Test Plan

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DOCUMENT HISTORY

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0.1	2022-10-10	First draft.	All	GH
0.2	2022-11-04	Second draft.	All	GH, KK
1.0	2022-11-20	First version.	All	GH

1 INTRODUCTION

2 G3-IMPLEMENTATION

Test	Requirement	Description
1	4	Test if the existing module for orientation estimation works with G3.
2	5	Test if the existing module for localization estimation works with G3.
3	6	Test if the face mesh-module works with G3.
4	10	Test if it is possible to save calibration data from the forward-facing camera.
5	11	Test if it is possible to specify which forward-facing calibration data should be used.

3 SIMULATION ENVIRONMENT

3.1 Sound physics

Test	Requirement	Description
6	20-25	Test if sensor noise with the distributions given in requirement 20-25 can be implemented.
7	20-25	Test if sensor noise with the distributions given in requirement 20-25 can be added with the IMU and magnetometer data.
8	20-25	Test if sensor noise with the distributions given in requirement 20-25 can be added with the eye-tracking data
9	20-25	Test if it is possible to add the noises generated in Test 2 to an arbitrary sound source in the sim-env.

3.2 Implementation of new sensors

Test	Requirement	Description
10	26	Test if it is possible to generate accelerometer data in the sim-env.
11	26	Test if it is possible to generate gyroscope data in the sim-env.
12	27	Test if it is possible to generate magnetometer data in the sim-env.

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Test	Requirement	Description
13	26	Test if the bias for the accelerometer has been correctly calibrated by asserting that the IMU measures an acceleration of $9.8\,m/s^2$ when at rest.
14	26	Test if the bias for the gyroscope has been correctly calibrated by asserting that the IMU measures an angular velocity of $0.0\,m/s$ when at rest.

3.3 Simulation validation

Test	Requirement	Description
15	16	Test if it is possible to obtain ground truth data for target tracking modules from the sim-env.
16	17	Test if it is possible to obtain ground truth data for newly developed modules from the sim-env.
17	18	Test if it is possible to manually set the trajectory of the gaze vector in the sim-env.
18	19	Test if it is possible to simulate a scenario where there are 5 or more sources of background noise being generated at the same time.

3.4 Usability

Test	Requirement	Description
19	28	Test if the functionality of the GUI is the same when resizing the window.
20	29	Test if it is possible to terminate the simulation via the terminate button in the GUI.
21	30	Test if it is possible to implement the explanations mentioned in requirement 30.
22	31	Test if it is possible to launch the sim-env with fewer commands than 4.
23	32	Test if it is possible to launch the GUI with fewer commands than 4.
24	33	Test if it is possible to launch the sim-env with fewer commands than 1.
25	34	Test if it is possible to launch the GUI with fewer commands than 1.
26	35	Test if it is possible to implement flags to modify the behavior of the program when launching the sim-env.

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Test	Requirement	Description
27	35	Test if all flags in test 26 have the desired effect on the program.
28	36	Test if it is possible to implement pre-defined tests when launching the sim-env.
29	36	Test if it is possible to start the tests in test 28 with program flags.
30	37	Test if it is possible to make a script that installs all dependencies needed for the program.
31	37	Test if it is possible to make the script in test 30 run with only one command.

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4 EYE TRACKING

4.1 Saccade detection

Test	Requirement	Description
32	43, 48	Testing the ability to detect saccades. A test program is used to induce a point of view for the user. The point of view is set as a circle on the screen of a computer. The circle shifts position and the user is to follow the circle with the eyes. The circle will only induce 20 artificial saccades above an amplitude of 10° Successfull if at least 80% of the saccades are detected.
33	43, 48	Same as test 32 but the induced artificial saccades will have no restriction of amplitude. Successfull if 80% of the saccades with an amplitude above 10° are detected.

4.1.1 *Average saccade frequency*

Test	Requirement	Description
34	43	Similar to test 32 but the circle will shift position with a fixed frequency. Successfull if the estimated average saccade frequency matches the average of the fixed frequency of the circle with an accepted error of $\pm$ 0.2 [Hz].
35	43	Same as test 34 but the frequency of the circle is random. Successfull if the estimated average saccade frequency matches the average of the random frequency of the circle with a accepted error of $\pm$ 0.3 [Hz].
36	43, 44, 48	A person using the glasses is to listen and observe one person talking. Successfull if an average saccade frequency is calculated and the frequency is under 0.2 [Hz].
37	43, 44, 48	Same as test 36 but with two persons talking. Successfull if Successfull if an average saccade frequency is calculated and the frequency is above 0.2 [Hz].

4.2 Fixation detection

Test	Requirement	Description
38	46	Test eye fixation detection. Similar to test 32 but with a set amount of fixations. Count number of initiated fixations. Successfull if 90% of the fixations are correctly identified.
39	46	Test eye fixation saved location. Set up 7 points evenly distributed in the visual field of the user. The user is to fixate the eyes on each point from left to right. Succesfull if the fixations are displayed on the map in the correct order.

4.3 Smooth pursuit detection

Test	Requirement	Description
40	47	Test of smooth pursuit detection. Follow a moving object in 1 second by eye and see if the system will detect smooth pursuit. The object should have a distance of 5 meter to the users eye and have speed in range 1 km/h to 5 km/h. Successfull if smooth pursuit is detected within 1 second.

4.4 Listening detection using pupil dilation

Test	Requirement	Description
41	38	Test of the identification of the environment light level. Expose the camera to 3 widely different light intensities. Succesfull if the different light intensities matches the identification levels in order.
42	39, 40	Test of listening detection. The user is to focus and listen to a person talking. Succesfull if a pupil dilation is identified.

4.5 Real-time data

Test	Requirement	Description
43	41, 42	Test if the data from the eye tracking system is saved without data loss. Successfull if the data can be retrieved from a measurement.

5 TRACKING AND LOCALIZATION

5.1 Real-time optimization

Test	Requirement	Description
44	8, 42	Simulate the movement of three targets in the sim-env and estimate its path. Measure the time it takes to preform each update loop in the path estimation and calculate the average time. The test passes if the average time is less than 150 ms.
45	8	Video frame rate from real-time data with SLAM activated is to be measured. Passing test means > 23 fps with no affect on normal functionality.
46	8	If test 47 passed: Detected people exceeds 3 people.

5.2 Distance Perception

Test	Requirement	Description
47	9	The estimates from the new distance perception module will be compared with measurements from Visionen. Passing test means a MSE to the estimated distance from ground truth of 0.2 or lower within a range of 2 meters.
48	49	Eye tracking data is successfully integrated into EKF and SLAM. Passing test means higher or equal accuracy/confidence on prediction.
49	2, 3, 50, 51	Magnetometer data is successfully integrated into EKF and SLAM. Passing test means higher or equal accuracy/confidence on prediction.

5.3 New statistical tracking method

Test	Requirement	Description
50	8, 9, 16, 52	Simulate movement of three targets using the sim-env according to predetermined paths. Use the data gained to estimate the paths using the existing methods and calculate the estimations accuracy against the ground truth. The test passes if the accuracy is 90% or higher.

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Test	Requirement	Description
51	8, 9, 16, 52	Preform the test in test 50 with the new statistical method. Compare the results of the two tests. The test passes if the accuracy of the new method is equal to or higher than the old method.
52	8, 9, 16, 52	Record data of at least two speakers moving in Visionen using G3. Use the data gained to estimate the paths using the existing methods and calculate the estimations accuracy against the Qualisys measurement. The test passes if the accuracy is 90% or higher.
53	8, 9, 16, 52	Preform the test in test 52 with the new statistical method. Compare the results of the two tests. The test passes if the accuracy of the new method is equal to or higher than the old method.
54	8, 49, 52	Preform the test in test 44 with the new statistical method. Compare the results. The test passes if the average time of the new method is lower than the old method.

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