- **Discuss brainstorm project ideas**
    a. Present idea team feels most passionate about (in order of voting)

    BK

    - Jeffrey's Building a cheaper rover to deliver food
    - James' Building a rover to explore heavy terrain (such as Mars or natural disaster places)
    - BK's 3D LED fan

    Jeffrey
    - Tobe's COVID Rover
    - Jeffrey's cheaper rover to deliver food
    - James's explorer rover

    Johnny
    - James's disaster & relief rover
    - BK's 3D LED Fan
    - Tobe's mapping delivery drone

    Tobe
    - Tobe/Jeffrey rover for food delivery
    - James's rescue/explorer rover
    - BK's 3D LED Fan

    James
    - Tobe's COVID Rover
    - BK's LED Display fan
    - James's rescue/exploration rover

Consensus: Tobe's/Jeffrey's food delivery rover Idea
Secondary: James's explorer and rescue rover idea

- Present initial distribution of work/parts of project among members
    a. (bk) I can work on partial coding and building/enabling the sensors for the rover.
    b. (Jeffrey) microelectronics, sensors
    c. (Tobe) development of the phone app controlling the rover/ embedded system programming for rover
    d. (Johnny) Partial coding and building
    e. (James) little bit of coding, experienced with power tools and assembly, can build and make adjustments if needed

    1. physical rover itself (motors, chassis): Johnny, James

    2. sensor system and microelectronics: BK, Jeffrey

    3. app to control it: Tobe

- Goals to reach for the rest of summer
    a. Start researching and coming up with real world numbers and measurements
    b. UROP/other ways of funding project
    c. Realistic weekly hours per member to reach said goal(s)
        - How much time should we spend if we want to have a decent foundation after summer?

Meeting Notes

- Two different apps: one for customer ordering phone, one for the owner of the robot
- Goal by end of fall?
    - Finalize project by the fall (food delivery vs. discovery)
    - Finalize weight payload
    - Finalize test path, type of environment
    - Straight line? Real streets? Rural/suburban/urban?
        - Has to be something we can actually test (we don't have access to campus)
    - What obstacles?
        - Static
        - Moving
    - What are we buying vs. what are we making ourselves?
    - What size payload?
    - What size battery meets our needs?
- Goal by end of winter
    - Something that works

- Once fall starts, weekly check-in
- Minimum expectation: there is an app that I can give it information that says to go from one point to another, another app that robot receives and responds to the information
    - Cases that we can handle, and cases that we cannot
    - Ex. It doesn't handle dogs that run into it
- Keep track of your team's biggest obstacles, and your personal biggest obstacles
    - Wrong battery size, payload expectation too big, etc.
    - Resume: testing documentation, requirements documentation
    - Can talk about working remotely: testing things locally, verification

- For now:
    - What sensors?
    - Bump sensor, infrared sensor
    - Make some reasonable proposal for why we need something

- Fall:
    - Expected 10 hours a week each member

        - End of project, 1000 total hours
-
- Search and rescue rover:
    - No phone service and injured on hike
    - Ideas:
        - Rover to bring first aid supplies to injured individual
        - Patrol hiking area and can be used to send messages to ranger
            - Send audio and video back to base
    - Distance/Color sensors

Schedule a meeting once:

Have a set of use cases for project

Patrol hiking area and can be used to send messages to ranger

Clearly defined goals for what project looks like at end of winter

Environment: Drone should be able to be on bumpy roads/ test on Aldrich park trails

Static Obstacles: rocks, small branches, small creek/body of water

Distance: 50 ft?

App/Communication: Interface on robot, with buttons, select need for help, sends GPS coordinates

Battery size: ? (consider distance, payload, speed)

What are we buying vs. what are we making ourselves: ?

Payload: carrying flag for hikers to see?

Speed: 6mph?

Detect people: infrared sensors to stop? Stops if distance closing in

Clearly defined goal for end of summer:

interface/buttons

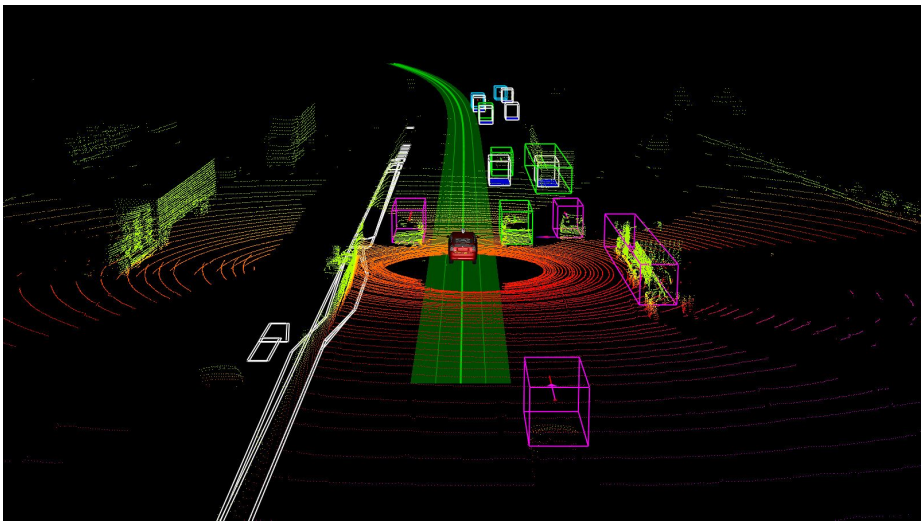
Start building the actual rover itself (can move)

What thing can send the gps signal?

After meeting: research sensors, battery sizes, gps signal by ***7/18 FOR NOW***

Parts

Sensors

- Sensor comparison
- **Lidar**: using lasers to paint a 3D Picture of the environment
    - Pros: don't need many sensors
    - Cons: up to 10x more expensive than the cost of a camera+radar
    - 
- https://blogs.nvidia.com/blog/2019/04/15/how-does-a-self-driving-car-see/#:~:text=The%20three%20primary%20autonomous%20vehicle,as%20their%20three%2Ddimensional%20shape.

- **Ultrasonic sensors**: uses echolocation to detect the distance of objects. https://www.youtube.com/watch?v=JIfKOMAU224
    - Range is up to 13 feet (2cm-400cm)
    - Pros: more sensitive than infrared sensors.
        - Only need one sensor in the front (can have a rotating mount)
        - Very affordable. (like 80 cents for one) https://www.aliexpress.com/w/wholesale-ultrasonic-sensor.html
    - Cons: there is no visual image for the user to see.

- **Bumper sensors** as a backup if the first sensor fails. Just attach a bunch of these guys around the rover.
    - Pros: Cheap and easy to implement.
    - Cons: Can only trigger if it makes direct contact with the sensor.
- Pyroelectric Infrared Sensor (detecting humans)
    - Research Paper

Battery

- From the video Johnny sent the last time we met
    - https://youtu.be/nv2FbwjIZRE?t=361

    - **16000mAh 3 cell battery** (Price $82.39)
    - URUAV 11.1V 16000mAh 50/100C 3S XT90 Plug Lipo Battery for Quadcopter Agriculture Drone Outdoor Charger Power
- If we're implementing a battery with solar panels, it seems that a Lithium Ion battery is best, but still need to consider overheating, other safety, etc.
    - Also need to consider how much Power and how much Voltage we need, for our sensors, gps signal, moving the rover, GUI/pinging software, etc
- I was thinking we could use solar energy, so that we can just leave the rover running 24/7, have it move around only when there is sun (has the energy to move), stationary otherwise

GPS Signal

- Garmin GA 25MCX Low Profile Remote GPS Antenna
- How external GPS works

Are we going to use 4 wheels or tank style tread (continuous track)? pros/cons

- 4 wheels can allow for diagonal driving and quicker turns
- It's easier to turn with tracks, since it's basically rotation. And better to cross over terrain and what not.
- Quick discrepancies
- Speed issue: Use gears of different sizes (slow, big source wheel → faster, small wheel)
    - Problem: Strain on small wheel moving against big wheel when high friction terrain

Miscellaneous

- Rover will be holding a flag to bring attention to people who needs help.
    - LED lights on the bottom of rover illuminates position for night time/darkness
- Add some LED lights to light up the road ahead when weather gets cloudy.
- Have a user interface on the rover for people to interact with. Such as an LCD monitor to display questions and have buttons for different responses.

STARSHIP COMPARISON

https://www.youtube.com/watch?v=ZejQOX69K5M
https://ardupilot.org/rover/index.html