GCS | Compass calibration redesign

August 2016

Ardupilot flight stack has recently implemented to their embedded compass calibrator a mask representing sections of a geodesic grid.

Their goal is “[...] to provide a **picture on how the calibration is progressing** with respect to the distribution of the samples collected and a **way for the GCSs** to somehow **guide the user** when she is performing the calibration [...]”

The challenge here was to **redesign the user interface incorporating the geodesic grid**, as it solves the problem of lack of feedback during calibration.

Our **previous research** showed that **calibration is one of the most used features on GCSs**[1]. The benchmark found that, out of the 14 tools analyzed, in relation to how they support users achieving goals, 12 of them received a “must improve” and 2 of them an “achieved with much effort” on the compass calibration[2].

The QGroundControl usability test revealed that users didn’t know how to start the process, didn’t know how to move to the next steps [3], were not sure it the process sequence was a must and found the feedback unclear [4].

The action

QGroundControl's flow was used as a **reference**, as it is the GCS we have been studying. The problems identified during the research basically originated from the **confusing task flow and feedback**, that led the user to feel insecure during the whole process, from start to conclusion. To solve this issues, we aimed at **clearer instructions**, a more **responsive process** and **clear feedback**.

QGroundControl's Flow

INSTRUCTIONS

Message instructs user on the calibration process

START

6 different orientations for the UAV (represented as an airplane) are shown

Orientation images have red borders

Message to put vehicle in one of the orientations and hold still

CALIBRATION

User puts UAV in position

Corresponding position border turns yellow

Arrow is shown indicating rotation

Message to rotate UAV until completed

FEEDBACK

Position image gets green border

Completed message

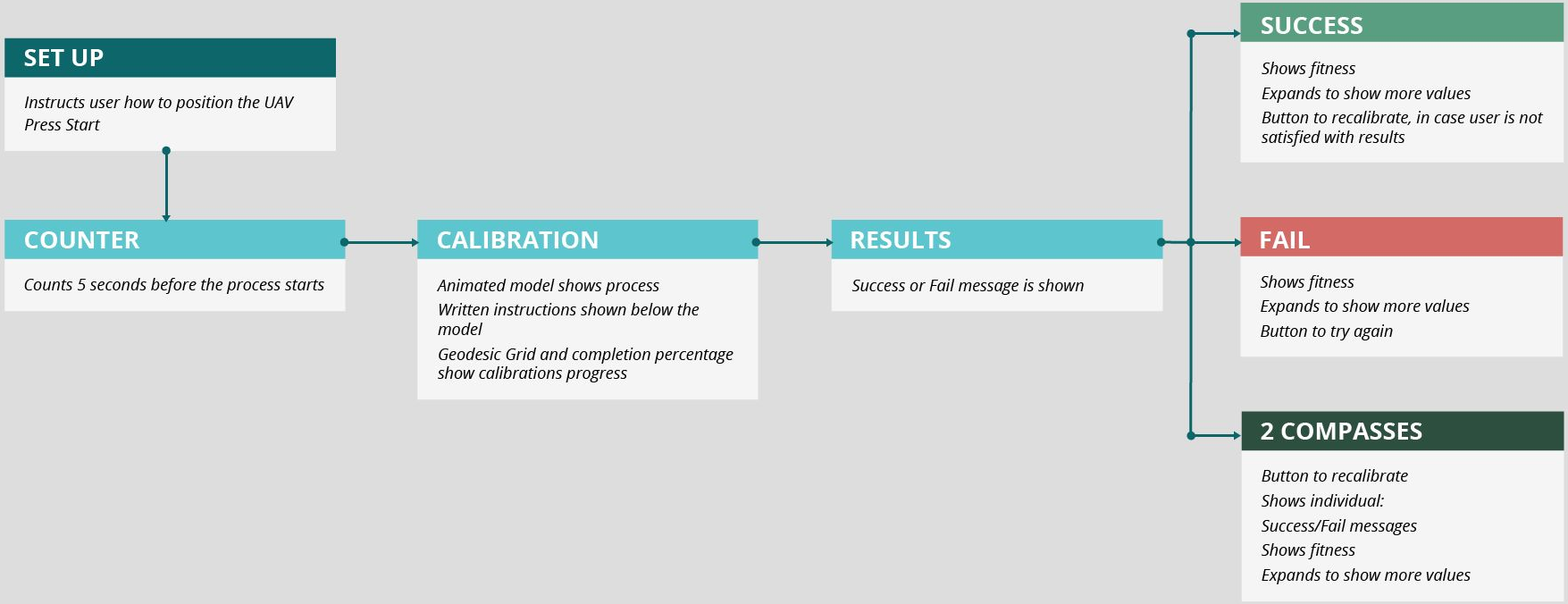
RESULTS

"Calibration complete" message is shown.

All 6 positions are green.

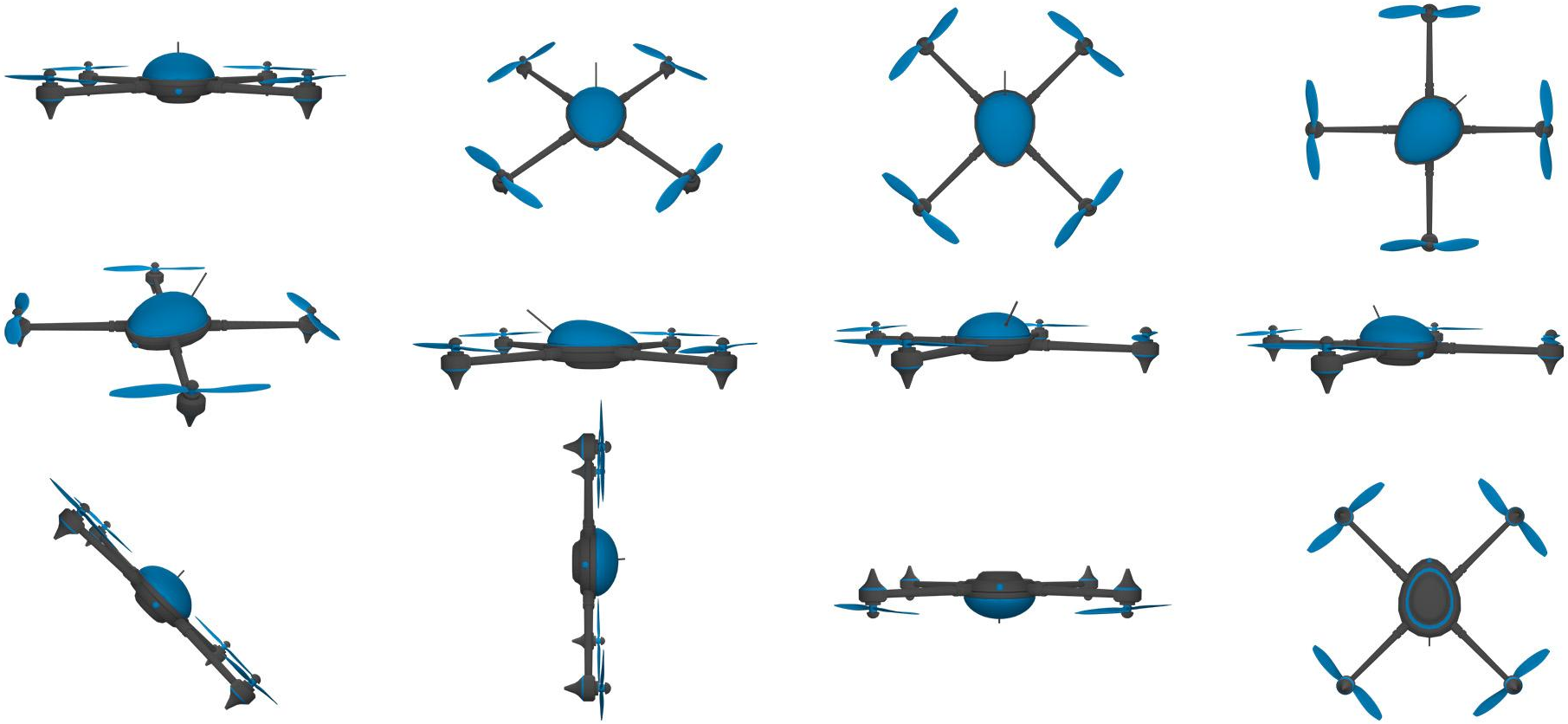
All positions have green borders and completed message.

Proposed Compass Calibration Flow



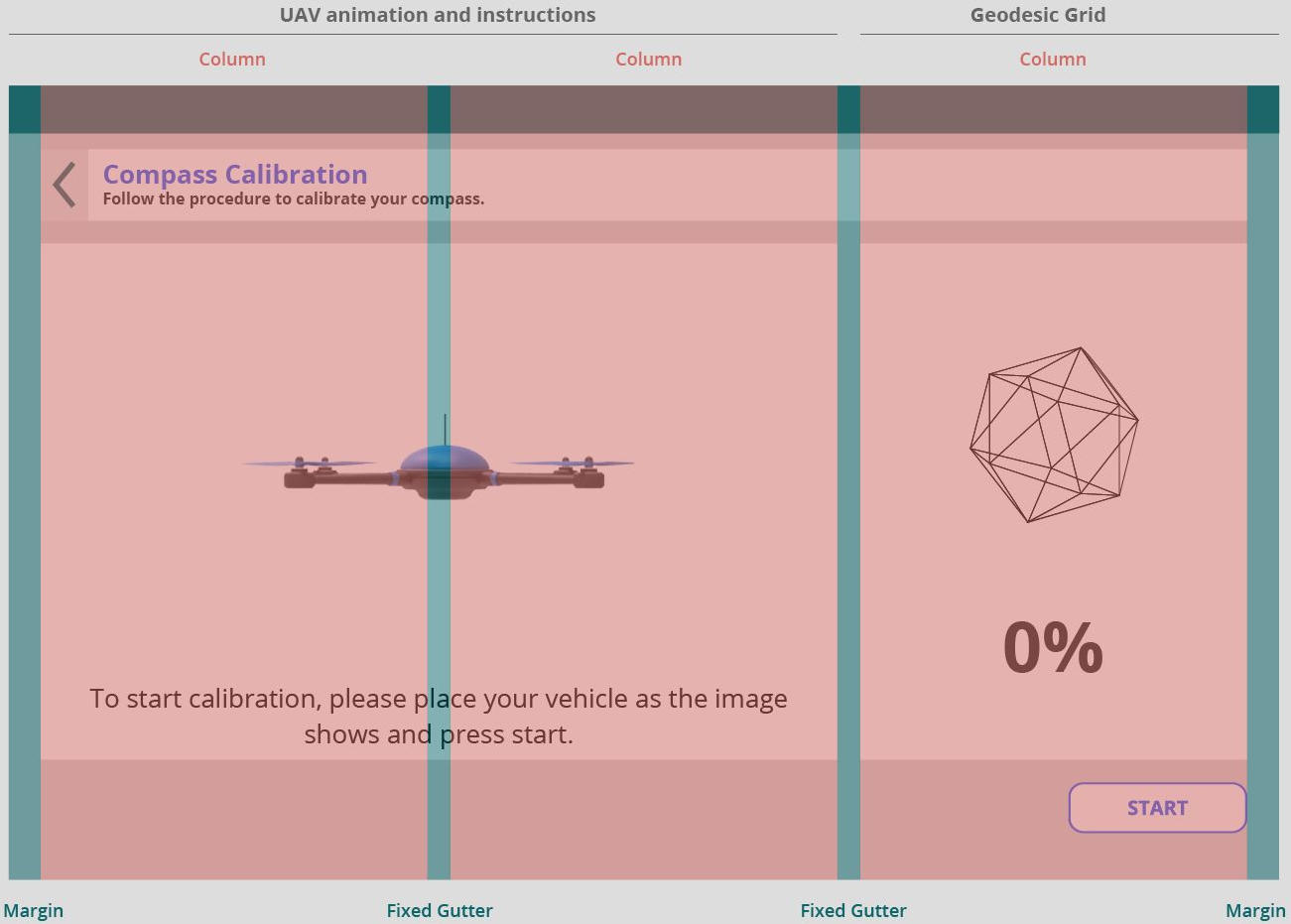
The instructions for calibration will be given by an **animated UAV 3d model**, while the **geodesic grid** will be completed accordingly to the user's action with the drone. We divided the screen in 2, so the **user can discover** and manipulate the geodesic grid.

We opted for an animation as it presents the user with **clearer instructions**. The animation presents one movement at a time, so the user **does not need to wonder about the sequence**. The animation also makes the movement clearer. We opted to use a quadcopter in the animation, as it is an easily recognizable UAV.



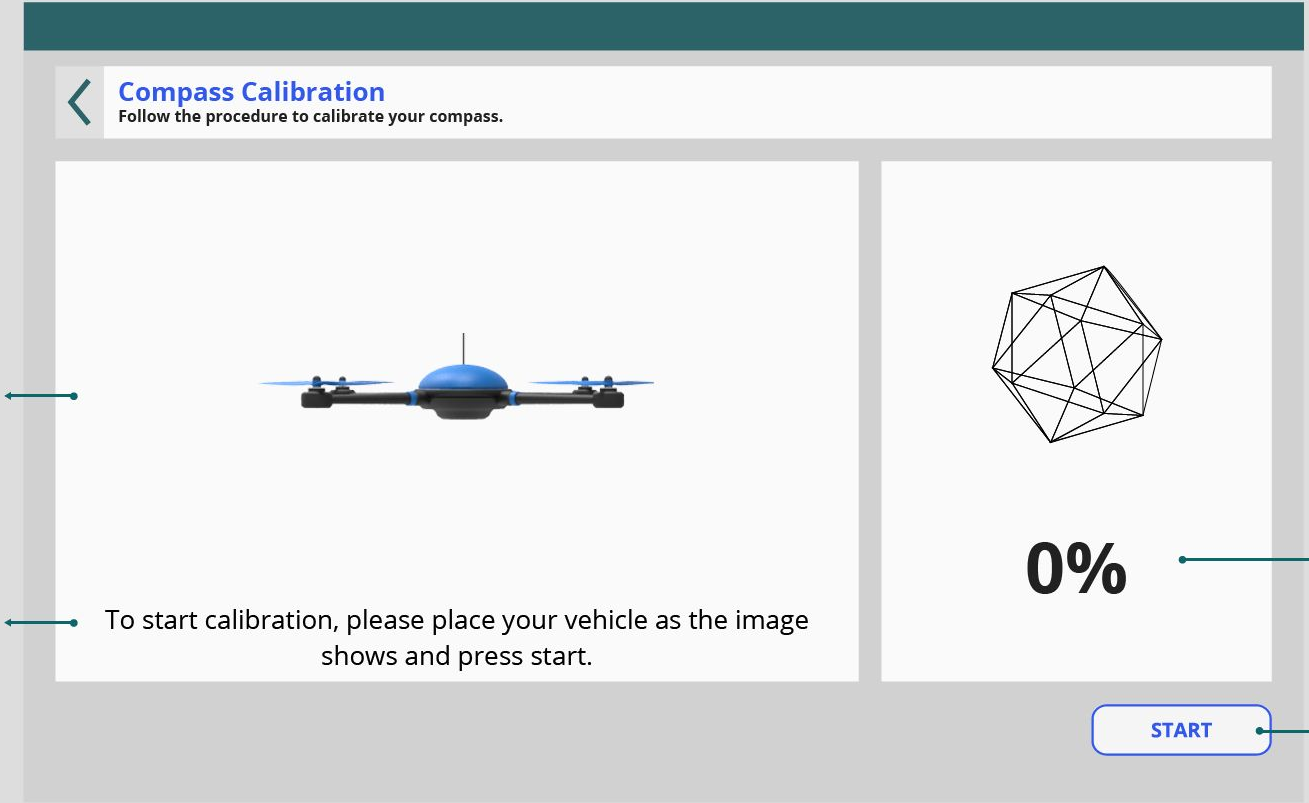
You can see the video **here**.

Grid



Note: the values and the geodesic grid in this image are just representations.

Specifications



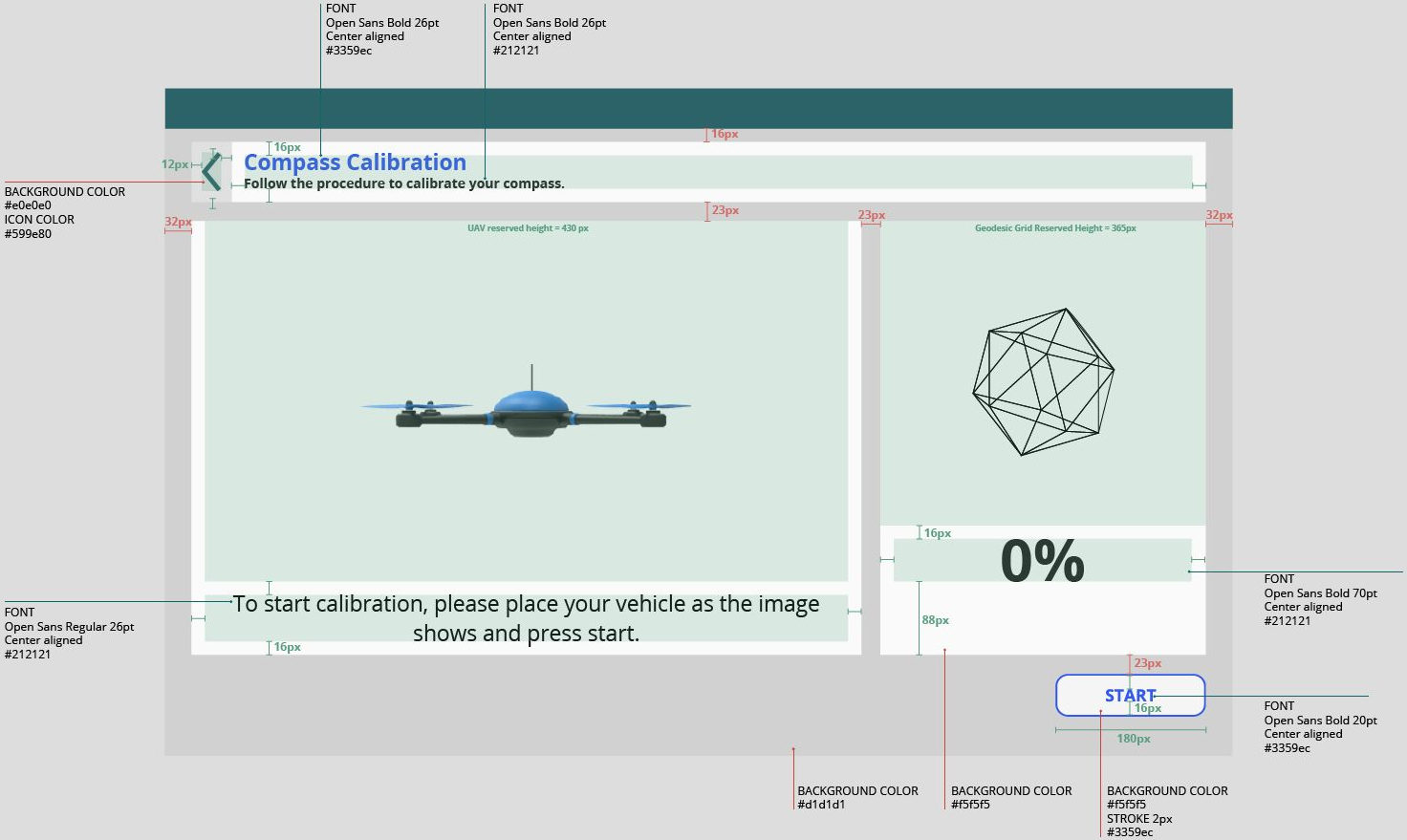
The UAV animation is the most important thing in the interface.

Instructions orientate and reassure users.

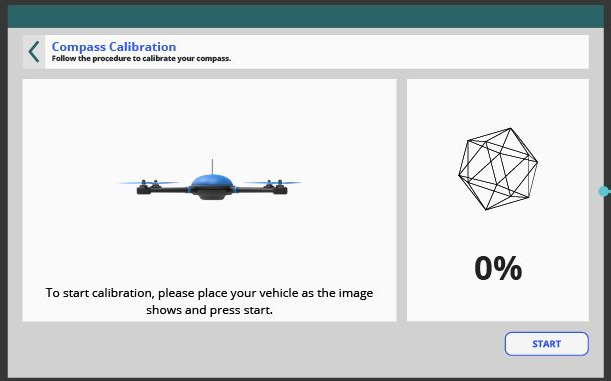
Percentage shows below the geodesic grid.

Buttons stay in the bottom. Start button must be high-lighted.

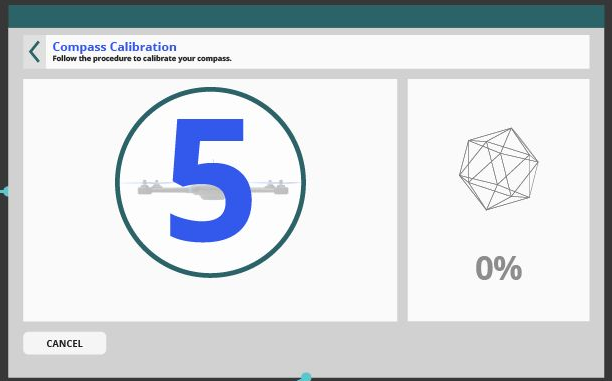
Specifications



Set Up

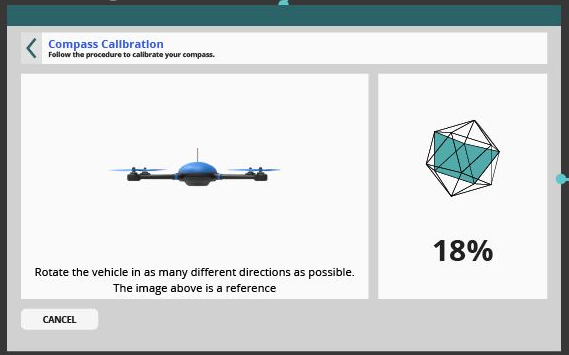


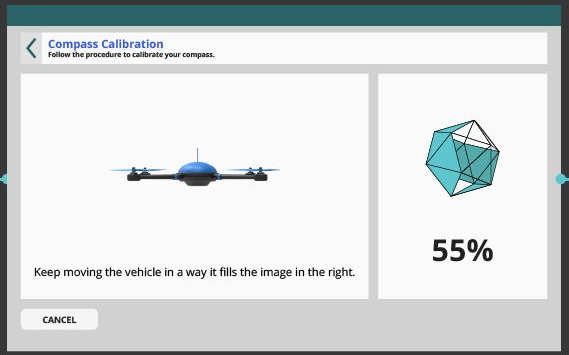
Counter

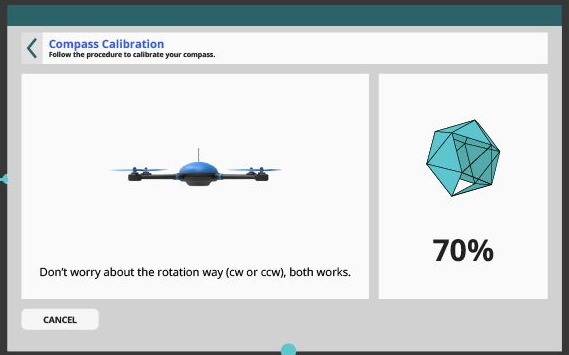


This is the full proposed flow and UI. For bigger image, go here.

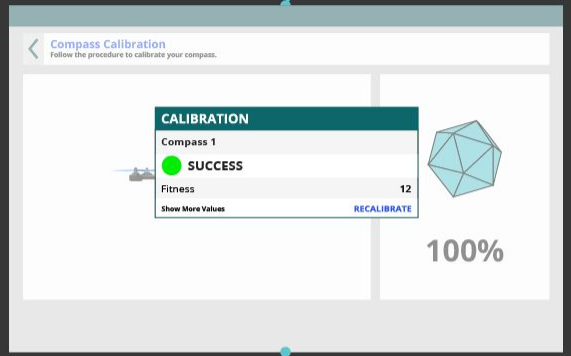
Messages

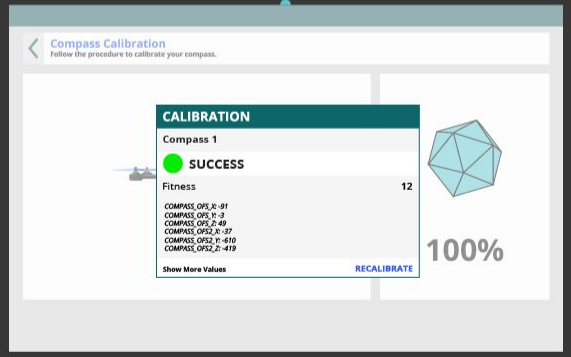




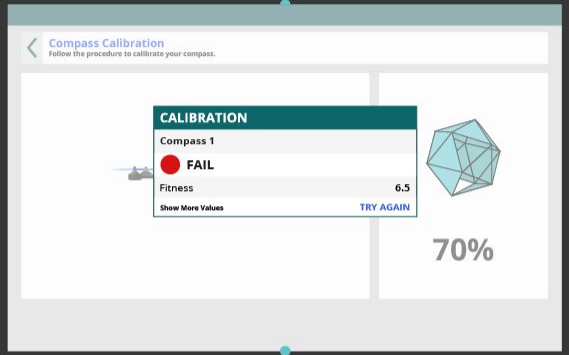


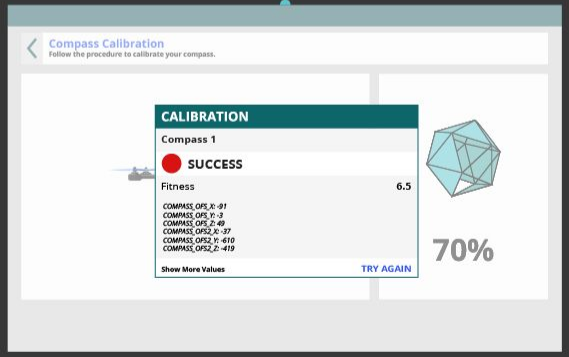
Success



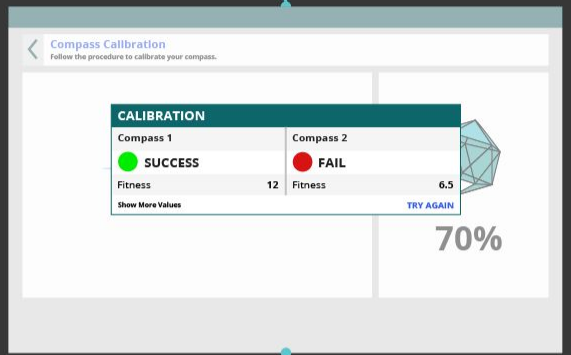


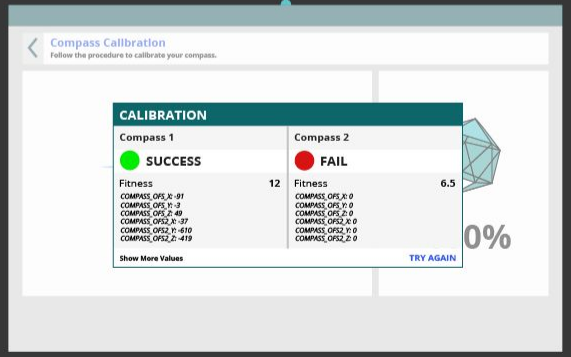
Fail





Two compasses





The changes in flow and UI make the process **clearer from start to finish**. The user can be more secure on starting the process and moving to the next steps. The instructions (written or animated) **guide users through the process**, while also giving more experienced user freedom to do the calibration in the way it is most beneficial to them.

We **improved the feedback**. The geodesic grid in itself is an improvement, as it shows, is a graphic way, the progress of the calibration. The “success” and “fail” **messages give a clearer feedback** to the user than a “completed” message, and also **let the user look at values and decide if they are satisfied** or if they want a recalibration.

These changes improve the user experience of the compass calibration, as they **reassure the user on what they are doing**, even when they have no experience with GCSs.

Thank you

Barbara Prestes
Beatriz Palmeiro
Carlos Felipe
Ronaldo Silva