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[ijrset@gmail.com](mailto:ijrset@gmail.com)

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# SaaS for Digital Transformation of Production Planning and Manufacturing

Shivani Gaikwad<sup>1</sup>, Ishwar Shelke<sup>2</sup>, Rushikesh Tambe<sup>3</sup>, Tejal Varpe<sup>4</sup>, Sandeep Warhade<sup>5</sup>

UG Student, Department of Information Technology, Pune Institute of Computer Technology, Pune, Maharashtra, India<sup>1,2,3,4</sup>

Professor, Department of Information Technology, Pune Institute of Computer Technology, Pune, Maharashtra, India<sup>5</sup>

**ABSTRACT:**Digital Transformation aims to replace traditional ways to modernized methods by adopting combinations of information, computing, communication and connectivity technologies. It has an impact and benefits on the business models, the operational processes and the customer experience. Industries use production or manufacturing planning software and Gemba Walk Process that allow managers and leaders to observe the actual work process and explore opportunities for continuous improvement. Managers can make sure that employees, raw materials and other required things are maintained to create finished products within scheduled timeline. The proposed system is a mobile application which is an interface for manufacturing industries includes dashboards, alert system for maintenance of machines, role authorization and system checks. As a result, the industries can improve quality, boost production and reduce equipment downtime of their production.

**KEYWORDS:**Digital transformation, production planning, manufacturing planning, Gemba Walk Process

## I. INTRODUCTION

The current era, often referred to as “era of digitalization” where there is a significant shift towards using digital technologies to transform traditional paperwork process. Industry 4.0, is a great transformation in the field of manufacturing, as it automates the processes and helps achieving the real time control. The primary goal of using a digitalization platform is to improve productivity, enhance business operations and customer value, increase revenues by integrating the latest technologies, and other such goals. Gemba Walk methodology is referred and used, which is a powerful process to gather the information, observe, monitor and understand, how the work is performed by humans and the machines. This paper will propose a framework for understanding and implementing a methodology for Digital Transformation in manufacturing and production planning. It demonstrates the process for monitoring of humans and machines by digitalizing the hardcore work and systematically defining the flow of processes.

## II. RELATED WORK

Industry 4.0 focuses on cyber-physical production systems (CPPS) which will provide digital representation, intelligent services and interoperable interfaces in order to support flexible and networked production environments. Smart embedded devices will work together seamlessly via the IoT, and the centralized system controls will be transferred to networks of distributed intelligence based on machine-to-machine (M2M) connectivity at shop-floor level.

[1] paper states, to achieve digital transformation of manufacturing, infrastructure and public services in the Russian Federation some external and internal challenges are considered. This paper explores the emergence of new forms of Gemba Walks enabled by the adoption of new digital technologies. They intend to identify the advantages and disadvantages of using digital technology to support the execution of these new forms of Gemba Walks in more complex, globalized environments.

It follows an integrated approach to determining the stages necessary for Digital Transformation in Egypt’s manufacturing industry [3]. Furthermore, one of the critical components in the effective implementation of DT is the security of the organisation’s digital world. With the rising number of cyberattacks occurring every day, cybersecurity technology has become critical in every organisation.

Cloud Computing (CC) is one of the foundations of digital transformation. CC in manufacturing industry as a manufacturing version of CC, web-based applications or computer-aided are examples of possible deployments in the CC system. These applications are implemented at two service levels of CC system, matching SaaS and PaaS. There exist systems like Industrial IoT sensors, that measures and monitors the industrial processes. They can be deployed in the field, in manufacturing plants, or at other locations where there is a need to collect data about the performance of various equipment. One of the technologies that enable Digital Transformation is artificial intelligence and its various applications. With this technology along with machine learning, equipment becomes more efficient and effective in their operations as they become more aware of the processes and how to self-learn and solve any problems issued inside the production processes. ERP is a software toolbox that helps the company to link all its various modules to help transfer the information vastly and in real time. With the presence of robust cloud system, Cloud ERP will be more efficient in data privacy and data velocity instead of traditional ERP software.

The need of digital transformation in manufacturing, infrastructure and public services for improving labour productivity, more competitive advantages for domestic products and provision of high-quality public services for the population. [4] It researches through the approaches, key principles which are relevant for evaluation of the effects produced by implementation of digital transformation related projects in terms of feasibility, sustainability and economic efficiency. This paper also had taken into consideration – the Russian Federation, and it shows the problems in implementing the tools of digital transformation and also solutions to achieve its goal in manufacturing, infrastructure and public services.

[5] This paper provides the research that aims to defining and analysing the literature part on digital transformation which is in current availability and it present six main findings. It also specifies a definition of Digital Transformation and how is it's use in the manufacturing industry. Moreover, significant challenges that exist in the manufacturing industry which uses digital transformation are been classified as well as the major enabling technologies that help to implement the Digital Transformation.

This paper analyses the main research direction for the digital transformation of manufacturing considering its essential drivers which includes cloud services and resource virtualization which led to the new Cloud Manufacturing (CMfg) model – an industrial replica of Cloud Computing [7]. Industry 4.0 represents the vision for the Industry of the Future which is based on Cyber-Physical Production Systems that assure the flexible, dynamically reconfigurable control of strongly coupled processes.

The purpose of this paper is to state current progress in manufacturing in Kazakhstan, state challenges and problems with implementation of Industry 4.0 in manufacturing. [8] So the main aim of this project is to define current state of industrial progress in manufacturing in Kazakhstan and along with it, the description and comparison of Kazakhstan model is performed with the European model. It proposes a possible way of implementation of Industry 4.0 technologies and improvements in manufacturing process in Kazakhstan.

[9] This study has provided better understanding about how the open process innovation relates to the digitization of manufacturing. External search depth for process innovations was found to be related to a higher degree of adoption of digital technologies in a firm. It states when seeking for improvements in digital technologies, firms should search deeply and not broadly.

Currently, the documentation of feedbacks and work done is done as a hardcopy, and maintaining of such paperwork is very inconvenient, less effective and prone to errors. [10] This paper is related to the maintenance of work instructions (WI) and check sheets for reliability and availability of trains for operations. In order to overcome the drawbacks of hardcopy documents, this paper presents and discusses the implementation of digitization through a rail mobile maintenance system, in which WI are digitized onto a tablet, and checklists are uploaded to a common server for easy data management.

To sum up, currently smart production systems may have only limited development prospects and it should be emphasized that the possibilities of realization have by far not been definitively recognized. [11] This paper summarizes considerations and preliminary research results on the consequences of the progressive use of digital technologies in industrial work. The conclusion reached is that, in the medium term, at the most a somewhat limited spread of digital technologies and their consequences can be expected to occur.

There is a huge impact of digital transformation on business. [12] This paper studies and researches on the effect of digitalization on businesses along with the advantages and disadvantages of the industry 4.0. It states the solution for optimizing the work process and activities due to the development of the industry 4.0. The best solution that incorporates all the requirements and activities of the companies were the integrated ERP systems, because it incorporates all the modules specific to a company's activity, as well as adding specific modules depending on the specifics and requirements of the company.

[13] It also talks about how Industry 4.0 has improved the reliability, flexibility and efficiency of industrial processes in today's digital era. The virtualization of industrial systems is discussed in this paper which is implemented through the DT architecture presented, which uses some typical elements of Industry 4.0 like much use of simulation along with the real process, virtual reality for monitoring purposes and wireless/remote communication.

Two case studies were presented with the objective to test the effectiveness of the proposed model [14]. The results demonstrate that organizations can achieve quantitative benefits by integrating and implementing Gemba-Kaizen practices. In addition, these organizations can also benefit from better working conditions and improved team spirit.

It includes the research and survey about the digital transformation approach [15]. To conclude, we claim for a profound debate that might take insight as we intended to do in this forum from different perspectives and field of studies. Promoting an interdisciplinary approach to detect and discuss the social consequences emerging from the use of the new digital technologies in many aspects of the industrial production and distribution of good and services would be fun.

### III.BACKGROUND RESEARCH

#### A. Gemba Walk

The Gemba walk is a management approach that involves physically visiting the location where work is being done, in order to gain a deeper understanding of the processes, identify areas of improvement, and engage with the employees involved in those processes. There are three important elements of Gemba Walk Process: Go and see, Ask Why and Respect People.

#### B. Digital Transformation

Digital transformation refers to the integration of digital technology into all areas of a business or organization, resulting in fundamental changes in how it operates and delivers value to its customers. The goal of digital transformation is to use technology to improve business processes, enhance customer experiences, and increase efficiency and profitability.

### IV.PROPOSED SYSTEM

In this system specifically four kinds of users are considered:

- A. *Admin*: Is the admin for the system, who can create users and provide required permissions and credentials to them.
- B. *Managing Director (M.D)*: The user who can view or update the specific data as per its respective requirements and receives the feedback from General Manager.
- C. *General Manager (G.M)*: Each section manager reports the feedback to General Manager, who further reports it to the Managing Director, and can login to view or update the specific data.
- D. *Section Managers*: All reports the feedback to G.M. They can login into system and fill respective data and they as well as M.D can view the graphical representation of final submitted data.

The sections included are:

- A. Safety
- B. A/O/L Operator
- C. Q/A
- D. Logistic
- E. Purchase
- F. HR.

Under A/O/L Operator includes sections as:

- a. Operational Engineering (OE)
- b. Assembly
- c. Die-casting
- d. Paint Shop
- e. Moulding
- f. Logistics

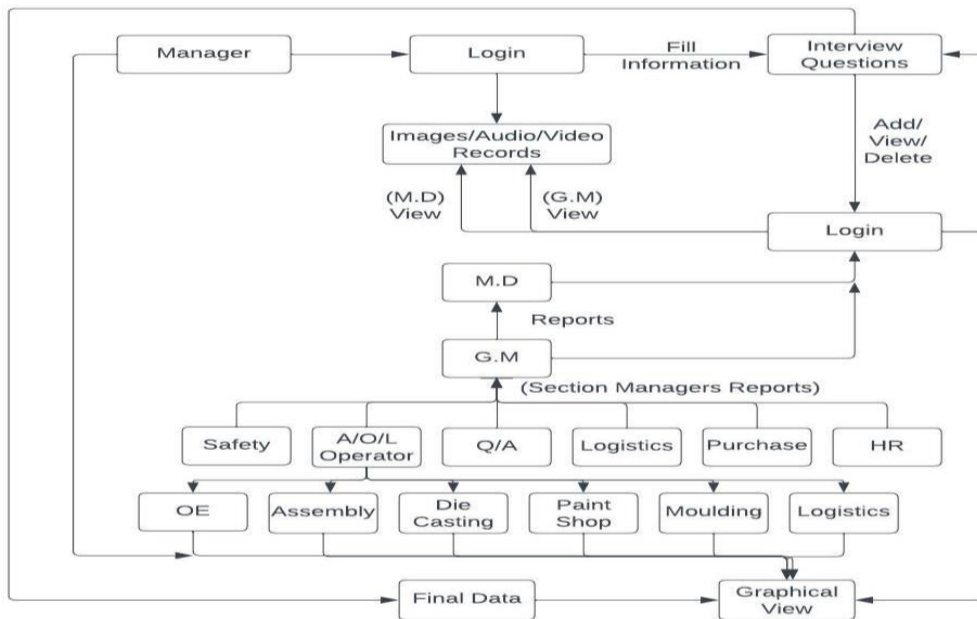


Fig. 1. Data Flow Diagram

The important modules included in mobile application:

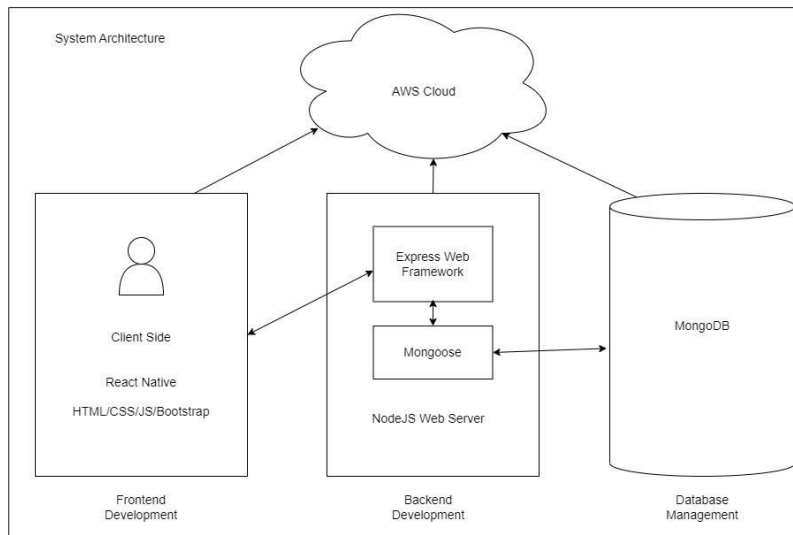
*Login/Register:* The admin can login into the system and can create users which can include another admin. The M.D or G.M can login on the app with respective permissions. Specific Managers can login with their login credentials provided by admin.

*Interview Questions:* The admin can login into the system and add interview questions which can be further viewed or updated by M.D or G.M and section managers can answer them.

*Problems and Route Map:* The section managers can enter problems and can view the route map of the workplace.

*Graphical View:* After the Section managers fills and submits the data. It reports it to the managing director. They can provide feedback to the user and can view the graphical representation of the report.

Tech stack implemented into the application



**Fig. 2. System Architecture**

For frontend Development, we preferred React Native over Flutter for the reason being its familiarity over JavaScript.

React Native is built on top of the React JavaScript library, which means that if you already know how to write React applications, you can easily transition to building mobile applications with React Native. Hence to explore and learn react native in a quicker and efficient way, we preferred it over Flutter as it uses Dart, a language that is not as widely used or familiar as JavaScript.

And with React Native on the frontend side, using Node.js on the backend, will have the advantage of using JavaScript on both ends of your application. This makes it easier to share code between the two and maintain consistency.

Of course, the decision to use Node.js for the backend ultimately depends on the specific needs and requirements of the project. We specifically preferred node.js with react native.

The data to be taken as input from the user in the UI of the mobile application is highly unstructured in nature.

MongoDB is well-suited for handling unstructured data because it is a document-oriented database. Unlike traditional relational databases like MySQL, which uses tables with fixed schemas, MongoDB stores data in flexible, JSON-like documents that can contain nested data structures.

This means that MongoDB can handle unstructured data more easily than traditional databases, since it does not require data to be organized into predefined tables or columns. Instead, data can be stored in a more natural format that reflects the way it is used in the application.

## V. IMPLEMENTATION

A mobile application is built using the technologies as explained in the proposed system that includes react native, node.js and MongoDB

Initially the application starts with the login or register page. As any user registers into the system, the admin provides login credentials to them, using which the user can login and access the data.

Below is the page designed for Admin who can create new users and provide them their login credentials as shown in Fig. 3 and Fig. 4.

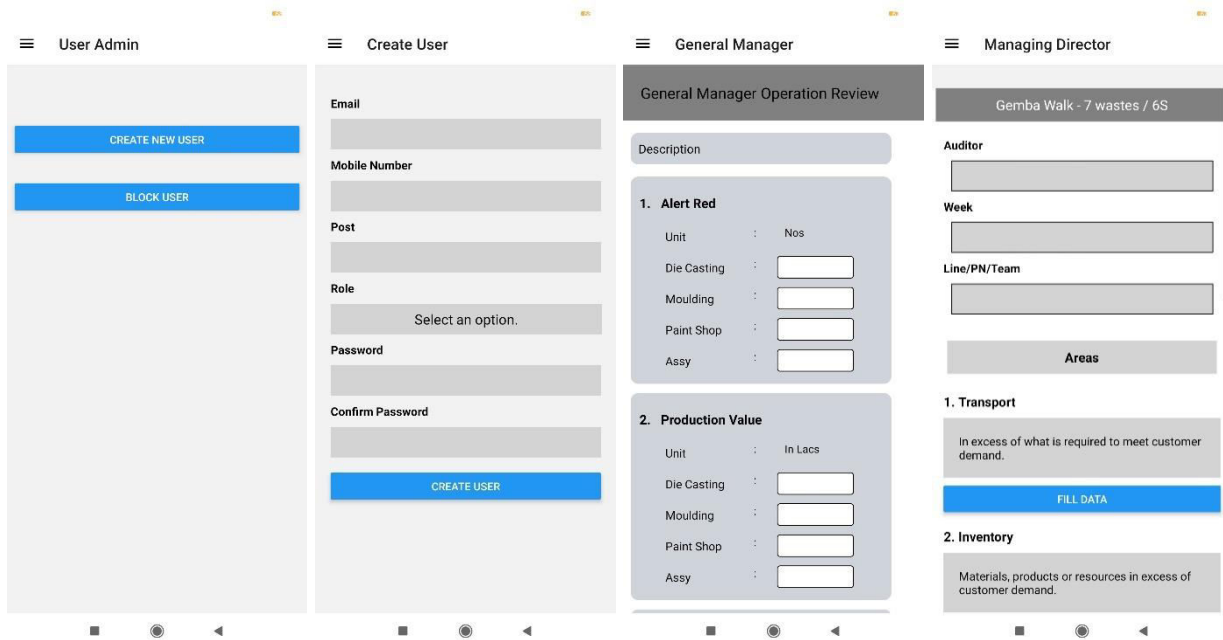


Fig. 3. User Admin

Fig. 4. Create User

Fig. 5. GM Screen

Fig. 6. MD Screen

The above screens, that is, Fig. 5. And Fig. 6 are frontend pages for the module visible to the General Manager and Managing Director. It includes the corresponding details which they can update into the input fields as per requirement and view the filled data.

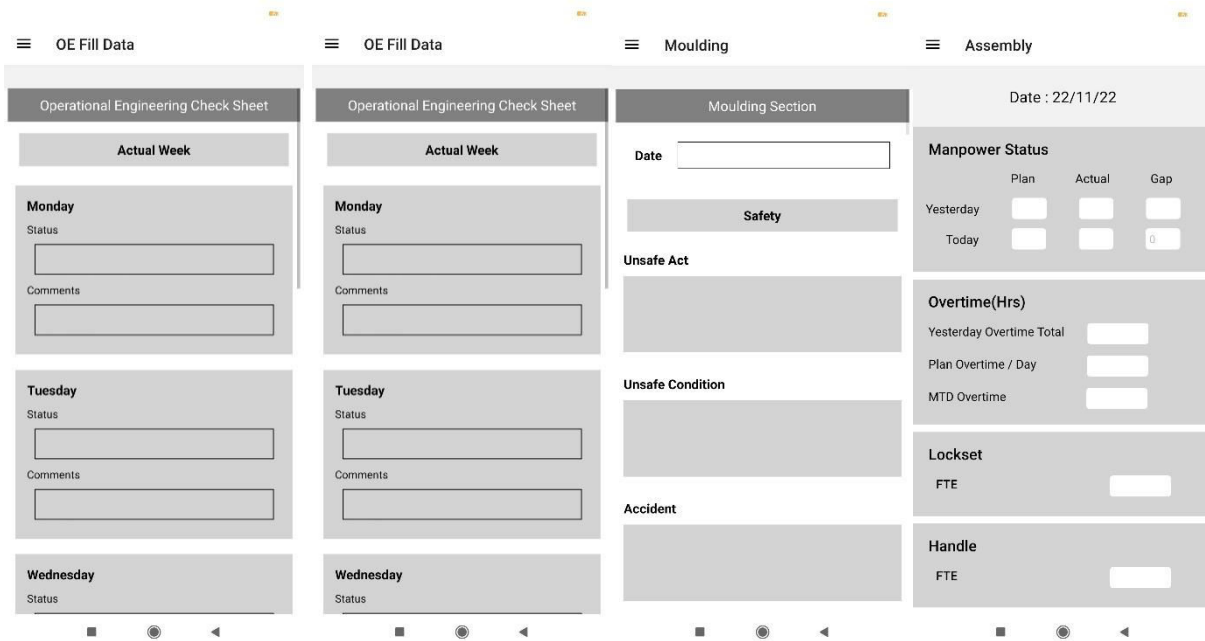


Fig. 7. OE Check Sheet

Fig. 8. OE Fill Data

Fig. 9. Moulding

Fig. 10. Assembly

Similarly, the above pages are designed for the Operational Engineering, Moulding and Assembly Section. On clicking the fill data button of OE check sheet, corresponding fill data page opens for respective characteristics, on basis of the respective field name like O.T. Hours, Absent Persons and as such.

And respectively fill data for Moulding and Assembly sections with a submit button at the end.

MongoDB Database Collections for OE:

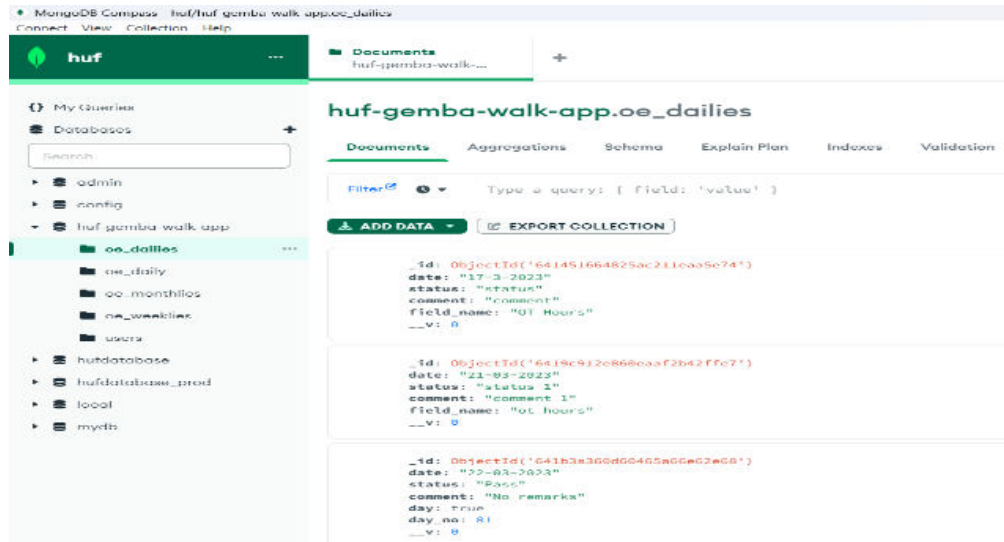


Fig. 11. MongoDB Collections

As the data is filled, it gets stored in the MongoDB collections as shown in above figure.

Fig. 11. Shows the collections created for OE.

On the basis of the frequency of submitting data which includes according to Daily, Weekly or Monthly, OE\_Daily, OE\_Weekly and OE\_Monthly collections are created respectively.

## VI. CONCLUSION

The study presented here aims to build a mobile application to monitor the working of machines and operators using the concept of Gemba walk process, keeping track of their tasks and identifying the profitability gain. By digitalizing the labour-intensive work and methodically defining the process flow, it illustrates the method for monitoring both humans and machines. Over all it depicts digital transformation being a customer-centric method that will continuously enhance the productivity and using the Gemba walk process, track and control the working conditions for more efficiency and improvement.

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