City Science - ACTUA TECH

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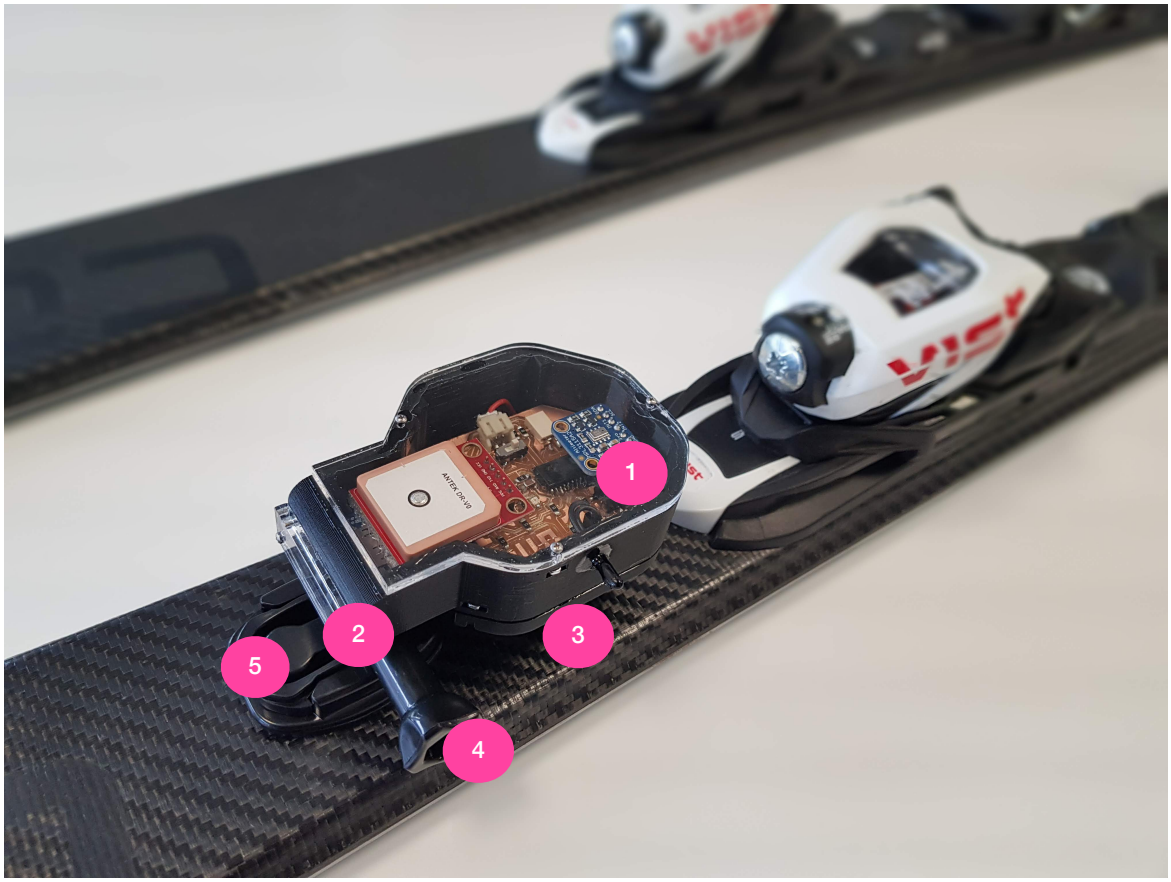
Whispers Of The Mountain

Andorra Ski Sensor MARK II Deployment

Main Components



1. Top Lid - Unmount lid to access ON/OFF switch. WARNING: When mounting and unmounting lid, make sure to not over tighten screws. Screw as far as normal force allows.
2. SD Card Lid / Side Lid - Unmount lid to access SD card. Push SD card to release it from the device. WARNING: When mounting and unmounting lid, make sure to not over tighten screws. Screw as far as normal force allows.
3. Battery Storage - Only unscrew if battery issues arise. Contact Andrés if this happens aricom@mit.edu
4. Mount Screw - Unscrew for mounting onto GoPro gear. When mounted, screw back in, to fix the device and avoid rotations or vibrations.
5. Mount Buckle - Buckle mounts onto adhesive GoPro Mounts. This buckle fits any GoPro accessory. The current model functions best when mounted in front of the ski binding.

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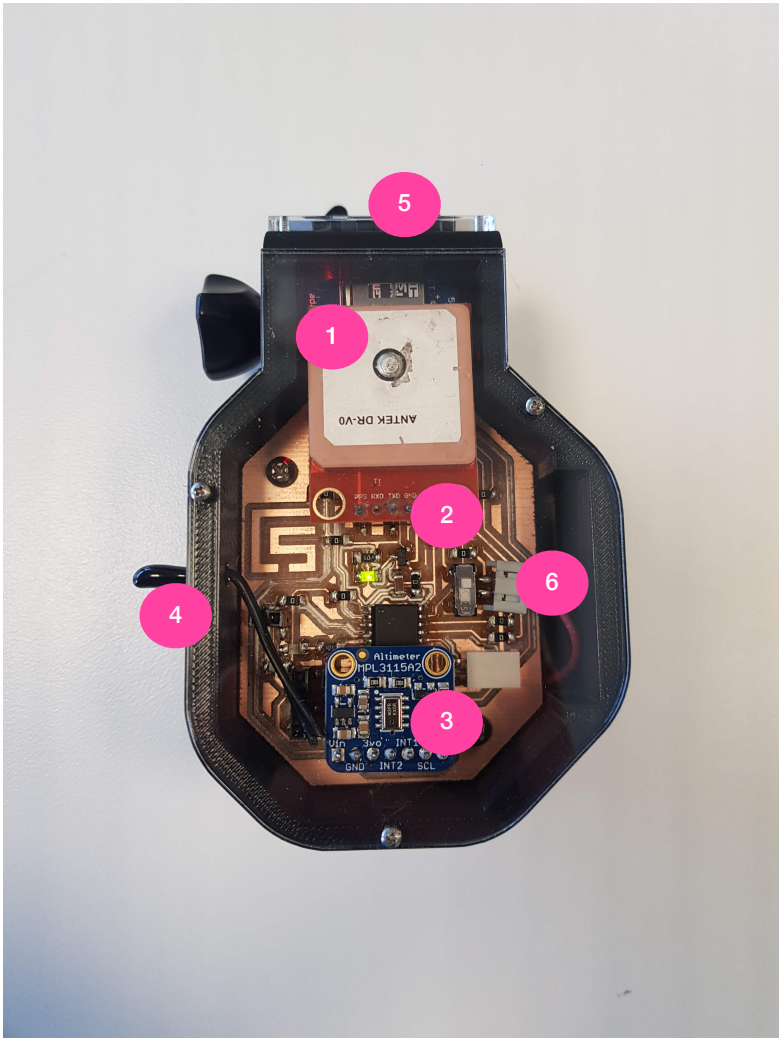
Electronic Components



1. GPS - Unmountable GPS Module with integrated Antenna.
2. ON/OFF Switch
3. Altimeter/Pressure Sensor - Unmountable Altimeter and Pressure sensor.
4. Temperature Sensor - Epoxy sealed weather resistant NTC temperature sensor.
5. SD Card - MicroSD card mount with push to release capabilities.
6. Battery Jack

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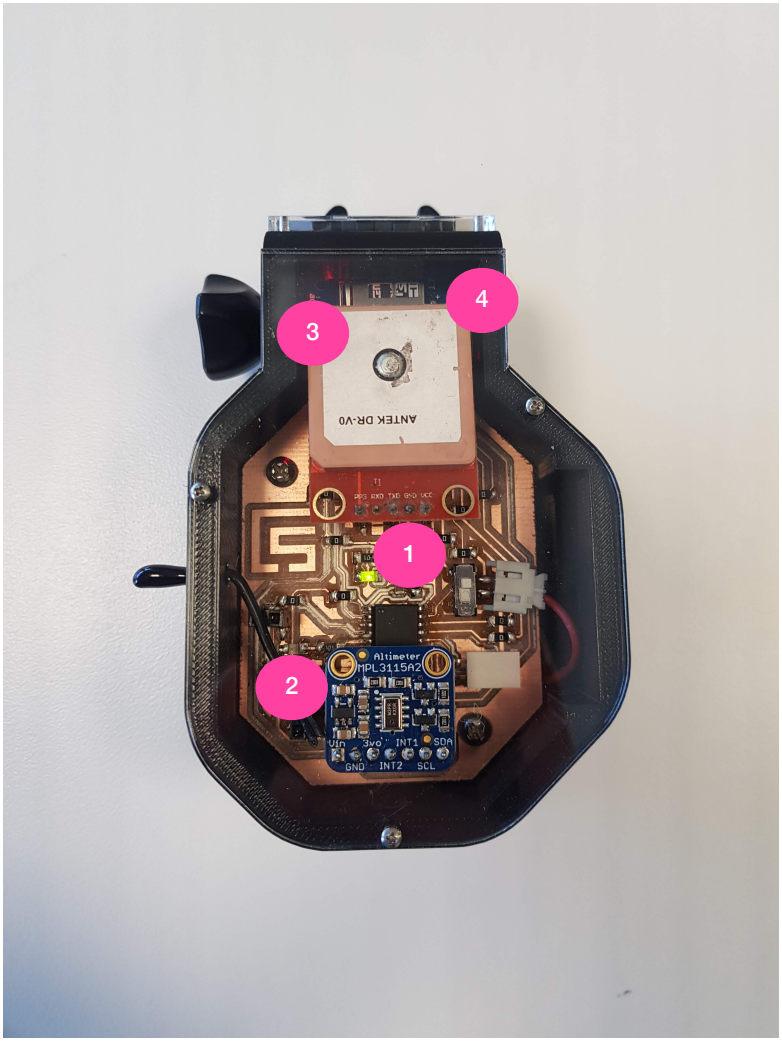
LED's



1. *GREEN* - ON/OFF - LED will stay ON
2. *BLUE* - Data Collection - LED will flash when device is turned on and all peripherals were detected correctly.
3. *RED* - GPS Fix - LED will flash when GPS has connected to satellites. If LED does not flash and just stays ON, it means that GPS has not found any satellites. It will usually take 15 minutes for the GPS to locate the first satellite.
4. *RED* - SD Card Write - This LED is more visible from the side lid. It will flash whenever data has been correctly saved into the SD cad. If the LED is not flashing it menas that no data is being logged.

Proper operation of the device would have LED 1 on, LED 2 flashing, LED 3 Flashing and LED 4 flashing. If all LEDs have their expected behaviors it means that data is being logged properly and you are set to go.

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Data Structure

- File names will be random three number sequences. We will be able to distinguish each data set with the timestamps in the data.
- Sensor will save data into a .txt file. The file can be converted into .csv in the computer.
- Data is structured as follows:

[Date (month-day-year hour-min-sec-millis), mills (MC Clock in milliseconds), Lat, Lat(N-S), Lon, Lon(E-W), Pressure (Pa), Altitude(meters), Temperature (Celsius)]

Operation Instructions

- **Insert SD Card.**
  - Unscrew both side lid screws (marked in red). NOTE: The lid might be a bit stuck to the case due to the resin used for waterproofing. If lid does not come off easily you just need to push firmly from the side as indicated by the blue arrow. Make sure to hold the device tightly when pushing so that the lid does not fly off.
  - Insert SD card into mount with the SD leads (gold tinted connectors) facing down. you should be able to insert the card without force. Once the card is aligned. Push it in until you hear a click. The mount operates as most GoPro SD Card readers.
  - NOTE: To retrieve SD Card you must push and the spring mechanism will eject the card so you can access it and pull it out.

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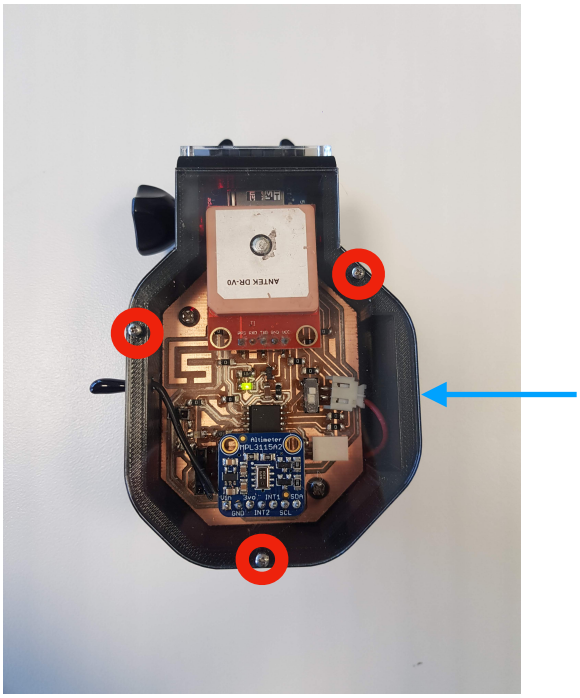
- **Turn Device ON**
  - Unscrew the three screws (marked in red) from the top lid with a standard philips driver. Be careful with nuts that are located within the casing as they might fall and when unscrewing. NOTE: The lid might be a bit stuck to the case due to the resin used for waterproofing. If lid does not come off easily you just need to push firmly from the side as indicated by the blue arrow. Make sure to hold the device tightly when pushing so that the lid does not fly off.



  - Once lid switch the device to the ON state. You should see a green light come ON immediately.
  - NOTE: It is highly recommended that the device be turned on at the site of deployment. If turned ON before, battery will be wasted and data that is not related to the mountain or the skis will be saved.
  - If everything is connected properly you should see the blue LED blink and then shut off right after turning the device on.
  - If everything connects properly, close the lid using the three screws and three nuts. Make sure to not put too much pressure when screwing in the lid so that breaking the edges is avoided.

- Mount Device onto Ski
  - Device is mounted using standard GoPro accessories so technically you can mount it into any surface that has a GoPro buckle. For the purpose of this project we will be mounting one of the sensors on a Snow Machine and the other onto a Ski.
  - To mount the sensor on a ski we will first adhere the mount (marked in yellow) onto the top of the ski. At a site close to the front binder. Make sure to center the mount (reference picture to see space to leave between mount and ski binder.
  - Use the screw (marked in green) to attach the sensor module onto the buckle (marked in red)
  - Tighten screw with a philips driver so that any rotation of the device is avoided.

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- Finally, slide buckle onto mount. Make any adjustment necessary so that the bottom of the sensor is touching the surface of the ski.

- **Deployment**
  - Once in the mountain check that all LEDs are working as explained in the LED section of this document. If all LEDs are showing proper behavior, you are ready to go! Have fun!

- **Turning Off**
  - Follow the same steps as turning the device ON but flip the switch the other way.
  - NOTE: It is important to always turn the device off when not using and when extracting or inserting the SD Card.

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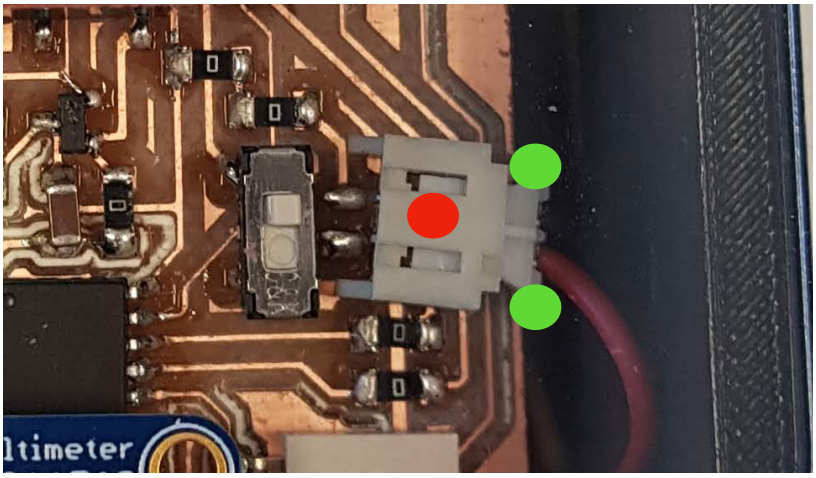
- NOTE: Battery will give about 6 hours off collection time. Keep good track of the time that the sensor is being used so that you have a good idea of the time left for proper operation.

- **Charging Batteries**
  - If batteries need charging, you must open the device and through the careful use of pliers disconnect the battery. Make sure to be gentle because pulling the battery off can damage the batteries cables and the board. When using pliers make sure to have a good grip on the sections marked in green below.
  - It is also advisable to press down with your finger on the battery jack, marked in red. This will help keep the board safe.
  - NOTE: One of the boards has a vertical battery jack which makes unplugging the battery much more comfortable and safe.
  - WARNING: ALWAYS TURN DEVICE OFF BEFORE EXTRACTING BATTERY.



- Once the battery has been remove, you can plug it into the blue charger supplied within the kit. See image below.
  - Connect the white cable to the USB-Wall adapter.
  - Connect the mini USB end to the blue chip's mini USB port (marked in red).
  - Connect the LIPO Battery into the battery jack (marked in green).
  - NOTE: Battery jacks have a safety plastic slot that avoids mistakes with reversing polarity. If you are plugging in the battery and it does not insert smoothly, you are probably putting it in backwards. Make sure to always plug it in in the correct orientation. Miss-orienting the battery can be dangerous and will kill the boards.