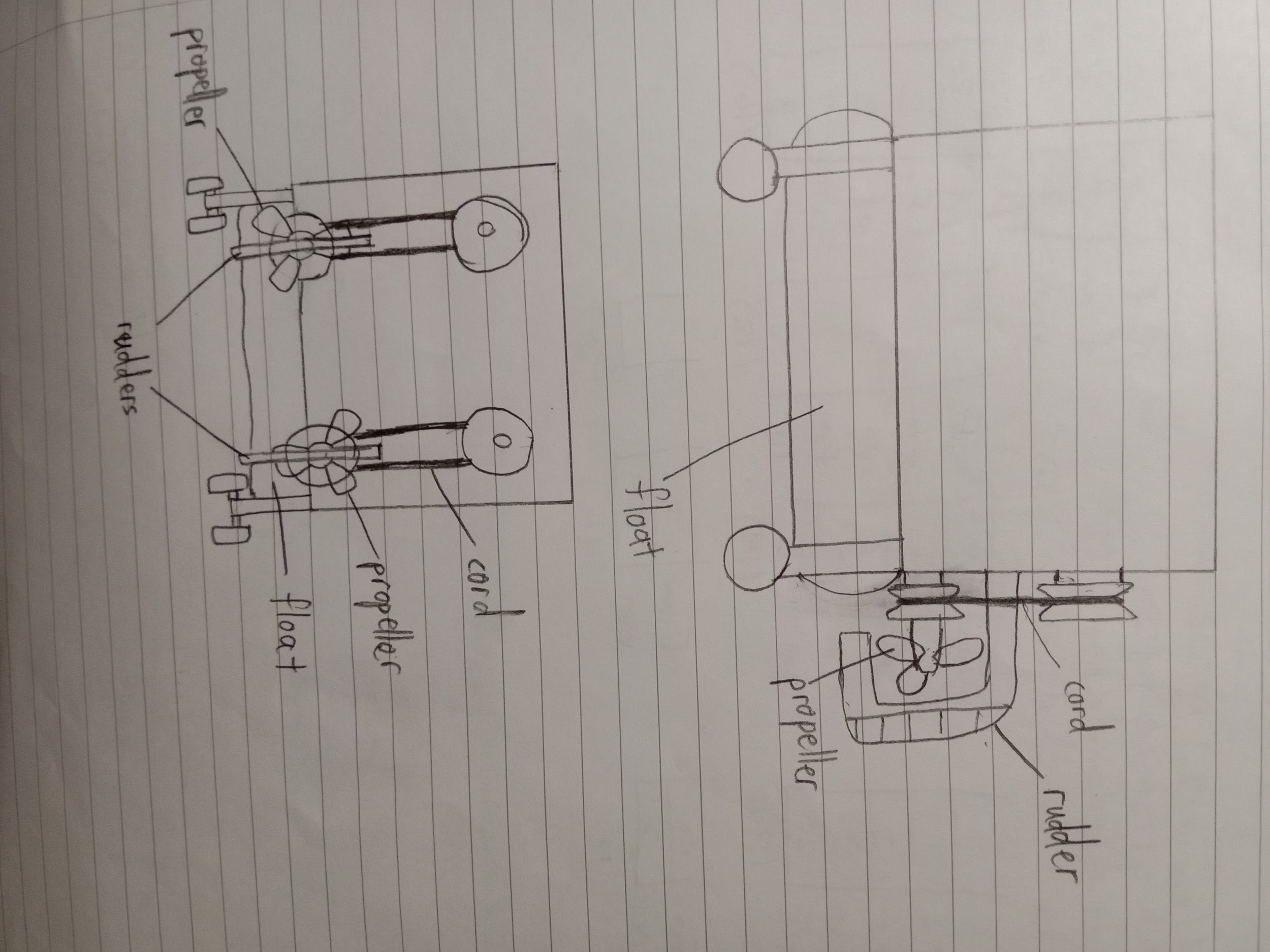
**Bowie is able to operate on water: (Benton Qiu)**

In order for Bowie to operate on water bowie can have a flotation system on at all times. This can consist of floaties or a basic lifering. Bowie would also have to be made out of waterproof material so the water does not interfere with the circuits. Bowie can have a DC motor for transportation as it is the standard for portable robots. The robot can have a rudder to steer and fins on the side for a more aerodynamic design made out of rubber for lower cost.



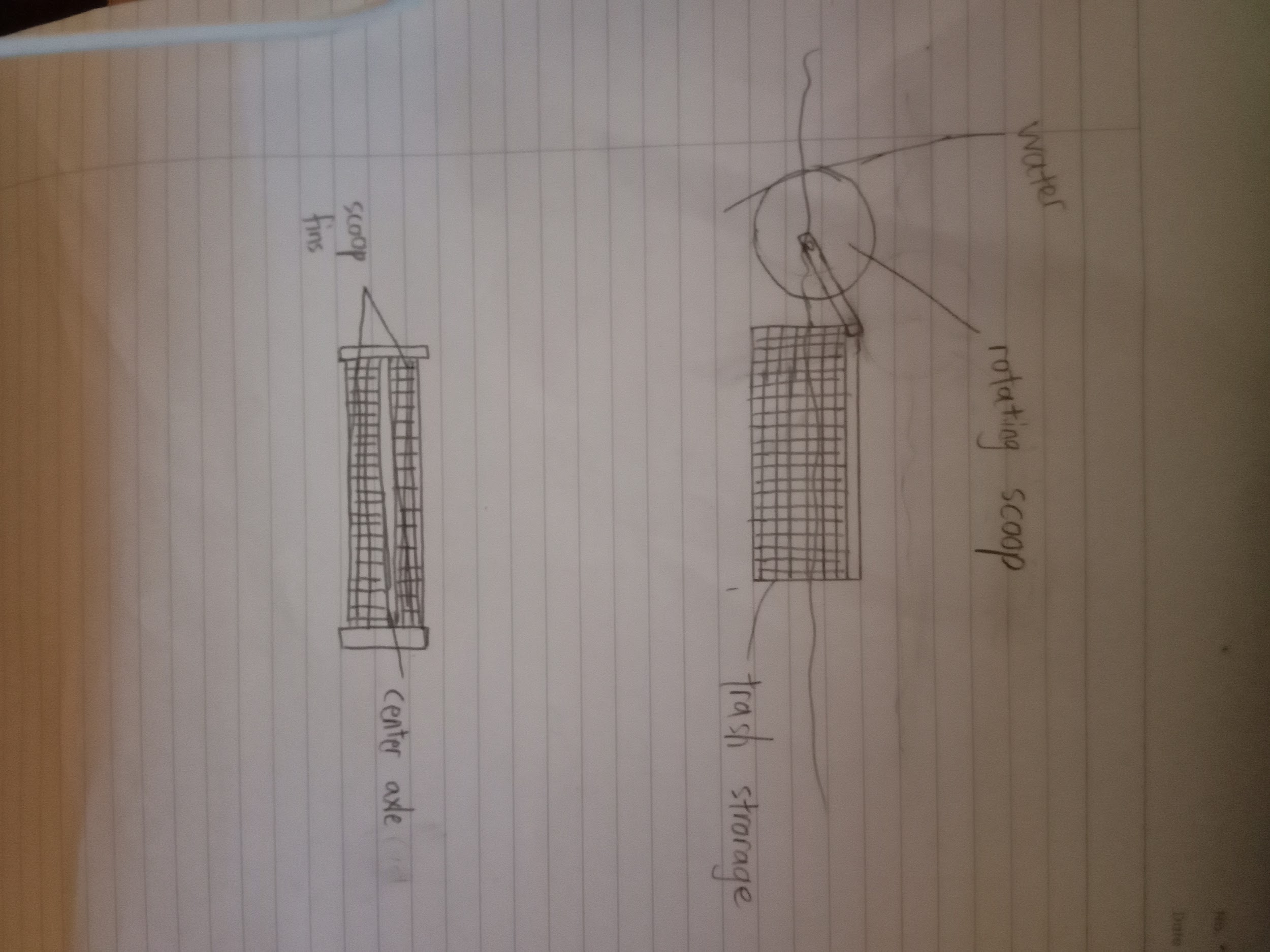
**Making Bowie able to traverse through water (Joshua Lai)**

Bowie can have floats and waterproof material at the base of the robot. A remote controlled propeller can be fitted to the back of Bowie, connected to a dc motor via a rotating cord. Additionally, a remote controlled rudder can be added to give Bowie the ability to maneuver. If more than one rudder is installed, they must be linked together to ensure that their movements are in sync.



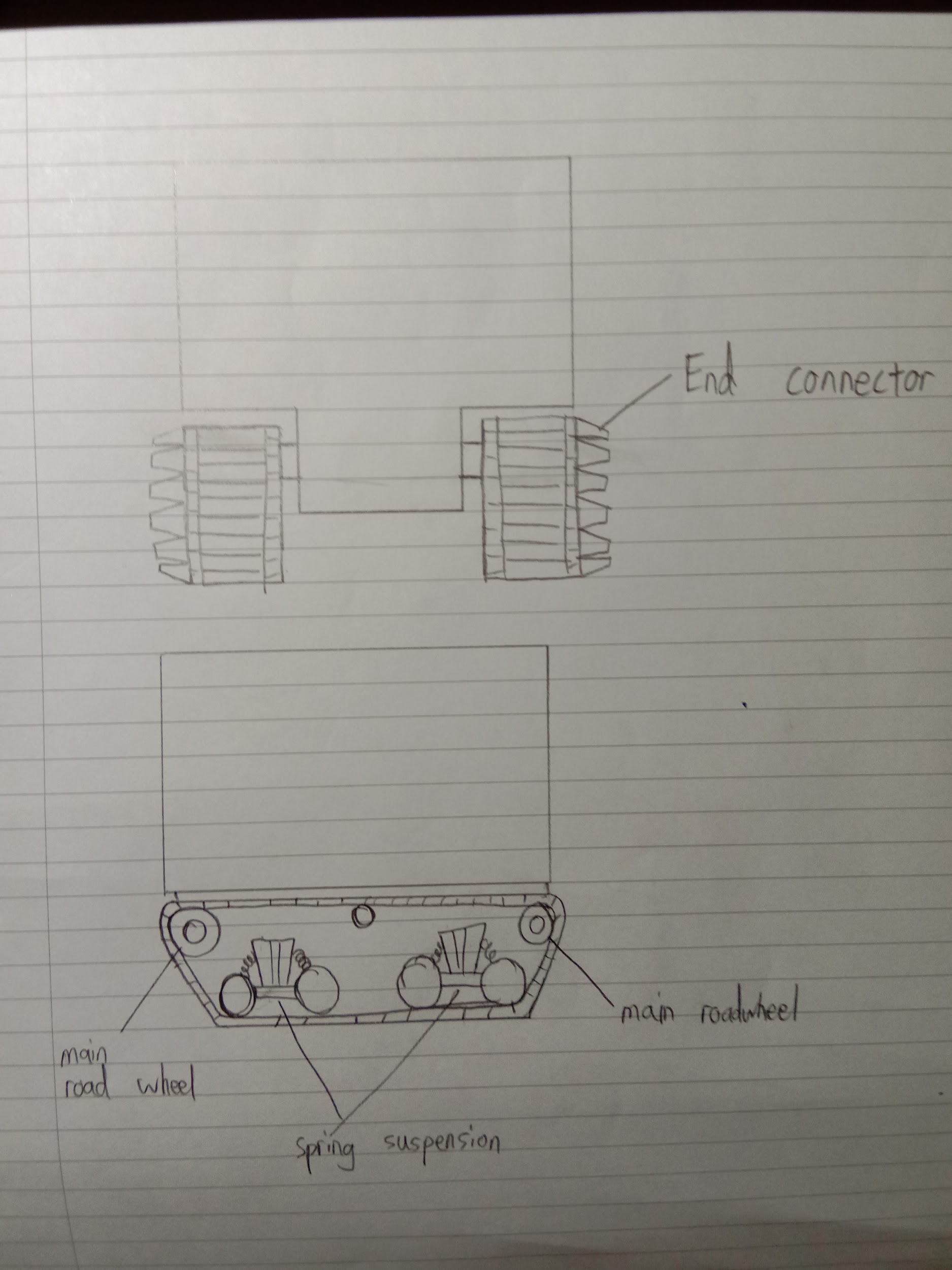
**Making Bowie able to collect floating trash (Joshua Lai)**

In order to allow bowie to collect floating trash, a removable cage-like storage tank can be fitted onto Bowie. This allows bowie to collect floating trash without unintentionally collecting water as well, thus maintaining its low mass and floating ability. A replaceable, rotating scoop can be fitted onto Bowie. The scoop rotates in a way similar to that of a harvester, as it rotates, it can pick up floating trash and dump them into the storage tank quickly and easily. The scoop should also have many tiny holes to allow water to flow out as the trash is collected in order to maintain the center of gravity and stability of Bowie in the water.



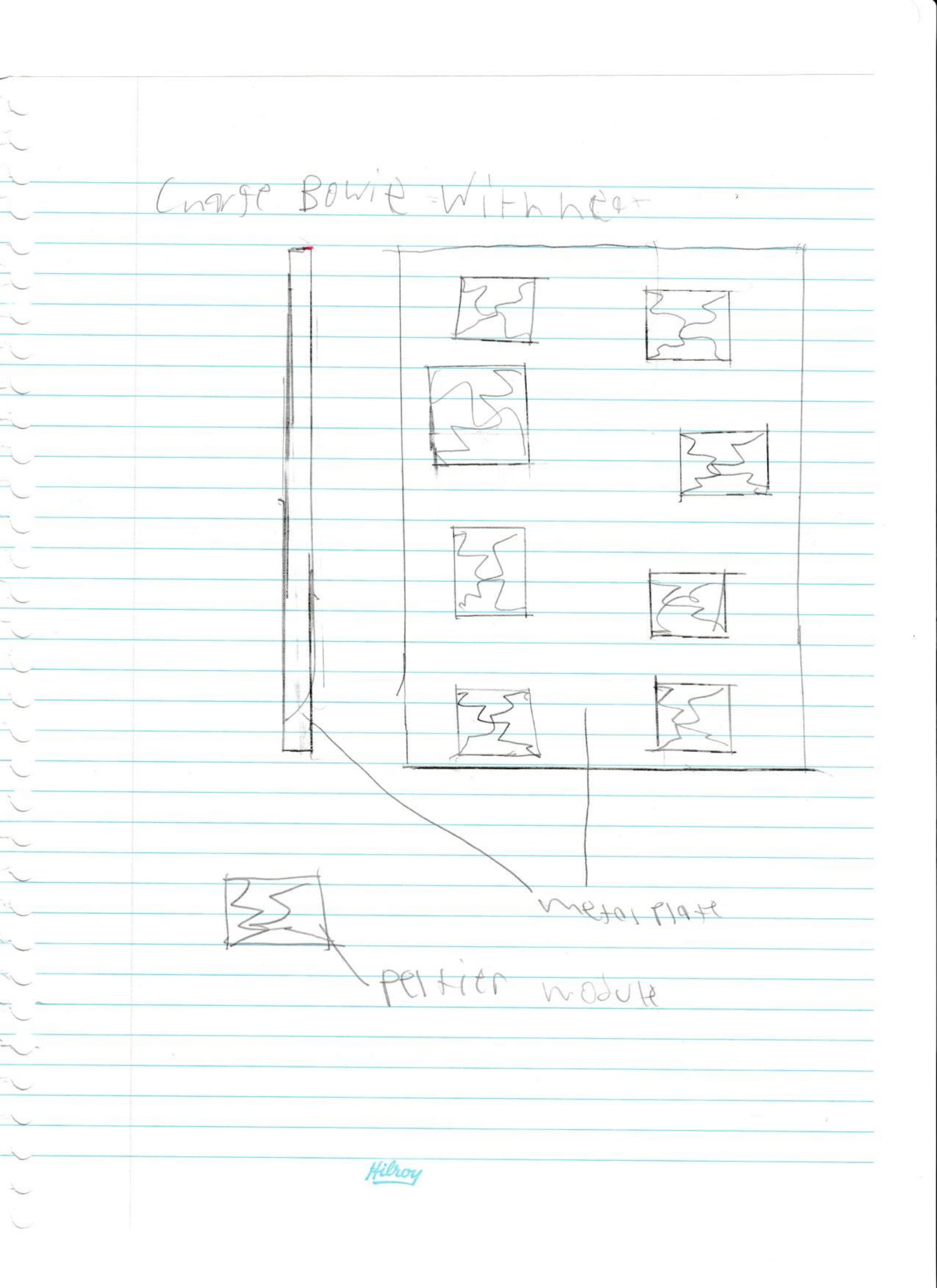
**Rubber tracks (Joshua Lai)**

Bowie can be made to use tracks instead of the rubber wheels it has currently. Tracks allow more even distribution of weight, thus reducing the chance of it getting stuck in terrain. Road wheels should be fitted at the front and rear ends of the tracks and act as the main driving force of Bowie on the ground. In order to maximise the surface area of the tracks on the ground, smaller road wheels can be added between the main road wheels using springs as suspension. In the account of soft or muddy terrain, the tracks can be further improved by adding end connectors, which reduce the surface tension Bowie exerts on the ground. The end connectors can be installed and removed at any time and must be easy to manufacture.



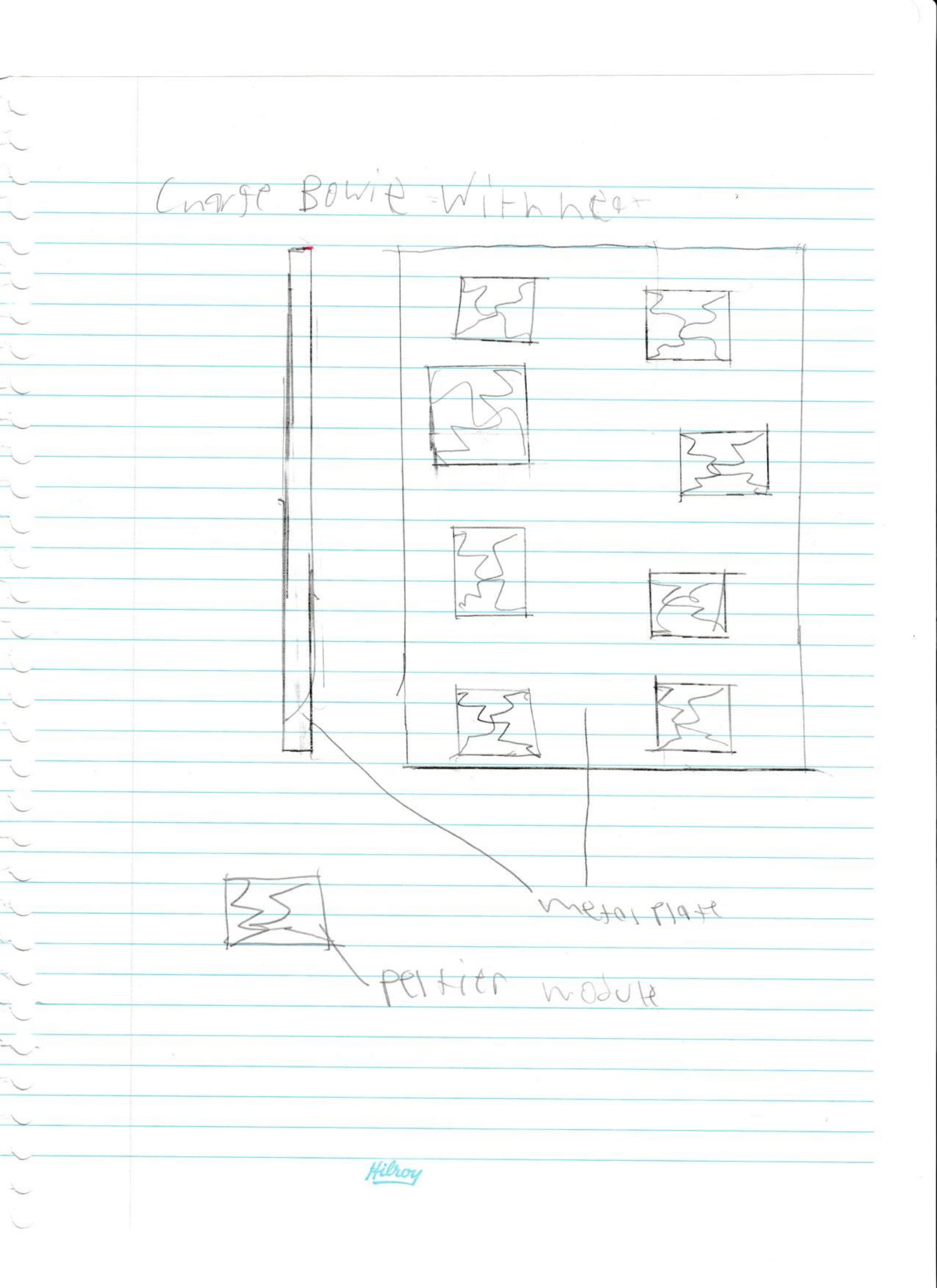
# **Charging Bowie from the surrounding Heat (Ali Zaidi)**

With the use of several Peltier modules with the hot side adhering to a metal plate, a voltage can be generated by the surrounding heat. A Peltier module is a square module with 2 sides to it, if heat is applied to the “hot” side of the Peltier module then a voltage can be generated. If a cool substance is applied to the “cool” side, then a voltage could be generated as well. The peltier generates it’s power from the difference in temperature between the 2 sides. So on a hot sunny day when bowie is picking up trash, while it’s working the robot can be charged



# **Charging bowie from the surrounding cool air. (Ali Zaidi)**

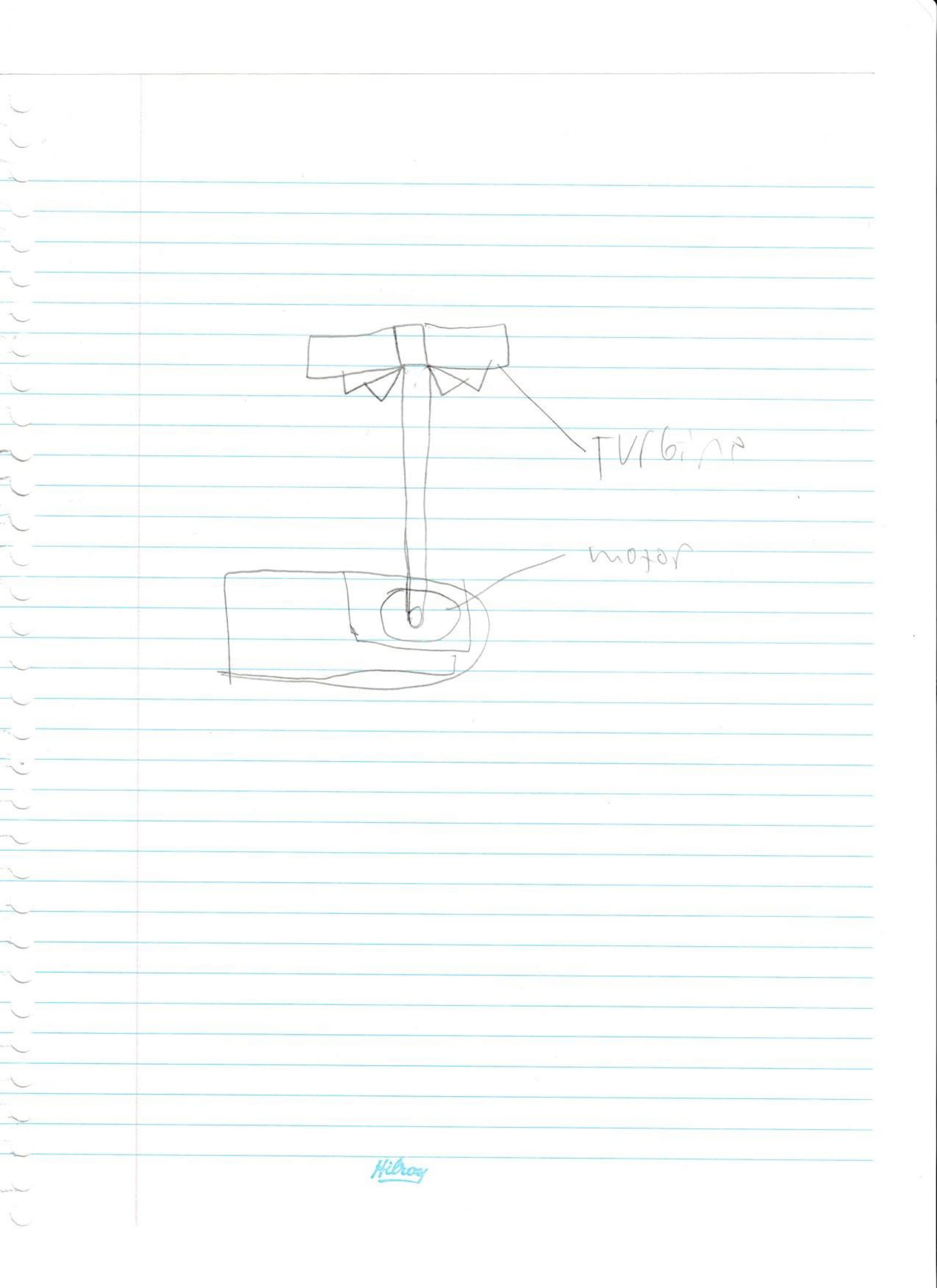
With the use of several Peltier modules with the cool side adhering to a metal plate, a voltage can be generated by the surrounding cool air. A Peltier module is a square module with 2 sides to it, if heat is applied to the “hot” side of the Peltier module then a voltage can be generated. If a cool substance is applied to the “cool” side, then a voltage could be generated as well. The peltier generates it’s power from the difference in temperature between the 2 sides. So while bowie is working on a cool windy fall night, he can be charged while he is working.



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# **Charging bowie from wind gusts (Ali Zaidi)**

With the use of a DC motor and a turbine, a voltage can be generated. When a voltage is applied to a DC motor the motor head begins to move. This is due to the fact that the electrical energy induces a magnetic field within the coils of the DC motor causing the motor head to move. However, the opposite is also true, if the motor head is turned due to some sort of external force, than this induces another magnetic field in the coil which moves the electrons in the coils generating a voltage. So on a very windy day when bowie is working, the kinetic energy from the wind can be converted to electrical energy which can be supplied to bowie.

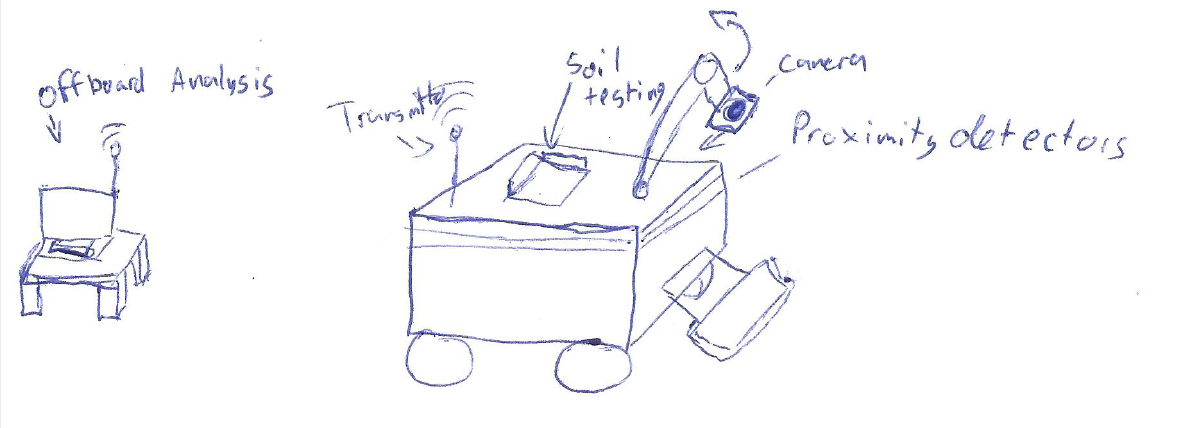


**Overnight Storage (Tarek Bedair):**



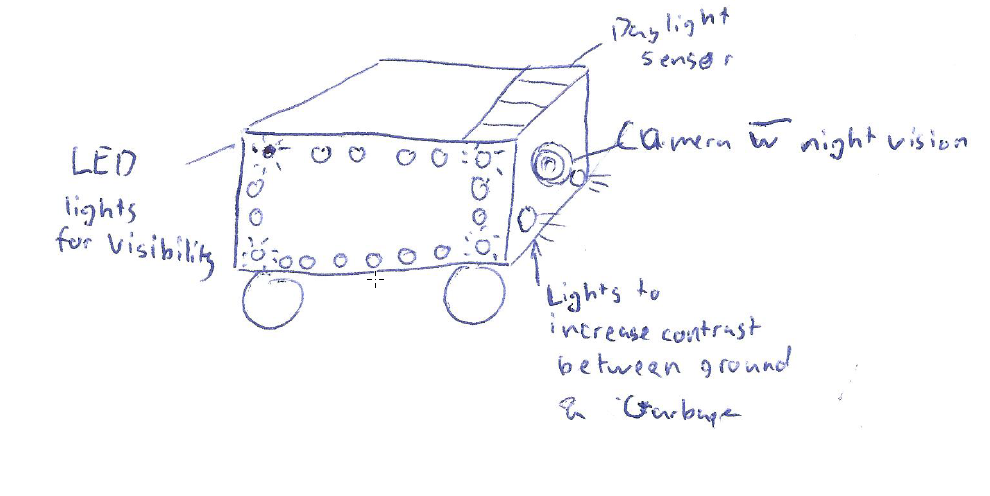
My concept for this combines a few important needs that we as a group felt needed to be filled. My goal with this was to provide Bowie a place to recharge and to be stored safely overnight, while still being relatively low-cost and appealing to look at. The main material that would be used in the making of this storage unit would be a medium cost wood or plastic. In order for this to last for a long time, some form of waterproofing (such as polyurethane) would need to be applied to outside of the unit to prevent rot and to reduce wear. When Bowie is in the house, a garage door type apparatus (that can be locked) will be engaged so sand and other things cannot enter. I also felt that this could also be a good way to charge Bowie, as he would mainly be here during times when he is not required to function. As such, a solar panel and battery cell would also be attached to the unit. In order for this to be fully autonomous, small modifications would be made to Bowie so he could dock within the house. Furthermore, a set of tracks would be put in place to guide Bowie into the dock. I also felt that this would be a good way to interact with the community a little more, as people may be able to paint the outside of the house and in general this unit should look fairly appealing.

**Tandem Bowie Unit (Tarek Bedair):**



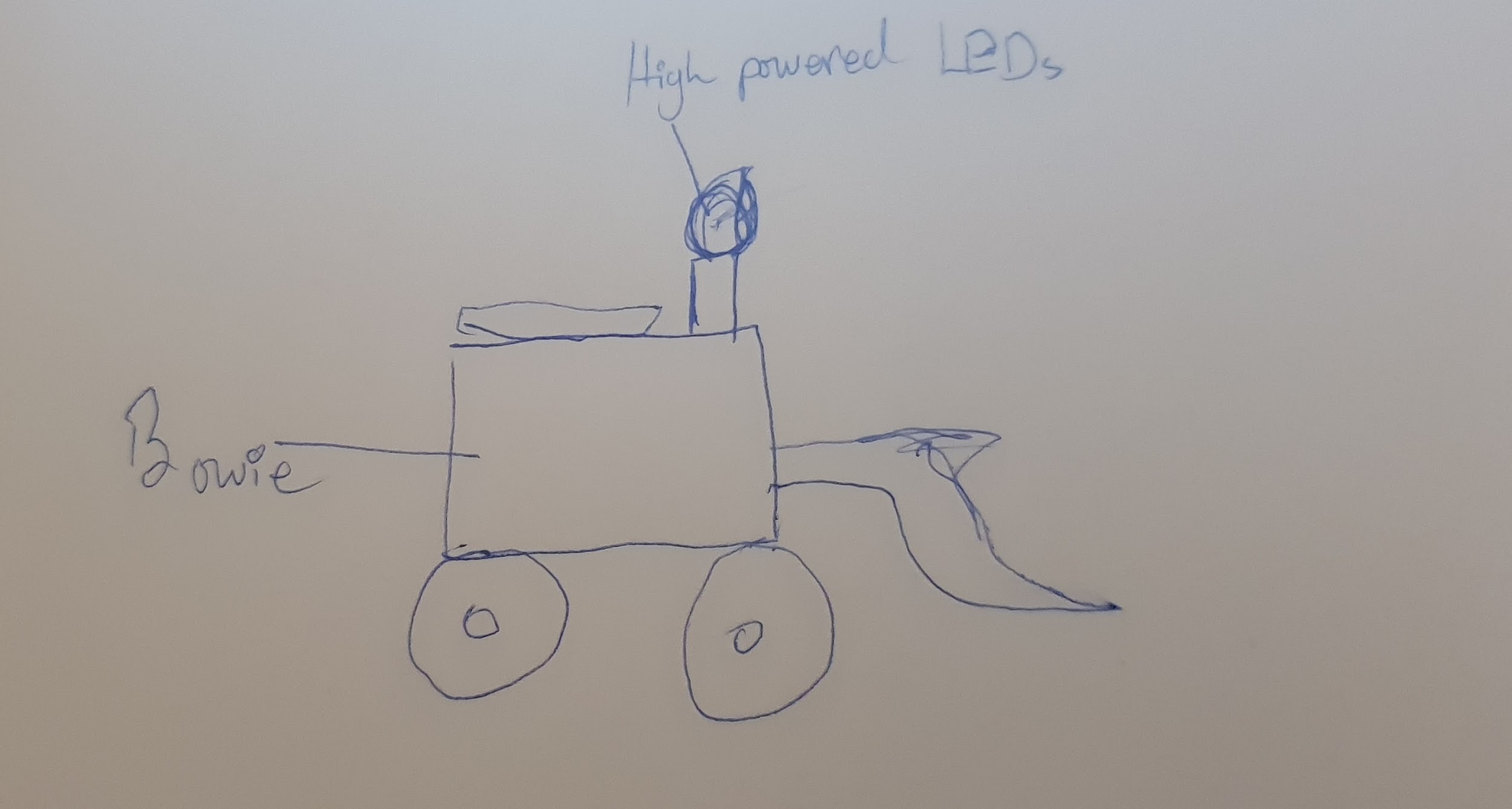
This isn’t necessarily an upgrade to the current Bowie unit, but instead a slight alteration on a separate unit, so that multiple robots would be able to work at the same time as a team. The goal here, was to provide Bowie with more information about the surroundings, without overwhelming him with a lot of information. I felt that a second Bowie dedicated to observing surroundings and creating a plan of attack for the cleaning Bowie, would be much more effective long-term. On-board this version of Bowie, there would be proximity detectors all around him, to ensure that any close by animals or other creatures are made aware of. An arm with a camera would also be attached to the top of Bowie, so that it can take videos or pictures of the surrounding area. Finally, a soil sampling device would be embedded within the middle section of Bowie, to take accurate readings of whatever information may be available. None of the processing of this information would occur onboard bowie. Instead, all the information would be transmitted to a computer, where any processing and distribution of information (to other Bowies) would occur.

**Night-time Functionality (Tarek Bedair):**

Some small modifications would need to be made to Bowie in order to operate solo at night. Ideally some form of night-vision in the form of either a camera with night vision or some high quality lights to provide contrast with the ground, so that Bowie would be able to see the surrounding garbage. A daylight sensor would be used, so that Bowie would know when to activate these features. This would assist in conserving power, and allow Bowie to operate seamlessly throughout the day and night. As a safety precaution, either bright LEDs or highly reflective tape would be attached to the Bowie’s sides, so that he would still be easily visible.

**HIGH POWERED LEDs (Mashiyat Islam):**

With high powered LEDs installed, Bowie will receive a better illuminated vision during the night time.This will be a huge advantage and will increase Bowie’s efficiency as it can work for a longer period, including during the night time when the disturbance from the passerby will be less. Also given that a design is made to protect itself from any kind of vandalism.

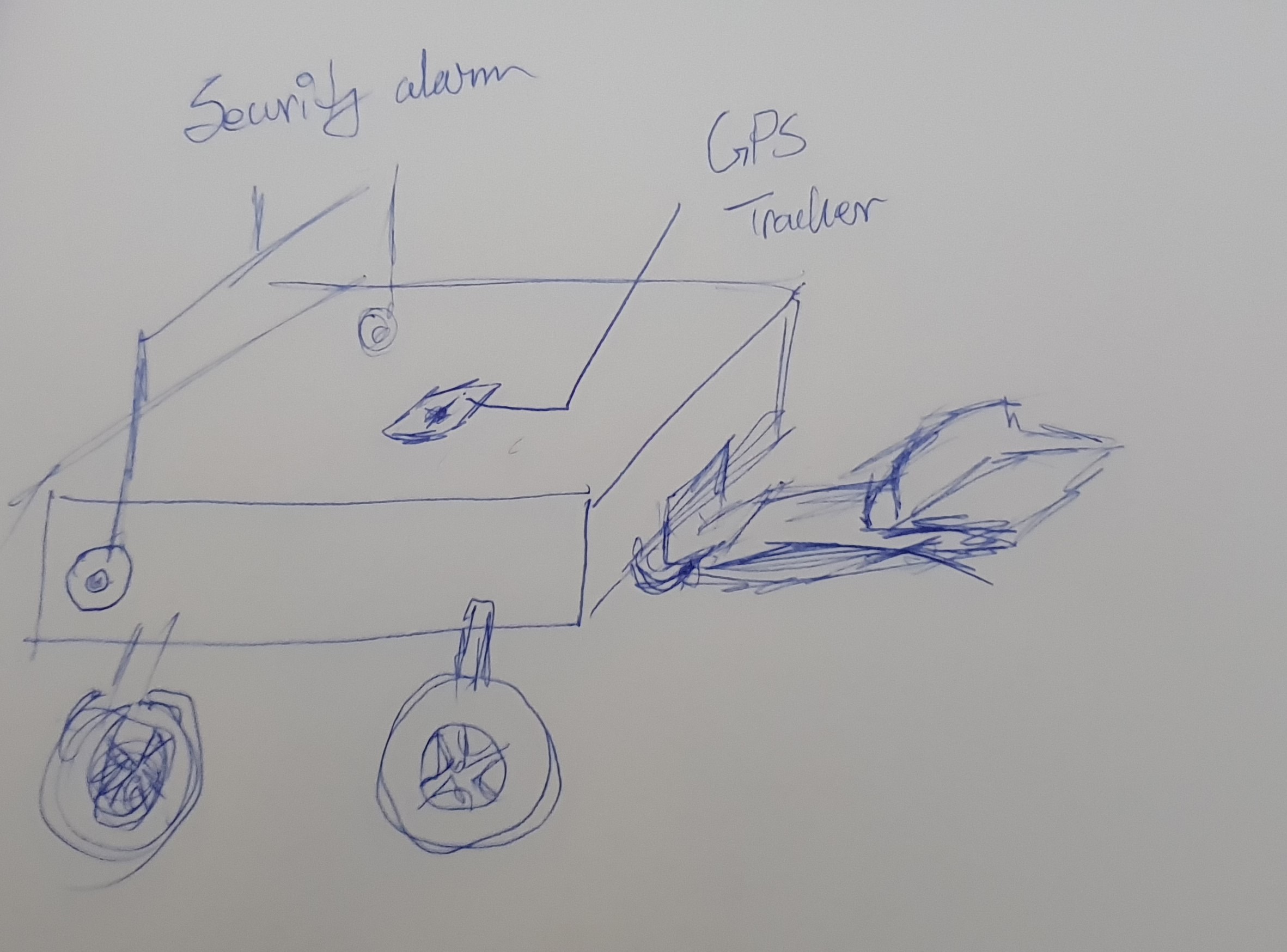
**NIGHT VISION CAMERAS (MASHIYAT ISLAM)**

Attaching a night vision camera on top will help Bowie see better during the night time. IT will make Bowie more wildlife friendly, as it will help Bowie see the wildlife better during the night and interact better.This serves the same purpose as the high powered LEDs.



**GPS TRACKER AND SECURITY ALARM (MASHIYAT ISLAM)**

Bowie will be installed with GPS tracker and can be tracked directly from the control panel. During the night time, Bowie will be vulnerable to vandalism. So for it to work during the night, it has to be able to protect itself or atleast stop from getting stolen.Also a security alarm will go off when it is picked up by and unrecognized person. During the day time it can be turned off as it will be under eye radar and will likely interact will people more. This will alarm the surrounding people when it is facing a threat.This way Bowie can somewhat protect itself during the night.

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**Solution A:**

**Solution B:**

**Solution C:**

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| --- | --- | --- | --- |
|  | **Solution A** | **Solution B** | **Solution C** |
| **Cost** |  |  |  |
| **Night-Time Operation** |  |  |  |
| **Less Reliant On Humans** |  |  |  |
| **Safe Interaction with Wildlife** |  |  |  |
| **Improved Interpretation of Surroundings** |  |  |  |
| **Overnight Storage** |  |  |  |
| **On Water Ability** |  |  |  |

**\*Charging station.\***

**\*Use a heated-up/cooled-down plate and Peltier modules to generate energy.**

**\*Use wind turbines and dynamo to produce enough power so it can sustain itself.**

**\*Budget- $100**

**\*A way that Bowie can navigate itself to the charging station.**

**\*Use markers (colored maybe) so it can find its way.**

**\*Integrate a charger into Bowie. \*China\***

**\* Waterproof materials.**

**\*7.4V ,5000mA.**

**\*Dual-Cell LiPo Battery**