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IIPM : A NOVEL APPROACH FOR PLANT MAINTAINS IN ENGINEERING OF INDUSTRIAL

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ABSTRACT: The revolution of industrial engineering makes many changes in plant maintenance. The industrial engineering achieved remarkable progress in plant maintenance in an efficient manner. Plant maintenance plays a vital role in industrial engineering. The performance improvement of the plant depends on the maintenance of production equipment, production speed, and product quality. Plant maintenance is essential to function in any industrial engineering. Better plant maintenance approaches are required to establish an efficient work environment. The improper plant maintenance leads to under maintenance or over maintenance. Many researchers are introduced different approaches to overcome plant maintenance problems. Even though, it achieved better performance results in plant maintenance, But unable to reach the current goals of industrial engineering. To overcome the limitations of plant maintenance in industrial engineering, this research work proposed a novel Internet of Things base Industrial Plant Maintenance(IIPM) approach. The proposed approach achieved better performance in plant maintenance.

Keywords : Industrial 4.0, Plant Maintenance, Internet of Things, Remote Control

I. INTRODUCTION

Plant maintenance is a process of complete management of machines and equipment in the industry. The plant maintenance can be defined as the operating status of physical plant to meet the challenges in production management. Plant maintenance is to improve the overall performance of plants by increasing the production speed and high-quality products. The performance of the plant also depends on the maximum utilization of resources and improve cost reduction. In-plant maintenance the industrial engineering gathering relevant plant data, plant operation visualization and plant operation analysis. Industrial engineering can be defined as, the process of engineering that can deal with the design, improvement, and installation of integrated systems. The plant maintenance is the state of the art in industrial engineering and different approaches are considered also applied science and technology. In industrial engineering the plant maintenance for manufacture is more complicated, to optimize the plant maintenance process and industrial operations the disciplinary approaches needed. Industrial engineering is evidence for the plant maintenance activities. Industrial engineers optimize plant maintenance and improve the performance by applying their knowledge and tools. They enhance plant maintenance operations systematically to identify synergies, potentials, and opportunities.

In industrial engineering plant maintenance involved in the best utilization of resources and investments to maximize the reliability of the system, meet the current needs, and optimize the market value. It's helpful in maintaining balance performance, cost, and risk. Plant maintenance is essential to perform in order to maximize the performance and minimize the cost. In industrial engineering, asset management, machine and equip management are an integral part of the plant maintenance. Many approaches are introduced for the maintenance of plant machines and equipment, Also different policies are introduced for improving the performance of the plant. The plant maintenance of industrial engineering is a combination of science and technology. The previous plant maintenance approaches or policies are a failure in the utilization modern facilities of science and technology. In this research work, we proposed a novel plant maintenance(NPM) approach in industrial engineering. The NPM approach makes the involvement of the Internet of Things(IoT) in plant maintenance. IoT concept is very essential in large industrial plant maintenance. This approach performs the monitor of machines and equipment, identification of work location, finding emergency and etc.

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The remaining paper is organized as follows: Section II given the discussion of the related works. We present the methodology of the proposed framework in Section III. Section IV shows the comparison of experimental results. Finally, in Section V, we conclude the research work.

II. RELATED WORK

Many researchers are focused on the methodologies to reduce the cost reduction and improve the performance of the plant in industrial engineering. Many authors defined differently approaches to plant maintenance.

Mohamed Er-Ratby et al[6]., introduced maintenance function to reach customer expectations globally in industrial competition. Plant maintenance is defined as the combination of administrative, technical, and managerial actions. Maintenance in its narrow meaning includes all activates related to maintaining a certain level of activity. The maintenance function followed the guidelines of the conceptual framework. The framework of the aim is to consolidate the maintenance object and economic object of the company in the industry. Even though this framework achieved better results, but the performance of maintenance is not measured.

D.S. Mungani et al[1]., proposed three different approaches with three different process methods in industrial engineering. Those are Reliability Centered Maintenance(RCM) for continuous process, Total Productive Maintenance(TPM) for a batch process, and Business Centered Maintenance(BCM) for the production line process. Even though these maintenance approaches achieved plan reliability, accuracy, and cost reduction. But still, plant maintenance approaches faced the complexity problem and economic problem.

Earl Long et al[5]., proposed Model Integrated Computing(MIC) to provide cost-effective development, integration and maintenance. In this research work, they describe the use of MIC in the engineering process to improve productivity in the context of manufacturing industry.

Tino Vande Capelle et al[7]., proposed reliability engineering to process availability, safety, and preventive maintenance in the plant. This research work unable to describe failure analysis and human interaction influences.

Mahesh Pophaley et al[10]., introduced the Six Sigma approach for plant maintenance. This research work explored the possibilities of enhancing the usefulness and effectiveness of plant maintenance practices by the integration of Six Sigma Operation Techniques(SSOT). The SSOT is a statistical orientation approach that can improve the profitability of the maintenance process.

III. RESEARCH METHODOLOGY

3.1 Industrial Engineering

Industrial engineering is the branch of engineering that concerns the event, improvement, implementation, and evaluation of integrated systems of individuals, knowledge, equipment, energy, material, and process. industrial management draws upon the principles and methods of engineering analysis and synthesis. It eliminates waste of your time, money, materials, energy, and other resources. industrial management is additionally referred to as Operations management, Production Engineering, or Manufacturing Engineering counting on the point of view or motives of the user. In lean manufacturing systems, Industrial engineers work to eliminate wastage of your time, money, materials, energy, and other resources.

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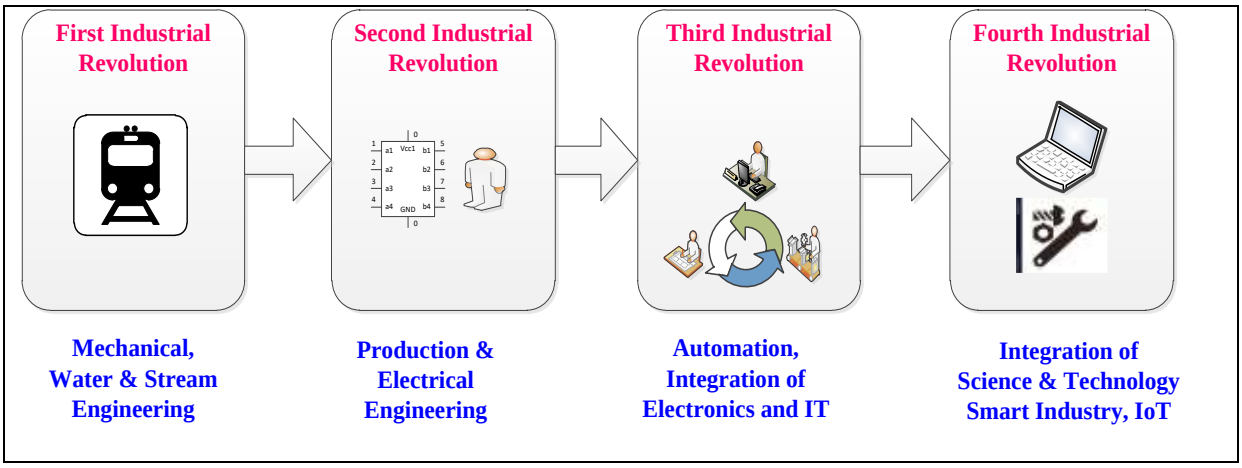

Fig 1 Evolution of Industrial Engineering Process

The industrial engineering has rapid growth in applied science and technology. Fig 1 shows the revolution growth of industrial engineering. The first industrial revolution started with mechanical, water, and stream engineering. In the second industrial revolution improve the utility of production and acquired electrical engineering. The third industrial revolution introduced the integration of electronics and information technology. It's also impacting on automation industry. In the present fourth industrial revolution enhancing the integration of science and technology, improve smart production in industry and implementation of IoT in industrial engineering.

3.2 Problem Statement

In industrial engineering, the plant explored in large areas. The maintenance of the plant is very complicated in large industrial areas. In the existing plant maintenance, approaches used Condition Monitor(CM) units. In large industrial plants, a huge number of operated machines and CM units are deployed. To perform the proper monitor of all machines in the plant, every individual machine is associated with another machine.

Each CM unit is associated with an individual machine physically and logically. However, the monitoring schema is given improper condition monitor results, it leads to failure of plant maintenance. To overcome these problems proposed an IoT enable approach for dynamic identification, associate, and locate equipment for larger plant maintenance. Even though the IoT enabled approach achieved better results in maintenance cost and machine location identification. But this approach is only focused on equipment condition only. To overcome the limitations of the present approach, this research work introduced a novel IoT base Industrial Plant Maintenance (IIPM) approach. The IIPM approach can be to perform plant remote monitoring, improve smart work, industrial data collection and decision making.

3.3 Proposed Approach

Plant maintenance is essential in industrial engineering, most of the industrial engineering plants performed in the traditional approach. The traditional approaches are unable to procure current industrial needs. To overcome the limitation of the previous approaches, this research work introduced a novel IoT based Industrial Plant Maintenance (IIPM). The proposed IIPM approach has three different levels.

At each level enable IoT and communicate in the duplex model. The industrial plant area is enabled by IoT, each event of the plant is monitor by the control room. The operations and maintenance of the plant is control remotely. The IoT platform is introduced and established in the middle of the industrial plant and remote control room. Each device and equipment of the industrial plant is associated with IoT.

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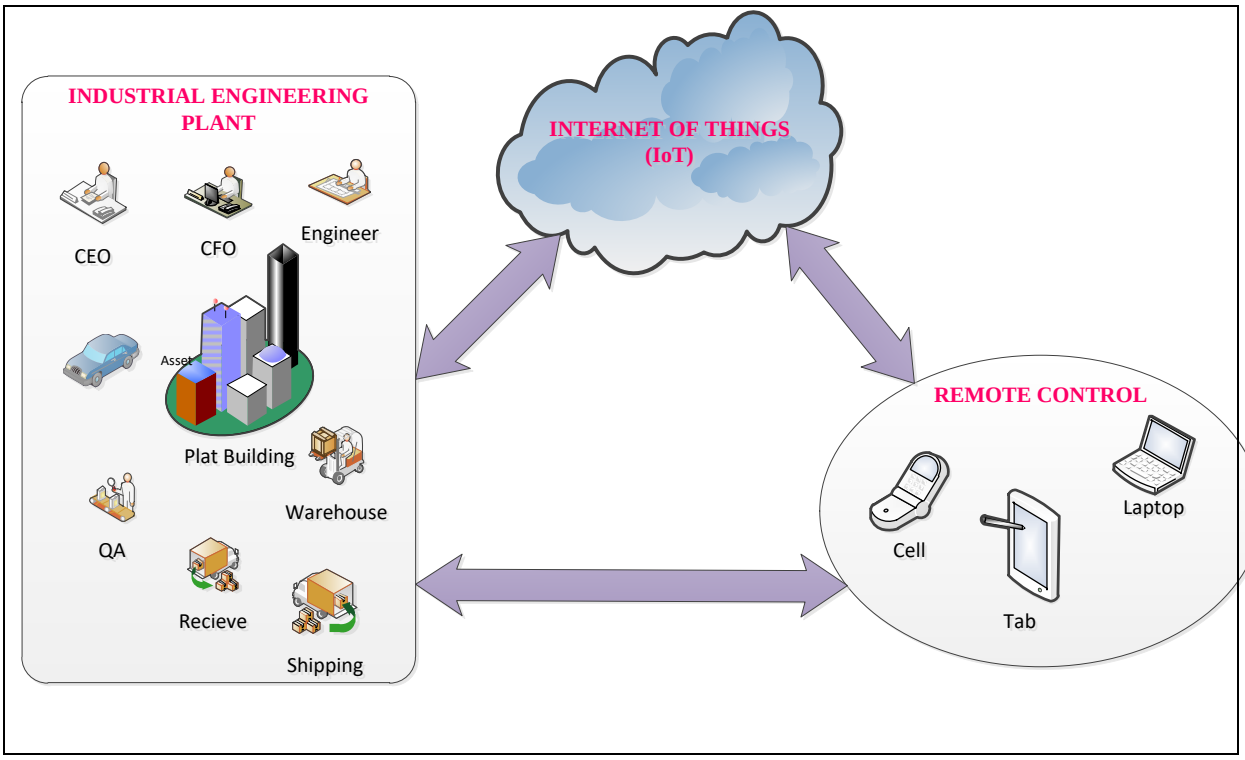

As well as each device of remote control room also associated with IoT platform. Then device of the control room can access the plant information and instructions as well. In industrial plants, each machine and equipment is operated by the control room through the IoT. Every information of the plant is accessible at the control room, such that, machines status, emergency status, work locations, employee status, inputs, and outputs of the plant. So the proposed IIPM approach achieved better performance in plant maintenance.

IV. RESULTS ANALYSIS

In this section discussed performance of the proposed approach in industrial engineering plant maintenance. The results of proposed approach is better with comparison of existing approach.

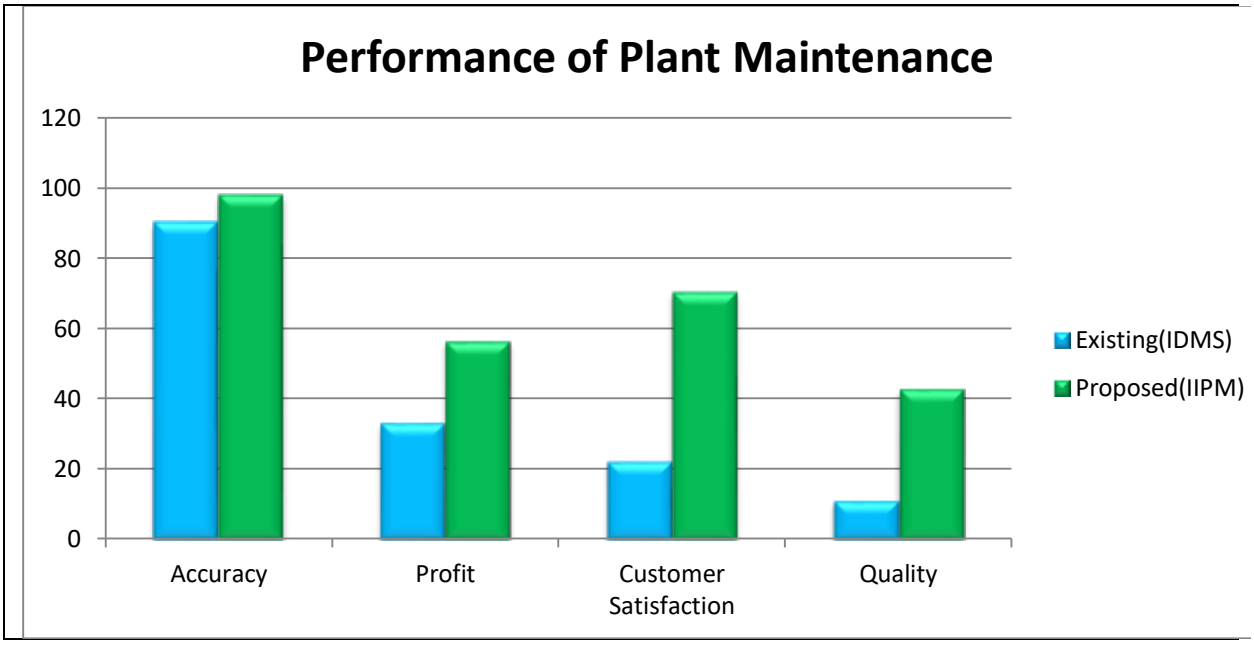

Fig 3 Bar graph representation on performance of plant maintenance

The performance of the IIPM approach is measured in terms of accuracy, profit maximization, customer satisfaction, and quality. The proposed approach improved performance. The accuracy is improved to 98.11%, profit is 56.21%, customer satisfaction is 70.36% and quality is 42.74%. The performance of plant maintenance is high with the comparison of the existing IDMS[15] approach..

V. CONCLUSION

Plant maintenance highly impacts on industrial engineering. Many approaches are introduced with the help of science and technology in industrial engineering. The previous approaches are focused on the single aim of plant maintenance. To overcome the limitations of the previous approach, introduced a novel IIPM approach. This approach is fully maintained and operated by the Internet of things. This approach is a better solution to minimize the risk of failure across the plant by optimal allocation of maintenance resources to different workstations. The proposed approach improves the industrial plant safety and reliability. The research work concludes that the proposed IIPM approach is better improved the plant maintenance performance.

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