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Operation of Industry 4.0 on Smart way of Manufacturing/Machining on the basis of IOT

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Abstarct :-

This paper presents The new era of manufacturing, known as Industry 4.0, necessitates the extensive utilization of mechatronic systems. In this context, Cyber-Physical Systems (CPS) and the Internet of Things (IoT) play a pivotal role. These technologies are implemented through integrated platforms that utilize connectivity protocols, facilitating extensive information sharing among various devices. The principles of smart manufacturing can be effectively applied to processes such as machining in the foundry industry and Computer Numerical Control (CNC) operations.

This paper focus on the integration of wireless technology and operations of smart way of manufacturing according to smart conection regarding IOT, CPS, Cloud computing.

keyword :- IOT, CPS, Cloud computing , Application

1. Introduction:

The Role of Software Systems in Industry 4.0 and IoT-Based Online Monitoring

Software systems have played a crucial role in manufacturing for several decades. These systems facilitate the monitoring and control of various processes, ranging from individual machines on the shop floor to broader organizational management activities. In recent years, information technology systems have gained increasing prominence in the corporate and product strategies of manufacturing companies. This shift has been largely influenced by the emergence of Industry 4.0, a paradigm that originated in Germany and represents the fourth industrial revolution.

The primary objective of Industry 4.0 is to establish smart factories capable of producing on-demand, customizable, and adaptable products tailored to individual customer needs. This new industrial era is underpinned by Cyber-Physical Systems (CPS) and the Internet of Things (IoT), leveraging the power of Information and Communication Technologies (ICTs) integrated into shop-floor operations. Essentially, this paradigm fosters a virtualized manufacturing environment, transforming physical systems into digital services through extensive ICT implementation.

An online monitoring system is essential for overseeing environmental conditions and the operational status of critical industrial equipment. Such systems enable precise failure prediction, timely maintenance, and efficient equipment repair, thereby enhancing operational efficiency and minimizing downtime. Additionally, these systems contribute to the seamless integration of equipment operation, maintenance, and management. However, industrial environments often present harsh conditions that render conventional measurement methods either unreliable or prohibitively expensive. A notable example is continuous steel casting, a vital transitional process between steelmaking and rolling in the steel production industry, where precise monitoring is crucial.

The Internet of Things (IoT) offers a promising solution for online monitoring and related activities by integrating wireless sensor networks (WSNs) and mobile Internet technologies. IoT has emerged through the convergence of advancements in wireless communication, the Internet, and micro-electromechanical systems (MEMS). It is closely associated with machine-to-machine (M2M) communication in smart manufacturing, as M2M enables comprehensive data acquisition, transmission, analysis, and service management.

From a technical perspective, a standard IoT system architecture consists of three primary layers: the sensing layer, the network layer, and the application layer. The foundation of IoT lies in extensive sensor networks and mobile terminals that continuously collect and transmit data. Within an IoT framework, WSNs play a crucial role in gathering and transmitting environmental data. An IoT-based online monitoring system typically consists of a vast array of wireless sensor nodes deployed in industrial settings to collect data related to temperature, pressure, speed, and other key parameters.

Due to the diverse range of sensors and communication protocols involved, IoT environments are inherently heterogeneous and complex. The collected data—whether in raw or processed form—are transmitted to a central server via a base station (or sink node). At the server level, advanced data analysis enables fault detection and the identification of critical events without requiring manual intervention. This automated approach significantly enhances efficiency and reliability in industrial monitoring and management.With the continuous advancement of Industry 4.0 technologies, the adoption of IoT-driven monitoring systems is expected to expand further. Future developments in artificial intelligence (AI) and machine learning (ML) will enhance predictive analytics capabilities, enabling more accurate failure detection and proactive maintenance strategies.

2. Problem identification :-

It is almost certain that problems will occur while drilling. even in very carefully planned wells for example in areas in which similar drilling practice are used hole problem may have been reported where no such problem existed previously. while working on conventional drilling machine main problem faced by operator is human comfort. in mass production, batch production conventional drilling is not that much effective, accuracy, depth of cut, oil feeding quantity is also important parameter that should be consider

3. Problem constraints: -

As we are mechanical background so IOT system implementation is quite difficult. WiFi connectivity, Bluetooth connectivity is also somewhat difficult for us. As we work on accuracy ,depth of cut there are another era also where work will happen like oil feeding i:e coolant quantity supply , long way connectivity if we work on conventional drilling machine then if we think about the mass production ,batch production then automatic conveyer system is also implement the movement of drill-bit & ram is controlled by stepper motor. these are faced like coding and slipping of motor with machine shaft

4. Objectives :-

conventional drilling machine is used then accuracy is not maintain while drilling but by using IOT feedback system is also availablewith the help of electrical, mechanical & computer based system drilling operation in easier than conventional with the help of sensor ,stepper motor, i.e electro-mechanical system drilling operation is easy The main objective of the study is to reduce human effort as the operator work on conventional drilling machine operation like chuck fixing ,tool changing ,cooling feeding ,work piece fixing & removing done by him . as the IOT application is embedded in conventional drilling machine human effort reduce automatically another parameter is depth of cut where we have to work .

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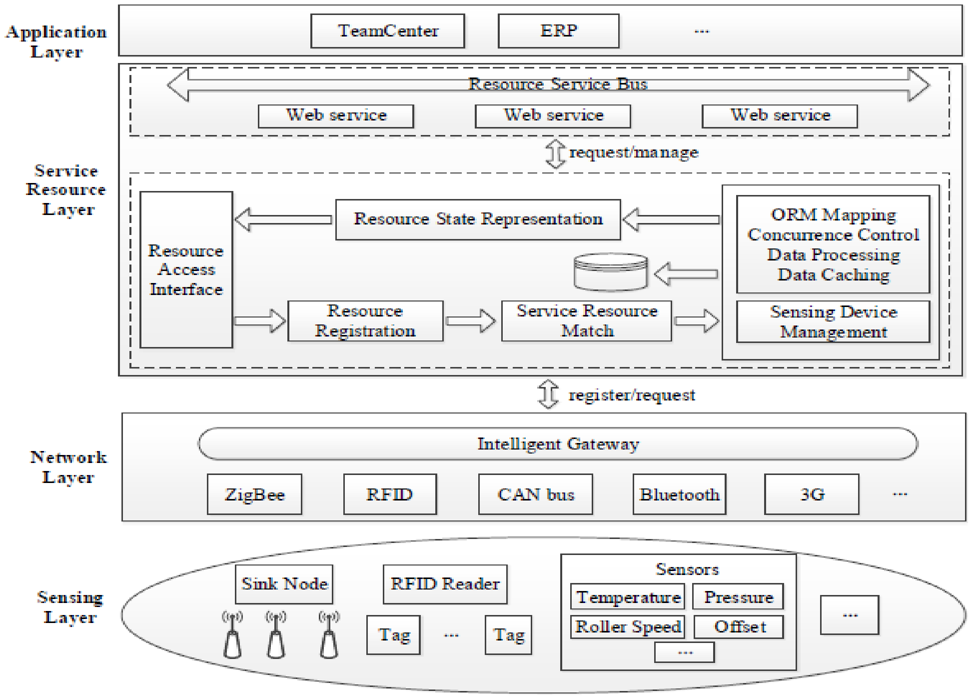

5. Methodology :-

1. System Design: The architecture consists of a drill machine integrated with IoT-enabled sensors, controllers, and cloud-based data management.

2. Sensor Integration: Smart sensors (such as pressure, temperature, and position sensors) are embedded in the drill machine to monitor real-time operational parameters.

3. Data Acquisition and Processing: Collected data is transmitted to a cloud platform via a wireless communication module. The cloud system processes the data for performance analysis and predictive maintenance.

4. Remote Monitoring and Control: A user interface (UI) is developed to provide operators with real-time insights and remote control functionality via a web-based dashboard or mobile application.

5. Automation Implementation: Using microcontrollers and actuators, the system autonomously adjusts drilling parameters based on pre-set conditions to ensure precision and efficiency.

6. Testing and Validation: The smart drilling system undergoes rigorous testing in an industrial setup to evaluate performance, reliability, and efficiency compared to traditional drilling machines.

6. Literature Review :-

Several researchers have contributed to the advancement of smart drilling technologies:

J. Pan et al. investigated IoT frameworks for smart energy management in buildings, demonstrating the efficiency of real-time monitoring and control systems.

P.L.S.C. Alwis et al. designed an automated PCB drilling machine with optimized path planning, reducing operational time and improving drilling precision.

N. Blasubramnyam developed a PC-based drilling system where drill bit movement is controlled via C-language programming, improving accuracy over traditional drilling methods.

Raju Belgavakar et al. proposed a sensor-integrated drilling system that monitors temperature, pressure, and depth of cut, enabling real-time adjustments for optimized performance.

Deepak Devasagayam et al. designed an automated wood drilling machine capable of three-dimensional precision, reducing manufacturing costs compared to conventional systems.

7. Conclusion :-

Based on the literature review, proposed methodology, and initial implementation, integrating IoT and automation into drilling systems is both feasible and beneficial. The smart drill system significantly enhances precision, efficiency, and operational control, making it a valuable solution for small and medium-scale industries. This technology minimizes manual intervention, optimizes drilling accuracy, and reduces energy consumption, thereby improving overall productivity. Future work will focus on expanding automation features, incorporating AI-based predictive maintenance, and testing the system across diverse industrial applications.

8. Reference :-

1. Mohd Asif Mansuri, Mohd Asif Ansari, Akash Gondane, Sandesh Kaushalya, Irfan Ansari, Sagar baraikar, "**Application of Industry 4.0 on Smart way of Manufacturing/Machining on the basis of IOT.**" IJTIR vol. 4, March 9, 2019

2. J. Pan, R. Jain, S. Paul, and T. Vu, **"An Internet of Things framework for smart energy in buildings: Designs, Prototype, and Experiments,"** Internet of Things Journal IEEE, vol. 2, no. 6, pp. 1-1, 2015.

2. P.L.S.C Alwis, A.S Premarthna, Y.P Fonseka, **"Automated Printed Circuit Board (PCB) Drilling Machine with Efficient Path Planning,"** Research Symposium of Engineering, 2014.

3. N. Blasubramnyam, **"Design and Fabrication of an Automatic PC-Based Drilling Machine,"** HCTL Open IJTIR, vol. 7, 2014.

4. Raju Belgavakar, Harshkumar Bhatt, Aniruddhsinh Parmar, **"Sensible Drilling Operation,"** International Journal of Advance Engineering and Research Development, vol. 5, issue 03, March 2018.

5. Deepak Devasagayam et al., **"Design and Fabrication of Automatic Wood Drilling Machine,"** IJETSR, vol. 4, issue 4, April 2017.