

## Industrial Social Network for Zero Defect Manufacturing

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### Project Details and Motivation

Zero Defect Manufacturing (ZDM) is intrinsically a multi-disciplinary approach. It requires parallel progress of different technological pillars, including sensor devices, quality inspection systems, industrial informatics, data analytics and knowledge management. A lot of attention is given towards implementing analytics such as Machine Learning (ML), regression analysis etc., upon timeseries data collected in production processes. Textual data types that capture the knowledge and experience of people working in manufacturing workplaces, addressing, and solving quality issues, can be very useful for ZDM needs. Industrial Social Network (ISN) solutions can be very efficient for serving communication needs in manufacturing environments. They allow informal communication, that is more appealing to the users, regarding internal instances and events occurring in the workplace, as well as the exchange of knowhow and best practices. Such solutions, capturing informal knowledge from employees in the shopfloor, combined with IIoT data, can prove very valuable in servicing ZDM objectives.

In the context of the H2020 project MANUWORK led by LMS, WEP has developed the RAPpID ISN solution (see Figure 1). RAPpID is used by personnel involved in the manufacturing process (engineers, line operating levels, maintenance personnel, etc.), allowing the sharing of knowledge of past and new best practices for line operations, as well as recent lessons learnt. It promotes better connectivity and socialising among employees and line operators working in the production area, as well as engineers/other experts working in other parts of the manufacturing plant, or even external suppliers or colleagues from other facilities of the company, allowing to raise immediate problems and seek to solve them. This allows therefore to reduce downtime, improve production quality, and hence reduce losses.

The objective of ISN4ZDM is the integration of RAPpID ISN to ZDMP to extend ZDMP with an additional “component” that provides new knowledge-based services towards ZDM.

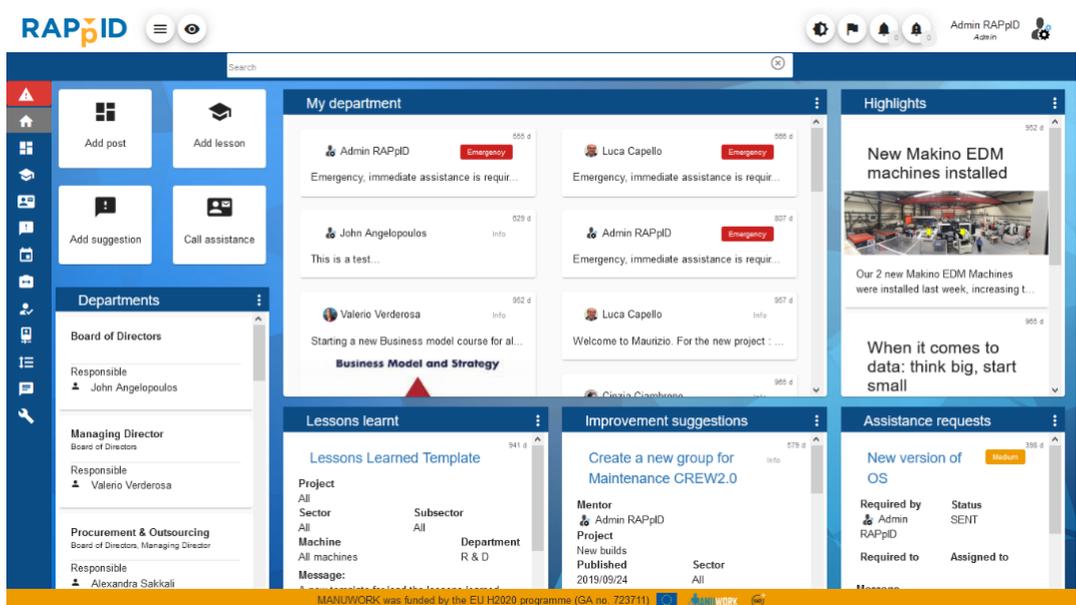


Figure 1: RAPpID ‘Home Page’

## ZDMP Fit

RAPpID complements existing ZDMP functionality with new capabilities that are geared towards combining employees' tacit knowledge with IIoT data (events, incidents, analytics, etc.) that are typically used for ZDM purposes. RAPpID benefits from the integration with ZDMP both from business but also from technology aspects. RAPpID, through its integration to ZDMP, can gain access to a large potential customer base of ZDMP. Moreover, by integrating RAPpID to ZDMP, "data in motion" or "data at rest" managed by ZDMP can be accessible to RAPpID users via RAPpID dashboards, allowing employees to use typical social network functions such as comment, discuss, "like", post, etc., upon these IIoT based events. Textual input from users can be combined with IIoT data in a knowledge database implemented by LMS using semantics and ontology technology.

ISN4ZDM project has identified two key objectives:

1. Extend the functionality of RAPpID ISN solution with a knowledge base that aims to link IIoT/machine data typically generated in some manufacturing environment with textual information typically available in ISN solutions such as RAPpID. This objective fits with the ZDMP ecosystem that provides applications and components to assist manufacturers. In other words, the business objective of ISN4ZDM fits with the business objectives of ZDMP ecosystem.
2. To increase the impact towards the manufacturing community, ISN4ZDM has identified several ZDMP components to integrate (see list below), fostering the extension of the ZDMP ecosystem with additional and unique functionalities offered by ISN4ZDM, and increasing the capability of ISN4ZDM to penetrate the ZDMP market, thus being a win-win case for both ZDMP and ISN4ZDM.
  - a. **Portal:** Facilitates access to ZDMP
  - b. **Secure Authentication and Authorisation:** Single Sign On to RAPpID and ZDMP
  - c. **Data acquisition:** Data access, exchange and analytics with ZDMP, for IoT extracted data
  - d. **Service and Message Bus:** 'Listening' and communicating critical events to RAPpID, facilitating "data-in-motion" exchange with ZDMP
  - e. **Application Run-time:** Container-based orchestration and hosting of components
  - f. **Marketplace:** Offer and access RAPpID in cloud through the ZDMP 'Marketplace'

Figure 2 provides the overall architecture of the ISN4ZDM system (RAPpID tool, with the new ZDM modules) and the integration with several ZDMP components.

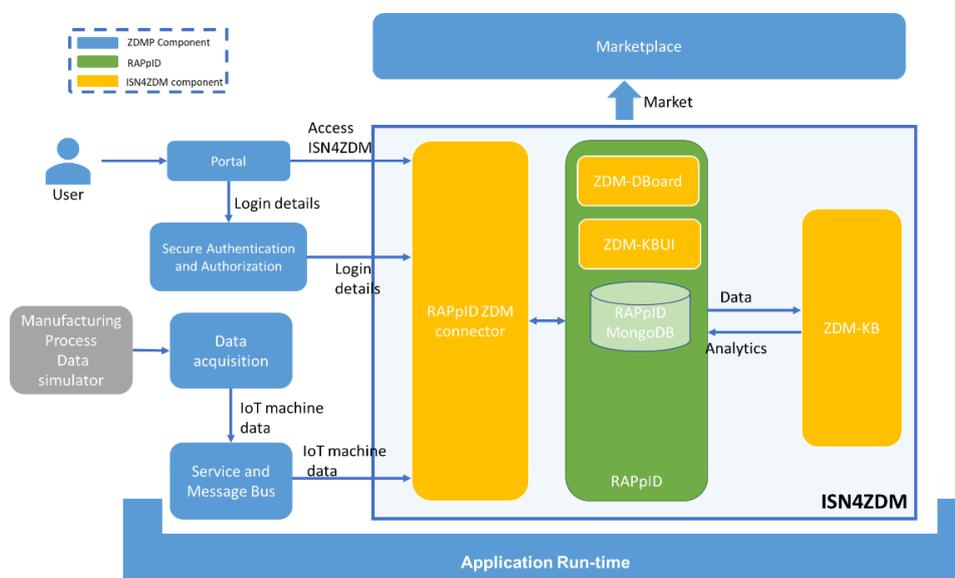


Figure 2: ISN4ZDM high-level architecture. Blue: ZDMP zComponents

Integration of the “Portal” and “Secure Authentication and Authorisation” (SA&A) components of ZDMP has a two-fold objective. First, providing access to RAPpID directly from the ZDMP portal, similar to other zApps. Second, allowing the use of Single Sign-On (SSO) mechanism offered by the SA&A mechanism to provide access directly to RAPpID for a user (RAPpID “licenced” user) authenticated by the “Portal”. Data is sent to the “Data Acquisition” component that is used for handling data from IoT sensors and other sources as “it allows the connection to different kind of data sources”. The data from the “Data Acquisition” is transferred to the “Service and Message Bus” component that provides a standardised communication interface to exchange messages, events, and data. This message bus implements a publish/subscribe messaging concept which allows the connected components to broadcast (publish) information on specific topics and to listen for certain events and topics (subscribe)”. “RAPpID ZDM connector” listens to specific topics in order to store data in the RAPpID internal MongoDB database and eventually provide this data to RAPpID end-users through the ZDM-DBoard. Data available in the RAPpID system is available through SQL connection to the ZDM-KB in order for the ZDM-KB module to build the Knowledge Base (KB). The KB is re-built periodically (e.g., every 1 hour) by querying on both the textual and machine/IoT data of RAPpID. ZDM-KB provides a SPARQL query API as well as domain specific API so as to ease the integration of the client of the ZDM-KB component. The ZDM-KBUI is integrated with the ZDM-KB via the ZDM-KB API.

## Participants’ Details

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  - **Profile:** WEP is an Italian IT SME of around 100 employees. WEP offers complete IT development services and system integration, following its expertise and core competencies. WEP is working to manage and develop many projects in various sectors: utilities / manufacturing, energy, telecommunications, system integrators, banking, insurance, financial, and more.
  
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  - **Profile:** Laboratory for Manufacturing Systems & Automation (LMS) is oriented on research and development in cutting edge scientific and technological fields. LMS is involved in a number of research projects funded by the EC and European industrial partners. Particular emphasis is given to the co-operation with European industry as well as with a number of "hi-tech" firms.

## ZDMP Details

The ZDMP – Zero Defects Manufacturing Platform – is a project funded by the H2020 Framework Programme of the European Commission under Grant Agreement 825631 and conducted from January 2019 until December 2022. It engages 31 partners (Users, Technology Providers, Consultants and Research Institutes) with a mission to “Provide the platform, components, services, and marketplace to achieve the right product, at the right time, with the right conditions using the right resources.”. Further information can be found at [www.zdmp.eu](http://www.zdmp.eu). ZDMP channels 3.2M€ of SME orientated funding to subprojects, such as this one to both facilitate SMEs with their innovations and increase the value of the ZDMP ecosystem.

## Links

● <b>Sub project website/LinkedIn (blog)</b>	<a href="http://isn4zdm.eu/">http://isn4zdm.eu/</a> <a href="https://www.linkedin.com/showcase/isn4zdm-project/">https://www.linkedin.com/showcase/isn4zdm-project/</a>
● <b>Architecture Component(s)</b>	<a href="https://www.zdmp.eu/documentation">https://www.zdmp.eu/documentation</a>
● <b>ZDMP Website</b>	<a href="http://www.zdmp.eu">www.zdmp.eu</a>