Sensor under test	Garmin LIDAR Lite v4	Progression
Operator	Vincent Savioz	75.00%

Test ID	S000	
Test Description	Wire the sensor, power it on and take distance measurements in a room without sunlight.	
Test Prescription	Wire the sensor to the controller (uC, PC, Arduino, etc.) and write a small program that can take distance measurements. The sensor needs to be in a room without any trace of infrared light (i.e. sunlight). Output the measures on a prompt if possible. In order to compare sensors, measures need to be logged.	
Expected Result	The sensor take distance measures up to its theorical limit without any problem and show them on the prompt.	
Results	*After a quick test on Arduino, a programm was developped on a STM32F746G-DISCO board in order to use a more powerful processor. The sensor outputs distance measurments without any problem.*	
Conclusion	*The sensor is working properly according to this test.*	Success

Test ID	S001	
Test Description	Characterize the distance measurement error of the sensor.	
Test Prescription	Fix the sensor on a surface and place an object in front of it at a known distance. Then, note the output distance versus the real distance and characterize its measurement error (proportional, linear, etc.). Create a way of calibrating it if necessary.	
Expected Result	After calibration or compensation, the sensor should measure the right distance according to its accuracy	
Results	*The error characteristic was done on a scale from 20cm to 600cm. Turned out the sensor can't properly measure anything after 300cm. Between 0cm and 300cm, we can expect an error between 1cm and 5cm. We now need to know if this error is constant in temperature and between different sets or not.*	
Conclusion	*Further measurement showed that the sensor has a typical error of +-2cm.*	Success

Test ID	S002	
Test Description	Optimize measurement results by eliminating value that are too far from the standard deviation.	
Test Prescription	Make a program that compute mean and standard deviation from a running or static set of measures. It then deletes extreme values and recompute mean value. It should increase sensor accuracy.	
Expected Result	The sensor shouldn't be sensitive to small perturbation in front of it.	
Results	*The "Maximum" method is used to measure a distance to the ground.*	
Conclusion	*The system is mostly insensible to noise.*	Success

Test ID	S003	
Test Description	Measure the sensor robustness in the lab sandbox using artificial snow (confettis).	
Test Prescription	Fix the sensor on the tripod and make sure it won't move (meaure repeatability). Then, note the sensor angle and floor from the plane and give them to the program in order to calibrate measurements.	
Expected Result	The sensor should be able to measure an offset at least 10mm high on the ground, even with perturbations.	
Results	*Tests showed that the sensor has a more or less +- 2cm error from the real distance. Apart from that, the sensor measures a right offset measurement, as long as the material on which the measure is taken is not too porous.*	
Conclusion	*The sensor measures an offset.*	Success

Test ID	S004
Test Description	Measure the sensor capability to output a right offset measurement in various temperatures and environnements.
Test Prescription	Take measurements at various temperatures and humidity values, i.e. room temperature, oudoor near-zero temperature, etc. but always without direct sunlight (in a low infrared environment), if possible during the night.
Expected Result	Sensor measurements shouldn't be affected by temperature too much.

Results	*The test was done in a temperature-controlled environment with temperature from -15°C to 40°C. Results showed that the sensor is almost not disturbed by the temperature and stay in its +-2cm error from the real distance.*	
Conclusion	*The sensor pass the test and can be reliably used at various temperatures.*	Success

Test ID	S005
Test Description	Measure the sensor capability to output a right offset measurement in an overcast outdoor situation (medium infrared environment).
Test Prescription	Take measurements during an overcast day without any direct sunlight.
Expected Result	Sensor measurements shouldn't be too much affected by a medium infrared environment.
Results	*The sensor can't measure any distance.*
Conclusion	*The sensor doesn't work in a medium infrared environment.*

Failed

Test ID	S006
Test Description	Measure the sensor capability to output a right offset measurement in an sunny outdoor situation (high to very high infrared environment).
Test Prescription	Take measurements during a sunny day in direct sunlight.
Expected Result	Sensor measurements shouldn't be too much affected by a high to very high infrared environment.
Results	*The sensor can't measure any distance.*
Conclusion	*The sensor doesn't work in a high infrared environment.*

Failed

Test ID	S007
Test Description	Finally, test the sensor in real snowy condition, at night if necessary.
Test Prescription	Take the sensor outside during a snowy weather, especially in poor visibility conditions in order to take measurements on real snow. Try to measure offsets and log data.
Expected Result	The sensor should be able to measure offset in real conditions.

Results	*Tests were conducted at night during a medium snowfall. Measures were taken during more than 1 hour every 30 seconds, with at everytime an offset measurement.*	
Conclusion	*It turned out that the LiDAR measures a right offset even when starting from 0cm*	Success