GSM:

Sheep lost:

If sheep lost has GPS functionality:

* From the delay function, if a sheep becomes a cluster head and has no followers, assume that they have wandered off, send a notification or signal with their current GPS location back to server
* Psuedo code:

If followerSheep == 0:

SheepLost == True

UpdateLocation(SheepID)

SendNotification(“Sheep ID:”,SheepID,” has been lost. The location is:”, Location”

If sheep lost has no GPS functionality:

* Alter the update interval of follower sheep's ids to n minutes
* If the number of followers decrease, note the missing ids
* Search other clusters for the missing ids
  + If found, ignore
  + If not found, notify that they are lost with their most recent GPS location
* Diagram

  Description automatically generated

Differentiating:

* Set IDs to be unique to each owner (ex: A1, A2, A3, …, B1, B2, …)
  + When initializing, make sure only IDs unique to the owners will be tracked and get ran through the programs:
    - Psuedo code for when detecting a new sheep as a follower:

if SheepID in InitialGroup:

AddFollowerID(SheepID)

else:

break

* Show the IDs on physical collars

Collar part:

* Design of the collar, how do you want the design look like (we might draw or cad)
* Need to have the unique sheep id written somewhere on the collar
* A full feature node should include this hardware:
  + GMS trans receiver (need to do research on the base tower available, how this sends the location, in what data type, how to connect this to the backend on the server)
  + GPS receiver, buy one? Or make one? (Need to figure out how this sends the location, in what form, data type)
  + Leader message broadcaster
  + RAM to store the ids (in what data types are the ids, how are they sent to the server?)
  + Microcontroller (processor)
  + Duty cycling capabilities(might need to read this again, but this is calculated using the delay function I think)
  + Wireless transceiver (for what? For receiving the broadcast message? What are the parts/component wee need to buy)

Vehicle

Have a fisheye camera

Drone

We could say to design a vehicle(that can work all day long) later, but for now just use the drone(to replace the vehicle) to prototype/to test.

Drone & Image Recognition

Using different colors of tags to identify the owner of the sheep, use the drones to monitor the sheep and search the sheep around the entire area. If the drone finds the location of the sheep, the owner can know the location of the sheep from the location of the drone. GPS will use on the drone, and that location will be same for the sheep.

The energy source is a big problem of the drone, so I think the solar panel will be a perfect solution for this issue. It is easy to connect the panel to the motor and use solar power as the new energy source instead of the battery.

Material for making drone

* Motors
* Electronic speed control
* Flight controller
* The drone frame
* Propellers
* Batteries
* Connectors
* Camera (if you want to build your own camera drone)
* Gimbal
* A mounting pad
* A micro SD card
* An RC receiver

<https://www.thecasefarm.co.uk/how-to-build-your-own-drone/>

<https://www.wikihow.com/Make-a-Drone>

Hardware specs:

* Drone + camera + GPS
  + Drone provides the mobility to monitor/track the sheep
    - Follow the ear tags
  + Camera is the eye that monitors and tracks the sheep, (computer vision). The vision range should reach 50m (estimated)
  + GPS samples and sends the location of the lost sheep

Software specs:

* Count objects up to 200 object
* Be able to locate and track the in frame objects

Camera specs:

* <https://www.studiobinder.com/blog/what-is-a-wide-angle-lens-definition/>
  + “a wide angle lens would be any lens with a focal length equal to or less than 35mm. Any lens between 35mm and 24mm is considered a wide angle camera lens. Anything between 24 mm and 18mm is considered an ultra wide angle lens. Below 18mm enters fisheye lens territory. Fisheye lenses are common in action sports, but in photography and film can cause unwanted wide angle lens distortion.”
* Fish eye lens: 180 degrees
  + Widest possible angle for camera lenses

Monitoring Mode:

* Initialize own sheep using colour distinction (ear tags with different colours for different owners/groups of sheep)
* Drone should recognize groups of sheep and follow the group
* The drone should be covering a radius of at least ( )km and be able to cover the entire communal feeding area

Tracking Mode:

* Ear tag for each sheep for
  + Initializing
  + Tracking/finding
  + Differentiating different sheep