



**BITS Pilani**  
Pilani Campus

## Firmware verification for Automotive Wireless Battery Monitoring Systems

Author: Sai Kartik (2020A3PS0435P)

Manager: Mr. Abhinandan Subbarao

Professor: Dr. Sathisha Shet K

PS Station: Analog Devices, India

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## **Aim**

This project aims to verify the firmware of battery monitor sensors for a car's wireless battery monitoring system (wBMS).

## **Problem statement**

Use automation concepts to test the software and deliver it to customers quickly and efficiently without bugs.

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- To automate the running of the test suite and generation of test report

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- Configure the front-end application (GUI) to control the network and test the functionality.
- Ensure the setup is RF-shielded fairly well

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- The major outcome of this phase is the finalised test plan/strategy which has to be adhered to.

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- This data is organised to fit various test cases to ensure coverage of all possible scenarios.
- Once the design of individual test cases is complete, each test case is linked in a chain in the Responsibility Traceability Matrix. [8]

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- Every failed test case should ideally be linked to at least one problem. This linking can help identify issues with the software [7]
- If a test case is blocked by a design flaw, they can be marked as such
- A report consisting of all failed and blocked test cases can then be prepared and provided to the development team for them to take further action.

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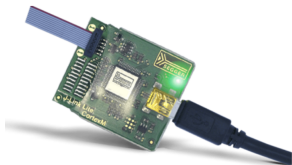
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- As a major objective of this project, the frameworks are designed to be easily automated.
- To allow everyone to access the test cases and modify them as necessary, open source software alternatives like pytest and python have been considered. [5, 6]

As discussed earlier, the gateways and nodes of the network are flashed with the software provided by the development team.

The development boards housing the necessary components are equipped with the required hardware pins to allow quick flashing through internal applications developed by ADI.



J-link Lite debugger

Once the relevant firmware has been flashed onto the respective devices, the nodes are made to join the network created by the gateways

Once the hardware is completely setup and the network is formed, the configuration for the devices in the network are uploaded to them through a GUI tool. This will ensure the reliance of the messages transmitted in the network.

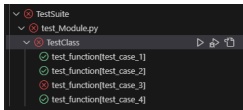
In order to allow automation, this tool can be designed to expose certain API endpoints which can be used by python scripts to communicate and carry tasks at a much faster pace compared to manual interaction with the GUI tool.

# Software setup: Pytest framework

## I

To fast-track the process further in terms of validation and testing, we can use the pytest library along with certain packages that allow communication with the wireless network.

Since this is a very popular framework, there are a lot of tools engineered to make our lives easy. This framework integrates easily with development applications such as VSCode and provides a clean user interface to the tests.



# Software setup: Pytest framework

## II



The user can decide to run specific tests to test various functionalities of the system as and when needed.

If we want to automate a larger batch of tests, we can use the command line options that pytest provides. This tool combined with a CI-CD tool like Jenkins to set triggers for various times to test [3]



We have seen how with the use of certain freely available tools along with standard industry practices, we were able to interface with a complicated wireless battery monitoring system and verify that the software complies with industry standards

- [1] URL: [https://www.segger.com/products/debug-probes/j-link-lite/overview/..](https://www.segger.com/products/debug-probes/j-link-lite/overview/)
- [2] URL: <https://jusst.org/wp-content/uploads/2021/06/Validation-of-Wireless-Battery-Management-System-wBMS-Gen2.pdf>.
- [3] Automation of testing: (CI/CD Pipeline). URL: <https://www.jenkins.io/>.
- [4] Minkyu Lee et al. “Wireless battery management system”. In: 2013 World Electric Vehicle Symposium and Exhibition (EVS27). 2013, pp. 1–5. DOI: 10.1109/EVS.2013.6914889.
- [5] Python docs. URL: <https://docs.python.org/3.9/>.

## II

- [6] Python test scripts. URL:  
<https://docs.pytest.org/en/7.1.x/contents.html>.
- [7] Yang Shuaishuai  
et al. “An automatic testing framework for embedded software”. In:  
[2017 12th International Conference on Computer Science and Education](#)  
2017, pp. 269–274. DOI: [10.1109/ICCSE.2017.8085501](#).
- [8] Wei Xie et al. “Vulnerability Detection in IoT Firmware: A  
Survey”. In:  
[2017 IEEE 23rd International Conference on Parallel and Distributed](#)  
2017, pp. 769–772. DOI: [10.1109/ICPADS.2017.00104](#).

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<sup>1</sup>Other documents regarding specific hardware/software architecture are for internal use only and cannot be shared as open sources/references

<sup>2</sup>Other documents regarding specific hardware/software architecture are for internal use only and cannot be shared as open sources/references