REACH

NEXT GENERATION DATA INCUBATOR

EXPLORE PHASE TECHNICAL SPECIFICATIONS

23/05/2023

This project has received funding from the European Union's H2020 research and innovation programme under Grant Agreement no 951981

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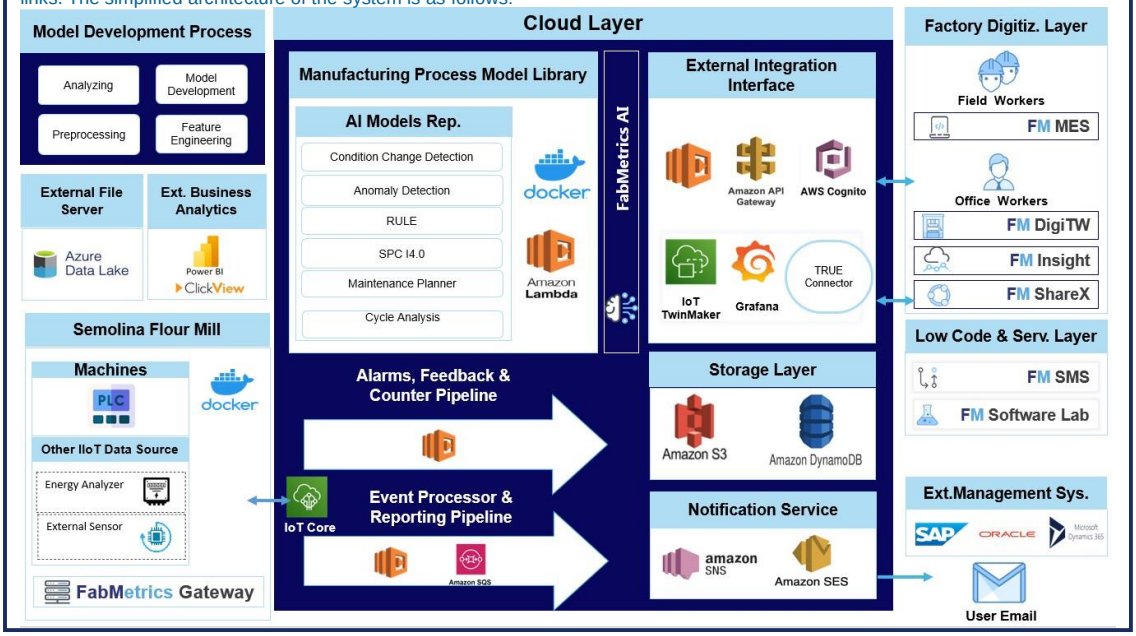
Technical Specification Double-side Page

1. **TECHNICAL SCOPE:** Summarize the mock-up devised during the EXPLORE phase: how have you addressed the challenge/Theme Challenges and tackled with its requirements and data. Include a diagram.

The technical solution is founded on our existing applications and AI/Mathematical models, complemented by the development of new solutions. FabMetrics, our low-code platform, plays a central role in enabling servitization models for equipment manufacturers(EMs). By leveraging AI and IIoT solutions, we empower EMs and their partner factories to embark on the journey of 'factory digitization'.In this context, we have devised a comprehensive 'factory digitization' solution that not only caters to the specific six factories outlined in the challenge but also provides an infrastructure that can be seamlessly integrated by any milling-solution provider (thereby they can extend their reach to all their factory clients: semolina flour or other flour mills).
The FabMetrics suite currently comprises the following four applications designed for factories, all customizable through the FabMetrics Software Lab:
FabMetrics Gateway: An industrial data collection and sensor fusion solution that connects smart supervisors installed in six production plants. It can also interface with the PLCs of the machines to enrich sensor data for more effective manufacturing analytics.
FabMetrics Insight: An AI-driven IIoT and Manufacturing Analytics Platform that provides end users with access to sensor data, AI agent configuration, AI agent outputs, and various reports, including maintenance reports. It also serves as an interface for managing maintenance job order management and accessing maintenance plans. Additionally, it acts as a gateway between field workers and office personnel for communication of maintenance workflows.
FabMetrics MES: A next-generation manufacturing execution system that enables seamless maintenance and production operations through interactive andon screens. It empowers maintenance and production teams to enhance efficiency by presenting real-time AI model outputs.
FabMetrics AI: A self-service AI infrastructure that empowers factories to deploy their own AI models and create meta-model solutions. For this particular use case, we have developed a meta-model solution, as detailed in the following question. End users can leverage this infrastructure to transform IoT data into predictive maintenance insights using the listed models. Model retraining is facilitated by the 'Feedback System and Classification Layer' of the solution.
In addition to configuring these existing four products for this use case, we will also develop the following solutions to align with Data Value Chain (DVC) practices and convert AI outputs into shop floor interactions:
FabMetrics ShareX: A platform designed to exchange digital assets such as raw data, processed data (e.g., Databoards, Dashboards, Reports), trained AI models, or software packages throughout the data ecosystem value chain. The True Connector will be used to facilitate secure and standardized data exchange in the development of ShareX.
FabMetrics DigiTW: A solution that integrates AI outputs into the Digital Twin of the factory. It allows end users to navigate within the digital twin, providing visibility of AI outputs and sensor data across all machines.
Furthermore, our technical solution addresses the challenge from a wider perspective, taking into account the energy shortage concerns faced by many companies. In response to this, energy monitoring systems have become increasingly prevalent, along with the growing adoption of condition monitoring systems. Additionally, the sensor data stored in Programmable Logic Controllers (PLCs) represents a valuable asset. To tackle these diverse data sources, we have designed a scalable and interoperable data acquisition layer capable of seamlessly gathering data from all these sources.
To ensure efficient operation, our solution incorporates an MLOps infrastructure layer that facilitates the execution of any signature or multivariate sensor data analysis model with ease. This layer provides a robust framework for running and managing machine learning models, enabling seamless integration of the outputs with raw data. The combination of these outputs and the raw data is then presented to end users through state-of-the-art digital twin and data visualization techniques, offering an intuitive and comprehensive view of the system.
The overall predictive solution encompasses both existing AI models and the development of new models, as described in subsequent questions. The solution is an end-to-end maintenance system that is beyond predictive maintenance. It also automates preventive and reactive maintenance processes as sketched in the figure.
For a more detailed understanding of the detailed architecture, solution view, and the products involved, please refer to the provided links. The simplified architecture of the system is as follows:



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2. **ALGORITHMS, TOOLS AND CONCLUSIONS:** Detail the algorithms and tools identified to accomplish the challenge/Theme Challenges. Show clear understanding of the used REACH dataset/s and addressed challenge/Theme Challenges.

The solution incorporates a meta-model approach, leveraging various models and tools to address the challenge at hand. For a more detailed understanding of the algorithms and tools used, please see the table on the provided link. The seamless flow of the meta-model is also sketched and can be reached over this link.
The provided dataset consists of energy records with a resolution of 1 per second. In order to extract insights from this limited dataset, which includes only 30 rows of Active Power, Active Energy, Current, and Voltage information, we conducted a correlation analysis. However, due to the scarcity of data and lack of substantial details about the factory, environment, machine, line, and data points, the correlation analysis did not yield definitive outcomes. The link on table will show the results.
Despite these limitations, our team has extensive experience utilizing the majority of the models mentioned in this solution across various use cases in different companies such as SAMPA, Borcelik, and FIAT (TOFAS). One of the use cases can be reached through the video link. In these cases, we have achieved significant outputs, particularly with current signature analysis using real-time data. Moving forward, during the 'experiment phase,' our next steps will involve gathering additional information about the data and understanding the hierarchical structure within the factory. This will enable us to further interpret and analyze the process effectively.

3. **SCALABILITY AND FLEXIBILITY OF THE SOLUTION:** Discuss whether the solution can truly cope with humongous and increasing datasets and how flexible it is to adapt to other related domains and integrate into Data Value Chains (DVC).

Our solution offers a high level of scalability and flexibility, thanks to our serverless cloud architecture and low-code functionalities. This combination empowers us to meet the demands of humongous and increasing datasets, while also adapting to other related domains and integrating seamlessly into Data Value Chains (DVC).
Technical Scalability: Our solution leverages serverless computing, utilizing native cloud services such as AWS Lambda and Docker technology. This architecture allows us to automatically scale our system in response to the growing volume of data, ensuring efficient processing and optimal performance. Additionally, AWS EC2 provides us with the flexibility to scale our compute resources based on the specific requirements of data processing tasks.
Flexibility: With FabMetrics (FM), businesses can benefit from our low-code capabilities, enabling them to rapidly create and deploy customized applications, workflows, and integrations. This flexibility empowers organizations to quickly adapt to evolving business needs and effectively address industry-specific challenges. The low-code approach streamlines the customization process, reducing time-to-market and development costs for EMs. It also minimizes the customization time required for their factory clients, enabling faster implementation and seamless integration.
Business Scalability: Our business model centers around the concept of 'servitization' for equipment manufacturers, extending beyond factory digitization. By leveraging our in-equipment built solution and low-code infrastructure, we significantly minimize field work, reducing it to only 10-15% compared to traditional factory digitization service providers. The EM's automation teams efficiently handle this reduced field work. As a result, the marginal cost of expanding our solution to new factories approaches near zero, leading to remarkable business scalability and a multiplier effect.
In summary, our solution's technical scalability, and our business model's focus on servitization provides us with the ability to expand and integrate into different domains seamlessly and bring a multiplier effect on our revenue model.

4. **DATA GOVERNANCE AND LEGAL COMPLIANCE:** Describe the security level of the proposed solution, i.e. how authentication, authorization policies, encryption or other approaches are used to keep data secure. Explain how will be compliant with the current data legislations concerning security and privacy (e.g. GDPR).

The proposed solution incorporates robust security measures by leveraging AWS serverless S3 and DynamoDB for secure data storage and processing. These services provide inherent authentication, authorization, and encryption features, ensuring the highest level of data security. Additionally, AWS Cognito, a fully managed service, strengthens the solution's security by facilitating user authentication, authorization, and access control, ensuring that only authorized individuals can access the data.
To enable secure data sharing, we will utilize the True Connector git library for FM ShareX. This platform aligns with established protocols and standards within the International Data Space (IDS) ecosystem, ensuring secure and standardized data exchange within the business ecosystem. ShareX will serve as a comprehensive tool for managing sharing policies, logging transactions, and facilitating secure exchange of data and trained models.
Regarding legal compliance, while the General Data Protection Regulation (GDPR) may not directly apply to our solution, we uphold privacy by design principles and follow data handling practices that protect factory data. Furthermore, the True Connector incorporates the MyData Framework for usage control, enabling fine-grained control over data usage within the connector and ensuring compliance with data protection regulations.
By leveraging secure native cloud services, utilizing the FM ShareX platform on the True Connector for secure data sharing, and strictly adhering to relevant data legislations, our solution ensures robust data governance. We uphold the highest standards of data security, privacy, and legal compliance, providing peace of mind for our users.

5. **QUALITY ASSURANCE AND RISK MANAGEMENT:** Describe the quality process planed for the final product. Technologically, which are the potential risks in all the phases of the project (design of the solution, development, testing, deployment…) and indicate mitigation plans to still fulfil the challenge/Theme Challenges and data provider requirements.

To ensure the quality of the solution, a comprehensive quality assurance process will be implemented. This includes validating requirements, maintaining detailed documentation, adhering to coding standards, conducting thorough testing (including user acceptance testing), and implementing monitoring mechanisms. Regular maintenance and updates will be performed to address changing data and conditions, ensuring the solution remains reliable, accurate, and compliant with requirements and industry standards. Risk plan for some risks is as following, complete risk plan can be downloaded over the link.

Risk	Likelihood	Severity	Impact	Mitigation
Missing data for AI analysis	Medium	High	High	Utilize transfer learning and probabilistic circuits to handle incomplete data. Leverage domain expertise and data to improve predictions in scenarios with insufficient datasets.
Regular updates are required for AI applications	High	Medium	Medium	Assess solutions' effectiveness regularly. Consider alternative approaches to avoid suboptimal results.
Software bugs affecting system interoperability	Medium	High	High	Perform code reviews and extensive testing to identify and fix software bugs. Prioritize software quality assurance.

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Annex 1. Means for accessing the MVP

Please, indicate in 1 page indicating the means for accessing the MVP for a potential customer (login information, website address, link to a demo video or whatever means are needed to check that the MVP exists and works).

Smart Flour Mills: PM with Digital Twins solution is available at (Website Link):

https://demo-mill.fabmetrics.net/#/login

Credentials for Equipment Manufacturer:

login: mill@fabmetrics.net

password: Inno123!

Credentials for Factory:

login: idea75@fabmetrics.net

password: Inno123!

Demo video of the use case link

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