Framework for software development of laboratory equipment and setups integrated into large scale DAQ systems (LabBot)

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Alexandr Chernakov[a, b], Nikita Zhiltsov[a], Vasiliy Senitchenkov[a], Nikita Babinov[a], Alexander Bazhenov[a], Ivan Bukreev[a], Paul Chernakov[b], Anton Chernakov[a,b], Artem Dmitriev[a], Denis Elets[a,b], Igor Khodunov[a,c], Alexander Koval[a], Gleb Kurskiev[a], Andrei Litvinov[a], Alexander Mokeev[d], Eugene Mukhin[a], Alexey Razdobarin[a], Dmitry Samsonov[a], Valeri Solovei[a], Ivan Tereschenko[a], Sergei Tolstyakov[a], Lidia Varshavchik[a], Paul Zatylkin[a],

[a] Ioffe Institute, 194021, St.Petersburg, Russia

[b] Spectral-Tech, AO, 194021, St. Petersburg, Russia

[c] Department of Plasma Physics, Peter The Great St. Petersburg Polytechnic University, St. Petersburg 195251, Russia

[d] Institution 'Project Center ITER' RF DA, Moscow, Russia

e-mail: alexandr.chernakov@gmail.com

ABSTRACT

The LabBot Framework project is intended to implement control of experiment and data acquisition without writing special platform codes, while achieving industrial-grade results.

- Set of industry-tested languages and approaches
- Small and medium-scale experimental setups
- Laboratory equipment
- Open source, GPLv2 licensed

BACKGROUND

- Intended for small and medium-sized research groups
- Large-scale experiment control systems, like EPICS
- Industrial SCADA systems, much relying on rock-solid durability of PLCs
- Tools like LabView, highly regarded in test-and-measurement industry, good support with NI ecosystem

IMPLEMENTATION

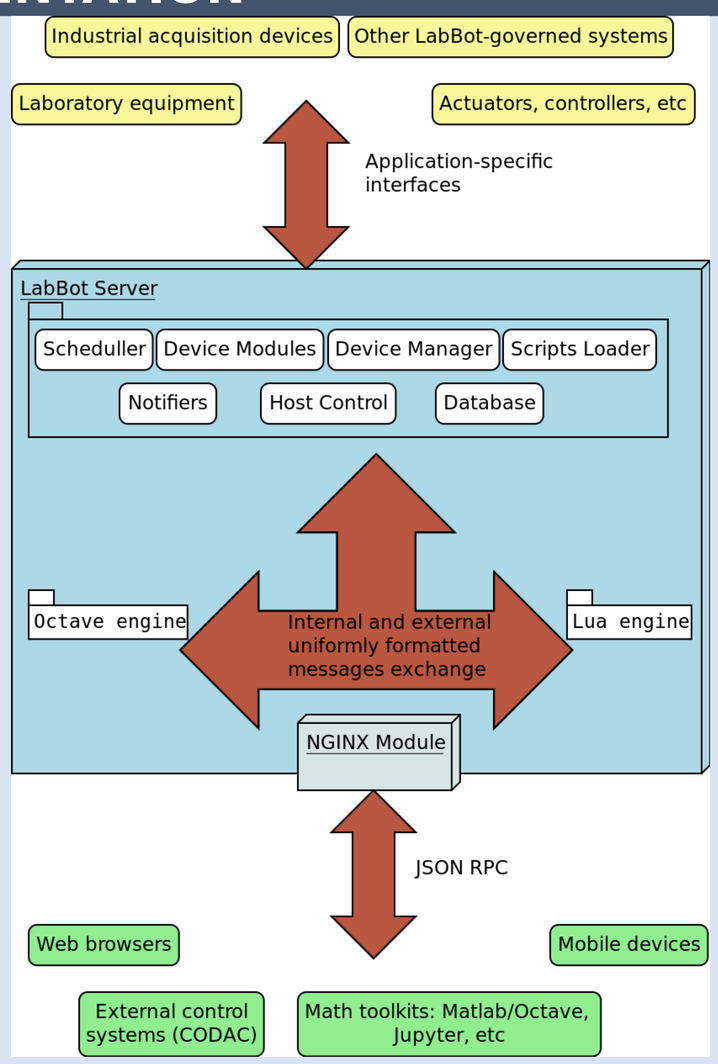

Fig. 1: LabBot framework overview

Modular System

- Module represent every entity inside automation system – equipment, database, etc
- Flexible yet unified request and response format
- Homogeneous format for data storage and transmission
- Modules can be loaded and unloaded during runtime

Math & logic modules

- Lua scripts for logic
- Lua API for accessing database, device manager, etc.
- Octave for mathematical processing of collected data

Remote access & API

- Remote (Web) participation support out-of-the-box
- Remote API available automatically - same as local inter-module communication via JSON RPC
- Available in almost any platform or language
- Each module is accessible via remote API

OUTCOME

Framework is being developed and used inside of our research group for 4 years. During that time we implemented several highly-automated experimental stands and pieces of equipment which were successfully used in research activity and served as base for publications[1, 2, 3]

Key results

- Software for equipment and setups of industrial quality
- Distributed by design
- Experimental stands serve as data sources for future analysis
- Equipment easily integrates in control system of any scale and complexity

Fig. 2: Integration of digital polychromators In DTS diagnostic in EPICS

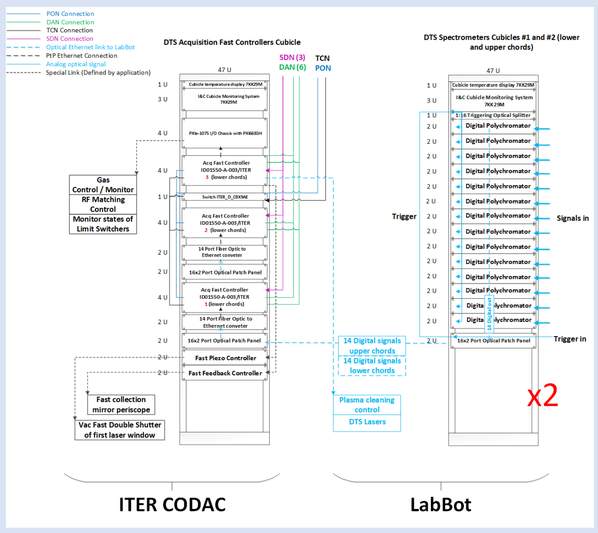

Fig. 3: Digital Thomson scattering polychromator, featuring 8-channel 5GHz ADC

Fig. 4: Experimental setup for research on sputtering and deposition processes in plasma (RF-stand)

Fig. 5: Components breakdown for RF-stand

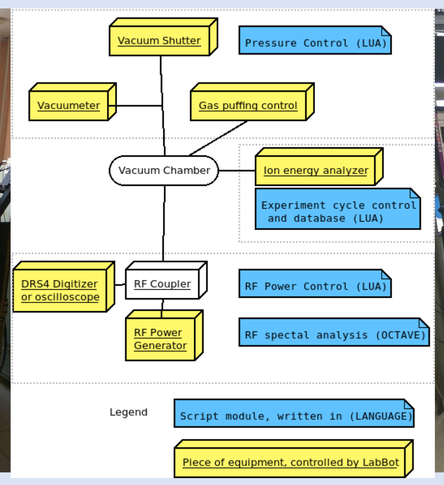

Fig. 6: Thermo-vacuum test Bench for research on RF-cables and in-vessel components

OUTLOOK

Further development of LabBot is aimed for adaptation to requirements of external users. In addition to the development of documentation and device modules, the development of the software package itself will be continued. The nearest challenges are: RAD tooling, adding support of new platforms, repository tools, etc.

We are eager to support other research groups willing to try using it in their activity

ACKNOWLEDGEMENTS / REFERENCES

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