<THE LCIMU SYSTEM>

TEST PLAN

Version *<1.0>*

<11/05/2017>

VERSION HISTORY

This test documentation was carried out throughout the course of the development of the whole system. It was summarily reviewed and as new deliverables were added on to the system this test documentation was updated.

Version #	Implemented By	Revision Date	Approved By	Approval Date	Reason
1.0	*Andrew.T.Omagba*	*<05/17>*			Initial Release: Prototype Test Plan

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1.0 INTRODUCTION

This section would highlight the purpose of the LCIMU test plan and give a brief insight into what this document is about.

1.1 PURPOSE OF THE LCIMU TEST PLAN DOCUMENT

The LCIMU Test Plan document, outlines the test strategies required to effectively define the approach to be used in the testing of the LCIMU system (Hardware and Software). The LCIMU Test Plan document was created during the Planning Phase of the project. Its intended audience is the project supervisor, course coordinator and all end-line users.

1.2 SCOPE

The LCIMU Test Plan describes the system/integration tests that will be carried out on the LCIMU system. The test will be made following the gradual integration of the LCIMU subsystems and components identified in the LCIMU design documentation. The testing method mainly utilized is the *white-box testing method*. Some test types are not applicable to this system now and will not be addressed. They are; Stress testing, User-acceptance testing, regression testing, volume testing and security testing. The test will be carried out in accordance with the IEEE software testing regulations (Murnane 2013)

2.0 COMPATIBILITY TESTING

The compatibility testing will be used to assess the integration of the LCIMU system (hardware and software) and the local computer.

2.1 TEST RISKS / ISSUES

The risks associated with testing the LCIMU system's compatibility with the computer are highlighted below:

- The potential for data corruption from viruses associated with libraries downloaded from the internet.
- The potential for the LCIMU system to malfunction when integrating the system's hardware and software components.
- Improperly assembling a group of components with mismatched communication protocols.
- Connecting two or more components together directly with different operational voltages.
- Running the system's software application from a computer with a low processing speed.

The strategies for mitigating the risks highlighted are:

- The computer to be used will be outfitted with a state of the art antivirus that would scan all libraries to be downloaded from the web.
- The specification of all components to be used for developing the LCIMU system will be checked, counter checked before being properly integrated into the system.

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- Only components with the same operational voltages will be connected. If any two components with varying operational voltages must be connected a suitable interface such as a logic level converter will be used to alleviate the risk of damage.
- The computer to be used to host the software application and support the LCIMU system will have to be high functioning in other to meet the requirements of the project.
- The system will be integrated incrementally to study and eliminate any defects or issues that might arise earlier on in the project before the project is fully integrated.

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2.2 ITEMS TO BE TESTED / NOT TESTED

Item to Test	Test Description	Test Date
System's Antivirus	System's response to a locally generated virus.	01/03/17
System's Components (MPU6050 and Arduino sensors)	The operational voltages of the component to be used will be checked.	01/03/17
System's Components (MPU6050 and Arduino sensors)	The interaction between the components will be assessed in stages.	05/03/17

2.3 TEST APPROACH

A proactive methodical-model based approach will be used in carrying out the test.

2.4 TEST REGULATORY / MANDATE CRITERIA

The compatibility tests will be in accordance with the ISO/IEC/IEEE 29119 standard for component testing.

2.5 TEST PASS / FAIL CRITERIA

The test pass/fail criteria will vary depending on the items to be tested as highlighted below:

- For the system's antivirus, the standard EICAR virus test would be carried out. The unharmful EICAR code text "X5O!P%@AP[4\PZX54(P^)7CC)7}$EICAR-STANDARD-ANTIVIRUS-TEST-FILE!$H+H* " will be saved on a file on the system and the response would determine if the system's antivirus passes or fails.
- For the components' operational voltages, the probes of a multimeter will be connected across the positive/ground pins to determine their operational voltages. If the voltages fall within an acceptable range, they pass otherwise they fail.
- For the interactions between the components, after a connection has been made between a pair of components, a successful connection (were data is exchanged) is a pass, otherwise if the connection wasn't successful it's a fail.

2.6 TEST ENTRY / EXIT CRITERIA

The entry and exit test criteria for the items to be tested are:

- For the system's antivirus, as soon as the EICAR file is saved, the test begins and when the antivirus responds or does nothing the test ends.
- For the components operational voltages, as soon as the probes from the multimeter are connected, the test begins and it ends when the probes are disconnected.
- For the component interactions, the test entry criteria will be when the components are connected and the code sketch is running. The exit criteria will be when the code sketch being ran (to ascertain successful connectivity) is terminated.

2.7 TEST DELIVERABLES

After the tests the deliverables will be mainly the results that will be listed in Appendix A.

2.8 TEST SUSPENSION / RESUMPTION CRITERIA

There were none for this test.

2.9 TEST ENVIRONMENTAL

The EICAR antivirus test file and a multimeter were among the requirements needed for this test environment.

3.0 FUNCTIONAL TESTING

Function testing is geared towards tests of the functional use cases of the LCIMU system software and hardware. The aim of this of this test is to verify proper data transfer, acceptance, retrieval and appropriate display. This type of testing is carried out, and the output analyzed, via the GUI for the software application. Whereas, it is carried out via the Arduino IDE and Intelli J for the hardware IDE.

3.1 TEST RISKS / ISSUES

Besides the risk of the system malfunctioning due to problems in the programming, there are no extraneous risks associated with functional testing the LCIMU system.

3.2 ITEMS TO BE TESTED / NOT TESTED

Item to Test	Test Description	Test Date
User registers	To validate user registration with input parameters	16/04/17
User signs in	To validate user sign in with registered input parameters	16/04/17
User starts the application	To validate if the application can be started by the signed in user	16/04/17
User captures data	To check if the user can capture data after starting the application	16/04/17
User displays data	To check if the user can display data	16/04/17
User stops the application	To check if the user can stop the application after data is displayed.	16/04/17
User logs out	To check if the user can log out	16/04/17
Upload code to the MPU6050	Check if the code is successfully uploaded	03/03/17
Display data returned from the MPU6050 on the Arduino IDE	Print out data to see if its consistent with the data types stipulated by the manufacturer.	03/03/17
Data can be packaged in a buffer	Print out data to see if its wrapped in a buffer	03/03/17
Call response sent	Print out a message to see if call is sent	03/03/17
Call response received	Print out a message to see if received	03/03/17
Called data sent	Print out a message to see if data is sent	03/03/17
Called data received	Print out a message to see if received	03/03/17
Wrap data from all serials in a buffer and send	Print out the data to see if wrapped in buffer.	03/03/17

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3.3 TEST APPROACH(S)

A reactive methodical-model based approach will be used in carrying out the test.

3.4 TEST REGULATORY / MANDATE CRITERIA

The functional tests will be in accordance with the ISO/IEC/IEEE 29119 standard for test processes.

3.5 TEST PASS / FAIL CRITERIA

The test items will pass if they successfully accomplish the goal as stipulated in the test description and will fail if they do not.

3.6 TEST ENTRY / EXIT CRITERIA

The test entry/exit criteria are:

- When all the planned tests have been executed.
- When all the identified issues have been addressed.

3.7 TEST DELIVERABLES

This test will result in a list of results listed in Appendix A.

3.8 TEST SUSPENSION / RESUMPTION CRITERIA

When the test is to be suspended the LCIMU system will be disconnected from the computer and when the test begins, the LCIMU system will be reconnected.

3.9 TEST ENVIRONMENTAL

The test environment will be on the local system or computer.

4.0 LOAD TESTING

Load testing will involve subjecting the LCIMU system to a specific workload criterion to evaluate its ability to continue to function properly.

4.1 TEST RISKS / ISSUES

There are no notable risks associated with load testing the LCIMU system.

4.2 ITEMS TO BE TESTED / NOT TESTED

Item to Test	Test Description	Test Date
No. of users that can utilize the system at any given time	To validate the number of users that can use the system at any given time.	30/04/17

4.3 TEST APPROACH

A reactive dynamic approach will be used to carry out this test.

4.4 TEST REGULATORY / MANDATE CRITERIA

The load tests will be in accordance with the ISO/IEC/IEEE 29119 standard for test processes.

4.5 TEST PASS / FAIL CRITERIA

The test items will pass if they successfully accomplish the goal as stipulated in the test description and will fail if they do not.

4.6 TEST ENTRY / EXIT CRITERIA

The test entry/exit criteria are:

- When all the planned tests have been executed.
- When all the identified issues have been addressed

4.7 TEST DELIVERABLES

This test will result in a result listed in Appendix A.

4.8 TEST SUSPENSION / RESUMPTION CRITERIA

There are none.

4.9 TEST ENVIRONMENTAL

This test will be carried out on the local system.

5.0 PERFORMANCE TESTING

Performance testing will involve subjecting the LCIMU system to varying activity profiles and evaluating its ability to continue to function properly under these different activity profiles.

5.1 TEST RISKS / ISSUES

The risks associated with performance testing the LCIMU system will be overheating of the internal sub-components. This risk was mitigated by enclosing the sub-components in a spacious pack with punctured holes allowing for dual air flow.

5.2 ITEMS TO BE TESTED / NOT TESTED

Item to Test	Test Description	Test Date
Sampling rate of the LCIMU system	To check the sampling rate of the LCIMU system	30/04/17
Length of Operation of the system within 24hours	To check how long the system can stay operational before shutting down in a 24hour time frame	30/04/17
Detection of high frequency activities	To check if the system can detect high frequency activities	30/04/17
Detection of low frequency activities	To check if the system can detect low frequency activities	30/04/17

5.3 TEST APPROACH

A reactive dynamic approach will be used to carry out this test.

5.4 TEST REGULATORY / MANDATE CRITERIA

The load tests will be in accordance with the ISO/IEC/IEEE 29119 standard for test processes.

5.5 TEST PASS / FAIL CRITERIA

The test items will pass if they successfully accomplish the goal as stipulated in the test description and will fail if they do not.

5.6 TEST ENTRY / EXIT CRITERIA

The test entry/exit criteria are:

- When all the planned tests have been executed.
- When all the identified issues have been addressed

5.7 TEST DELIVERABLES

This test will result in a list of results listed in Appendix A.

5.8 TEST SUSPENSION / RESUMPTION CRITERIA

The test will be suspended during preparation for individual high/low frequency activities and will resume when preparation is completed.

5.9 TEST ENVIRONMENTAL

This test will be carried out in a controlled environment such as the UNE laboratory.

6.0 UNIT TESTING

Unit testing will involve carrying out automated Junit tests on the classes and respective methods contained in the source code of the LCIMU application.

6.1 TEST RISKS / ISSUES

There are none associated with this test.

6.2 ITEMS TO BE TESTED / NOT TESTED

Item to Test	Test Description	Test Date
All classes on the LCIMU application source code	A Junit test will be carried out on the classes	30/04/17
Individual class methods on the LCIMU application source code	A Junit test will be carried out on the class methods	

6.3 TEST APPROACH

A proactive methodical approach will be used to carry out this test.

6.4 TEST REGULATORY / MANDATE CRITERIA

The unit tests will be in accordance with the ISO/IEC/IEEE 29119 standard for test processes.

6.5 TEST PASS / FAIL CRITERIA

The test items will pass if they successfully accomplish the goal as stipulated in the test description and will fail if they do not.

6.6 TEST ENTRY / EXIT CRITERIA

The test entry/exit criteria are:

- When all the planned tests have been executed.
- When all the identified issues have been addressed

6.7 TEST DELIVERABLES

This test will result in a list of results listed in Appendix A.

6.8 TEST SUSPENSION / RESUMPTION CRITERIA

There are none.

6.9 TEST ENVIRONMENTAL

This test will be carried out on the local system.

7.0 SYSTEM TESTING

System testing will involve testing the integrated LCIMU system hardware and software to assess its overall end -line functionality.

7.1 TEST RISKS / ISSUES

The risks associated with this test are cumulative and will be addressed as the different types of test preceding this are done.

7.2 ITEMS TO BE TESTED / NOT TESTED

Item to Test	Test Description	Test Date
The whole system	The whole system will be tested to assess its output.	10/05/17

7.3 TEST APPROACH

A reactive holistic approach will be used to carry out this test.

7.4 TEST REGULATORY / MANDATE CRITERIA

The unit tests will be in accordance with the ISO/IEC/IEEE 29119 standard for test processes.

7.5 TEST PASS / FAIL CRITERIA

The system will pass the test if it functions correctly and will fail if it does not

7.6 TEST ENTRY / EXIT CRITERIA

The test entry/exit criteria are:

- When all the planned test has been executed.
- When all the identified issues have been addressed

7.7 TEST DELIVERABLES

This test result will be listed in Appendix A.

7.8 TEST SUSPENSION / RESUMPTION CRITERIA

There are none.

7.9 TEST ENVIRONMENTAL

This test will be carried out on the local system and at the UNE laboratory.

TEST PLAN APPROVAL

The undersigned acknowledge they have reviewed the *LCIMU* **Test Plan** document and agree with the approach it presents. Any changes to this Requirements Definition will be coordinated with and approved by the undersigned or their designated representatives.

Signature: _____ Date: _____

Print Name: _____

Title: _____

Role: _____

Signature: _____ Date: _____

Print Name: _____

Title: _____

Role: _____

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APPENDIX A: TEST RESULTS

Items to Test	Result
System's Antivirus	Pass
System's Components (MPU6050 and Arduino sensors)	Pass
System's Components (MPU6050 and Arduino sensors)	Pass
User registers	Pass
User signs in	Pass
User starts the application	Pass
User captures data	Pass
User displays data	Pass
User stops the application	Pass
User logs out	Pass
Upload code to the MPU6050	Pass
Display data returned from the MPU6050 on the Arduino IDE	Pass
Data can be packaged in a buffer	Pass
Call response sent	Pass

Call response received	Pass
Called data sent	Pass
Called data received	Pass
Wrap data from all serials in a buffer and send	Pass
No. of users that can utilize the system at any given time	Pass
Sampling rate of the LCIMU system	Pass
Length of Operation of the system within 24hours	Pass
Detection of high frequency activities	Pass
Detection of low frequency activities	Pass
All classes on the LCIMU application source code	Pass
Individual class methods on the LCIMU application source code	Pass
The whole system	Pass

APPENDIX B: KEY TERMS

The following table provides definitions for terms relevant to this document.

Term	Definition
LCIMU	Low Cost Inertial Motion Unit
IEEE	International Electrical Electronics Engineering
ISO	International Standard Organization

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APPENDIX C: REFERENCES

Murnane, T. (2013). "ISO/IEC/IEEE 29119 Software Testing:The International Software Testing Standard." from http://www.softwaretestingstandard.org/.

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