



European Factory  
Platform

# SmartMetal

## EFPP-Open-Call-Experimenters

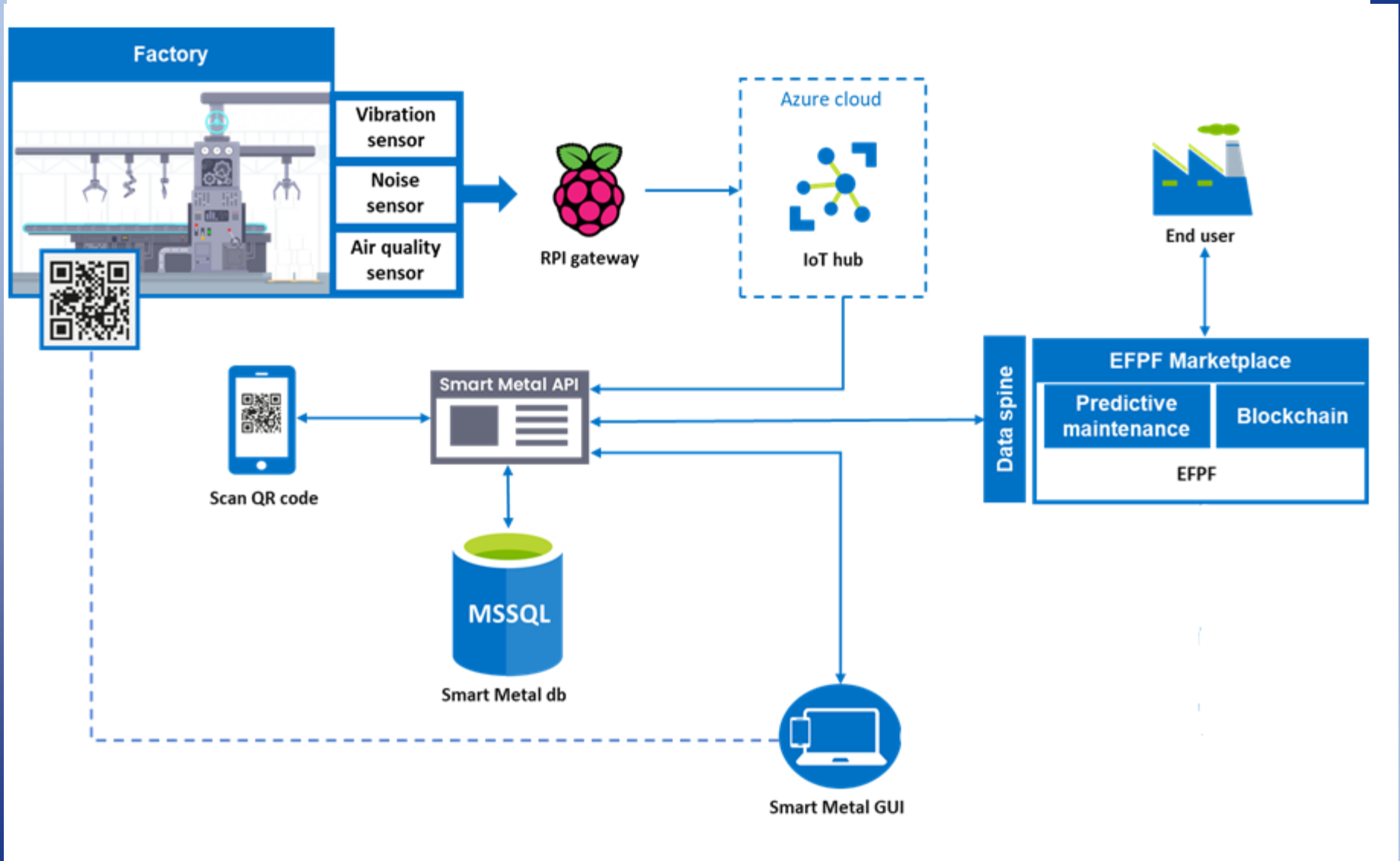
### 2022-09-27, Vienna, Austria

Dr Dejan Drajić, DNET Labs

# Project idea/concept

- Extend EFPF platform federation with the **Product passport service**.
- Provide new service for monitoring of workflow and business processes in factories using sensors and digital identity of the machines.
- The solution combines DNET's Product passport solution with the EFPF:
  - **Predictive maintenance** (Deep Learning Toolkit)
  - **Blockchain functionalities**to provide insights into business processes and to ensure their immutability for transparency purposes.
- The implemented solution is co-designed with the Digital Innovation team of Metalac and validated in their kitchenware factory.

# Technical Achievements and Outcomes





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- Measurement data from the **vibration sensors** are collected by the gateway node (based on Raspberry Pi).
- After the initial processing and formatting, data is transferred via Metalac's WiFi network to cloud.
- Measurements from the **noise** and **air quality** sensors are transferred directly to cloud via the same WiFi network.
- Existing **SCADA** system in the factory Metalac collects data about energy consumption.
- IoT application is developed in node red which collects data and transfer to EFPP predictive maintenance.

# Technical Achievements and Outcomes

- The received data is stored in the Smart Metal's database.
- Azure scheduler periodically collects measurements from (30 minutes), and publishes JSON messages to the Data Spine Message Bus.
- The **Smart Metal mobile application** is used for visualization of the measurements.
- QR codes used to identify machines on the factory floor are generated by DNET's Product Passport solution.
- Each QR code contains a unique identity of the machines in the format of GS-1 DigitalLink.

# Technical Achievements and Outcomes

- The EFPF Data Spine is used to enable data flow integration over the EFPF platform.
- The collected measurements are sent to the EFPF Data Spine message bus, where they can be accessed by subscribing to appropriate topics.

# Technical Achievements and Outcomes

- The EFPF predictive maintenance, i.e. **Deep Learning Toolkit** is fed with the data coming from:
  - the vibration,
  - PM sensor,
  - noise sensors,
  - as well as SCADA system

as input to the algorithm detecting if the measurement values are out of the predefined (expected) ranges, when alarms should be created by the algorithm, and eventually, predicting the **malfunction** and **anomaly detection**.

- The **Blockchain module** is used to ensure data traceability by writing the results of the assessment of the working conditions and regimes into the ledger.



## Main integration activities:


- Creation of new Smart Metal Service, where Product Passport service is expanded with noise and air quality sensors and the related data from SCADA.
- Adaptation of interfaces, where Data Spine integration is done.
- Implementation single sign on for authorization and authentication using Keycloak.
- Publish sensor messages to Data Spine message bus (this data could be accessed by subscribing on the related topic).
- Registering solution on Data Spine (Service Registry).
- Configuring Predictive maintenance module.
- Configuring Blockchain module.
- Subscribe Predictive Maintenance module to Data Spine message bus, and store results in Blockchain module
- **Deployment of solution on EFPF marketplace.**

# Technical Achievements and Outcomes

Please keep in mind that this is the beta version of the marketplace. Payments and transactions are currently not supported.


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## Smart Metal GUI

vApp

[filip.zigic@dunavnet.eu](mailto:filip.zigic@dunavnet.eu)

0 ⭐⭐⭐⭐⭐

0 Ratings

BUY €0.00

Application Smart Metal GUI for data visualisation in the following manner:

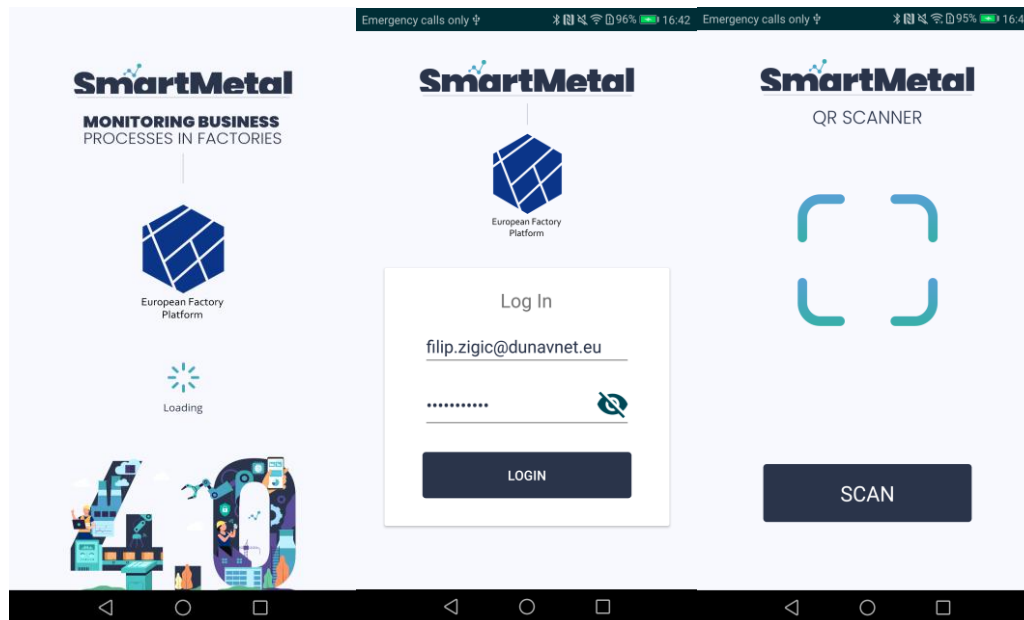
- QR codes are generated in the Product passport
- URL in QR code is link to the End-point of Smart Metal API
- By scanning QR code, page for Single sign-on, i.e. authorisation on EFPF keycloak is opened
- After successful registration, the page with diagrams for vibration, PM, noise and SCADA data is opened

**Dependencies**

No dependencies present

# Technical Achievements and Outcomes

After installation of the equipment in the premises and mobile phone application, as the first step user launches the application and provides log in credentials.



# Technical Achievements and Outcomes

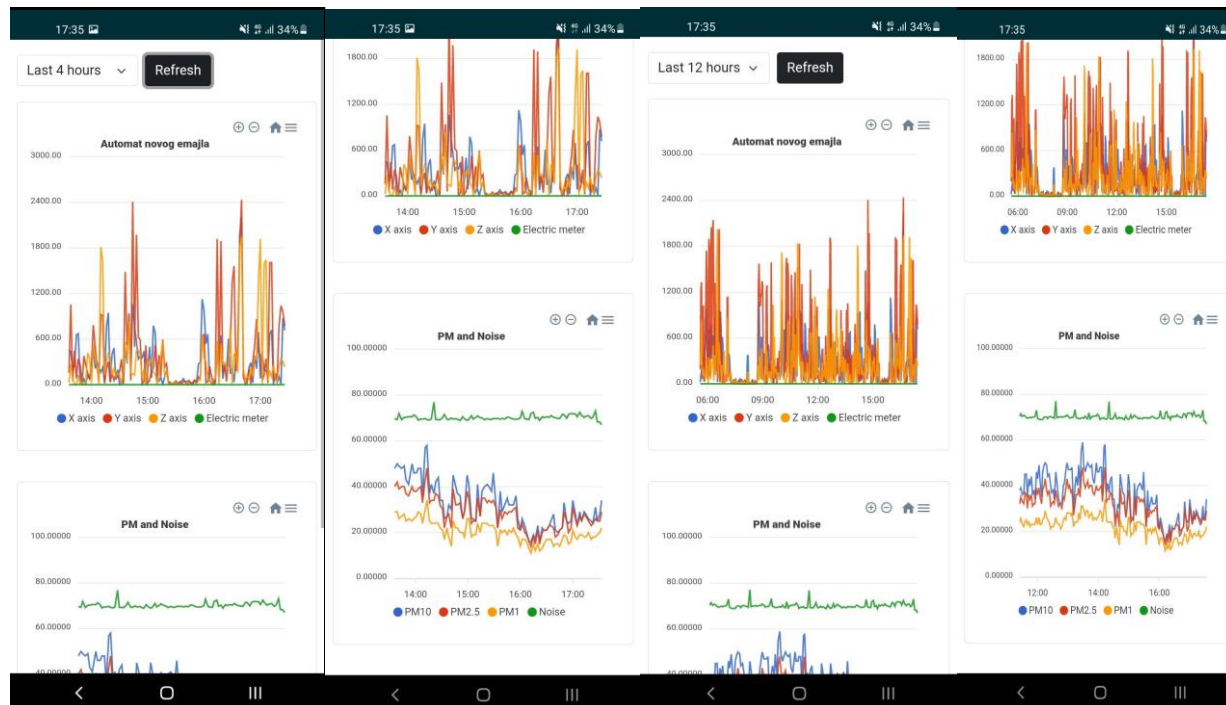
After successful login, QR scanner is opened and user types SCAN button and scan QR code (for the machine of interest) with mobile phone



# Technical Achievements and Outcomes

After that, the application pull data for the appropriate machine, and present obtained data to the user.

Screenshots with visualisation of collected data from vibration service, noise, PM and SCADA data:



# Technical Achievements and Outcomes

- This provides an overview of data – a graphical presentation with a filtering option.
- Data can be filtered by selecting the device and selecting the time period and type of granulation from the dropdown menu (examples are given for 4 and 12 hours).
- Vibration, noise, PM and SCADA monitoring of the industrial equipment optimizes operations and provides insight into the working periods of machines and assets.

# Technical Achievements and Outcomes

Collected data are provided to the Deep Learning toolkit.

```
sqlserverdnet.smart...o.PredictiveResults
SELECT TOP (200) Id, imei, measurement_time, result, precision, db_time
FROM dbo.PredictiveResults
ORDER BY Id DESC
```

	Id	imei	measurement_time	result	precision	db_time
▶	2877	f0:e0:fd:61:29:1e	2494-09-13 23:20:13.000	0.000000	1.000000	2022-06-21 09:48:27.900
	2876	Metalac_EE_488	2494-09-13 23:18:57.000	0.000000	1.000000	2022-06-21 09:46:51.640
	2875	Metalac_EE_588	2494-09-13 23:17:44.000	0.000000	1.000000	2022-06-21 09:46:08.317
	2874	3c:71:bf:87:5a:08	2494-09-13 23:08:52.000	0.000000	0.999999	2022-06-21 09:41:39.747
	2873	ec:92:07:4c:66:35	2494-09-13 23:20:13.000	0.000000	1.000000	2022-06-21 09:36:20.253
	2872	f0:e0:fd:61:29:1e	2494-09-13 20:20:40.000	0.000000	1.000000	2022-06-21 09:33:27.693
	2871	f0:e0:fd:61:29:1e	2494-09-13 18:00:39.000	0.000000	1.000000	2022-06-21 09:18:27.347
	2870	Metalac_EE_488	2494-09-13 18:15:19.000	0.000000	1.000000	2022-06-21 09:16:51.160
	2869	Metalac_EE_588	2494-09-13 18:16:39.000	0.000000	1.000000	2022-06-21 09:16:07.773
	2868	3c:71:bf:87:5a:08	2494-09-13 18:05:58.000	0.000000	0.999999	2022-06-21 09:11:39.533
	2867	ec:92:07:4c:66:35	2494-09-13 18:00:39.000	0.000000	1.000000	2022-06-21 09:06:18.840
	2866	f0:e0:fd:61:29:1e	2494-09-13 15:20:11.000	0.000000	1.000000	2022-06-21 09:03:27.063
	2865	f0:e0:fd:61:29:1e	2494-09-13 13:20:20.000	0.000000	1.000000	2022-06-21 08:48:26.703
	2864	Metalac_EE_488	2494-09-13 13:23:43.000	0.000000	1.000000	2022-06-21 08:46:50.753
	2863	Metalac_EE_588	2494-09-13 13:25:52.000	0.000000	1.000000	2022-06-21 08:46:07.143
	2862	3c:71:bf:87:5a:08	2494-09-13 13:03:13.000	0.000000	0.999999	2022-06-21 08:41:38.487
	2861	ec:92:07:4c:66:35	2494-09-13 13:20:20.000	0.000000	1.000000	2022-06-21 08:36:18.297
	2860	f0:e0:fd:61:29:1e	2494-09-13 10:20:44.000	0.000000	1.000000	2022-06-21 08:33:25.450
	2859	f0:e0:fd:61:29:1e	2494-09-13 08:20:35.000	0.000000	1.000000	2022-06-21 08:18:25.447
	2858	Metalac_EE_488	2494-09-13 08:20:27.000	0.000000	1.000000	2022-06-21 08:16:50.340
	2857	Metalac_EE_588	2494-09-13 08:24:33.000	0.000000	1.000000	2022-06-21 08:16:06.677
	2856	3c:71:bf:87:5a:08	2494-09-13 08:25:37.000	0.000000	0.999999	2022-06-21 08:11:37.770
	2855	ec:92:07:4c:66:35	2494-09-13 08:20:35.000	0.000000	1.000000	2022-06-21 08:06:17.893
	2854	f0:e0:fd:61:29:1e	2494-09-13 05:20:01.000	0.000000	1.000000	2022-06-21 08:03:24.940
	2853	f0:e0:fd:61:29:1e	2494-09-13 03:20:08.000	0.000000	1.000000	2022-06-21 07:48:24.670
	2852	Metalac_EE_488	2494-09-13 03:17:08.000	0.000000	1.000000	2022-06-21 07:46:48.970
	2851	Metalac_EE_588	2494-09-13 03:23:16.000	0.000000	1.000000	2022-06-21 07:46:05.547
	2850	3c:71:bf:87:5a:08	2494-09-13 03:22:47.000	0.000000	0.999999	2022-06-21 07:41:37.797
	2849	ec:92:07:4c:66:35	2494-09-13 03:20:08.000	0.000000	1.000000	2022-06-21 07:36:16.583
	2848	f0:e0:fd:61:29:1e	2494-09-13 00:20:11.000	0.000000	1.000000	2022-06-21 07:33:24.353
	2847	f0:e0:fd:61:29:1e	2494-09-12 22:20:00.000	0.000000	1.000000	2022-06-21 07:18:23.973
	2846	Metalac_EE_488	2494-09-12 22:19:35.000	0.000000	1.000000	2022-06-21 07:16:48.560
	2845	Metalac_EE_588	2494-09-12 22:21:54.000	0.000000	1.000000	2022-06-21 07:16:05.027
	2844	3c:71:bf:87:5a:08	2494-09-12 22:19:36.000	0.000000	0.999999	2022-06-21 07:11:36.280
	2843	ec:92:07:4c:66:35	2494-09-13 22:30:00.000	0.000000	1.000000	2022-06-21 07:06:16.003

of 200 | Cell is Read Only.

# Technical Achievements and Outcomes

- The sensors are identified by their IMEI (second column in the table).
- For all observed parameter are predefined operational ranges, i.e. the values of expected behaviour of the monitoring parameters.
- In the case that **Deep Learning toolkit** discover deviations, the notification will be generated, and also it will be stored in the **Blockchain module**.



# Summarize your EFPF Experience

- Regular be-weekly meetings with the project mentor
- Good communication with component owners
- Components are well documented
- Participation in the project give us an opportunity to expand Europe-wide and globally leveraging EFPF framework and partnerships.
- Deep Learning Toolkit component enhanced predictive maintenance capabilities
- We plan to use EFPF predictive maintenance service to enhance our Machine monitoring solution and make it more competitive on the global market.
- Further, collaboration with EFPF partners will strong our European and global footprint and creation of joint offering

# Target customers

- Target customers are manufacturing companies with diverse set of machines in use.
- The end user benefits are the following:
  - unification of representation of machines and the ability to exchange that information in a standardized format with other systems
  - monitoring utilization of the machines and based on that calculation of relevant KPIs including energy consumption, CO2 footprint, etc.
  - Reduction of the downtime by detecting deterioration in the performance of machines enabling them to react proactively.



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# Thank you for your attention!