IoT Application for Real-time PLC Monitoring through the MQTT Protocol

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ABSTRACT

Because today's world is an internet world, the Internet of Things (IoT) is a rapidly growing technology. The Internet of Things (IoT) is a combination of a communication system and an embedded system that is used to connect hardware devices to a network or the internet. IoT is used for data transmission and reception. These systems are used to monitor industrial applications by utilizing IoT to implement industry standard protocols Modbus, MQTT, COAP etc. Small scale industrial applications such as liquid level control, energy monitoring, and so on can be monitored wirelessly using wireless devices, mobile phones, and laptop computers in this system. The primary goal of this paper is to summarize the significance of IoT in monitoring small scale industrial applications. In this pro- posed work small-scale modern applications like energy consumption monitoring, machine switching, and so on are observed remotely by smartphones and computer systems. The fundamental idea of this work is to outline the significance of IoT to observe industrial applications.

Keyword - *IoT, Wi-Fi, MODBUS, PLC, MQTT, industry4.0.*

I. INTRODUCTION

Nowadays, industrial monitoring has a vital role in industrial areas to monitor and control the industrial applications or equipment. Industrial monitoring is used to know dynamic condition of industrial devices or machines. Industrial Monitoring is used to accomplish fast processing, minimize power consumption, to improve quality, lessen expensive systems and global management of industry [1].

There are lot of methods that are available to monitor and control industrial processes like Zigbee, PLC-SCADA, WSN, Internet of Things (IoT) etc. Nowadays," Internet of Things" is a most favorable technique for industrial process monitoring. IoT is combination of embedded system and communication system in which industrial equipment is connected to internet with the help of wireless sensor network and devices or industrial application can monitor and control through mobiles and laptops. British technology pioneer Kevin Ashton described the word "Internet of Things" in 1999. He described that any physical object in the world can be connected to the internet via sensors [2].

Now a variety of objects, sensors, devices, and any physical object are connected to the internet very easily due to IoT. IoT is also used for the exchange and collecting of data from physical objects or devices and display it on IoT dashboard through certain communication protocols. An IoT consists of hardware devices like sensors, actuators and drivers which can be connected using ZigBee, WSN, Bluetooth, ethernet, wi-fi etc. to the internet. For local connectivity LAN, MAN, WAN networks are used.

II. LITERATURE SURVEY

This work [3] designs and implements a web based real time programmable logic controllers (PLC) data monitoring system on EPICS data. This system is based on browser and server (B/S). Using MODBUS/TCP communication data have been archived in EPICS. Then all data is displayed in a real time chart in browser (Internet Explorer or Firefox/Mozilla). The chart is refreshed every regular interval and can be zoomed and adjusted. Also, it provides

data tips showing and full screen mode. Acquire of the data would be handled by multi-data acquisition card which has been hardwired communication with PLC using 24 VDC to 5 VDC and vice versa electronics circuit.

This paper [4] studies the visual status monitoring of sheep slaughter production lines based on industrial Ethernet and Internet of Things technology. The remote monitoring system of intelligent slaughter production line based on the Internet of Things and cloud platform is proposed and implemented in this paper. PLC (Programmable Logic Controller) at the production site collects real-time status data of the production equipment. The real-time status data are encapsulated in the form of MQTT (Message Queuing Telemetry Transport) messages via the MQTT gateway and sent to the Alibaba Cloud IoT (Internet of Things) platform. The Alibaba Cloud IoT platform forwards the status data to the data analysis server of the cloud server to complete the analysis and storage of the data. Then realize remote status monitoring through the Web server. The test results show that all modules of the system can be consistent with the design requirements. The system runs stably, and job data is monitored clearly, which meets the need for industrial remote monitoring systems.

In this present work [5] aims at remote monitoring and control of electrical parameters such as speed, current of Variable Frequency Drive (VFD) fed-three phase Induction Motor with Programmable -Logic Controller (PLC) and LabVIEW software. The LabVIEW Graphical User Interface (GUI) acts like a server that communicates with the remote authorized client and can access motor parameters via Transmission Control Protocol/Internet Protocol (TCP/IP). A hardware setup and an algorithm has been developed in PLC and Arduino module for acquisition of current and speed data of three phase Induction Motor. The speed and rotational directional control of induction motor is achieved through PLC programming. Object linking and Embedding for Process Control (OPC) server is used as an-interface to communicate PLC with LabVIEW software.

This article [6] studies data analytics application development for integration of industrial IoT data and composition of application services executed on edge and cloud. A solution is designed to support heterogeneous hardware platforms and focuses on the service layer that enables flexible orchestration of data flows and dynamic service compositions. The unified model and system architecture implemented, using the open Arrowhead framework model, is verified through two representative industrial use cases.re and runtime.

III. PROPOSED SYSTEM

IoT devices usually have some cloud service to manage the device from the web or mobile applications. The point of a device being networked, and it can access effortlessly from anywhere through internet connection. Online supervising of industrial process has become the most considerable aspect for industrial growth and profit as it is used to decrease process time, and costs as well as their maintenance problem. In this system, industrial processes like energy meter monitoring, DC speed control, PLC based color mixing and liquid level control are monitored through android mobiles, laptops etc. Using IoT. The basic block diagram for industrial process monitoring using IoT as shown in fig.1.

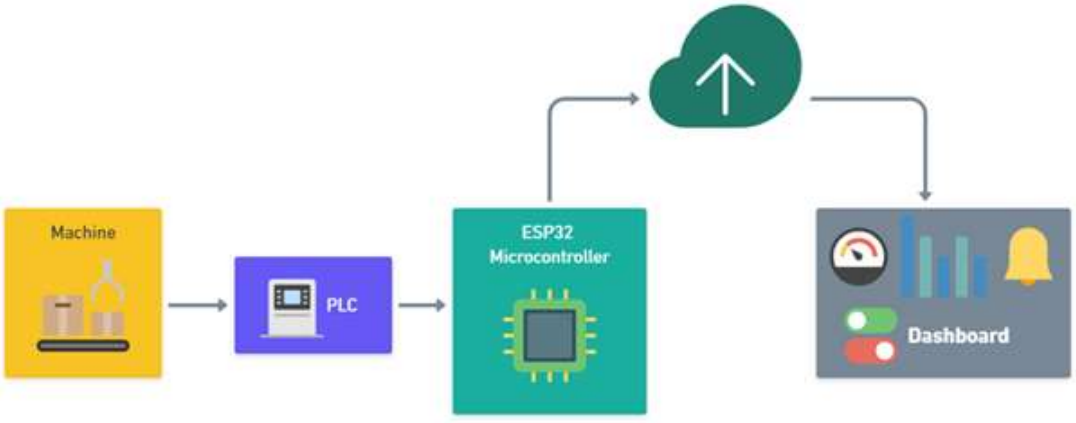

Figure 1 - System Architecture

- Initially, controlling and data acquisition for various parameters such as temperature, level, and pressure is done by a PLC in this IoT-based solution.
- The collected data is then transferred via Modbus protocol to the ESP8266 microcontroller and published using MQTT protocol to the cloud.
- Finally, the application allows the end user to monitor data and control the device over the internet.
- An application can also be used to monitor OEE, running time, stop time, efficiency, and machine availability.

The proposed system uses existing Machines, PLCs, Energy meters, and other industrial equipment and IoT wi-fi module ESP8266. Industry standard protocols are implemented on ESP8266 such as MODBUS and MQTT which acts as intermediate communication link. For the demonstration two different industrial applications are being taken into consideration.

IV. CONCLUSION

The combination of the ESP8266 microcontroller and Firebase cloud platform provides a reliable and scalable solution for monitoring and controlling industrial machines remotely. Firstly, the ESP8266 microcontroller is a cost-effective and efficient device with built-in Wi-Fi connectivity. It can be easily integrated into existing industrial machinery to collect data and transmit it over the network. This allows for real-time monitoring of various parameters of the machine-like safety door is open or closed. Secondly, Firebase provides a robust cloud platform for data storage, processing, and analysis. It offers seamless integration with the ESP8266, enabling easy communication between the devices and the cloud. The data collected by the ESP8266 can be securely stored in Firebase's real-time database, making it accessible from anywhere at any time. This enables industrial managers and operators to monitor machine performance, detect anomalies, and make informed decisions promptly.

Furthermore, Firebase's data analytics capabilities allow for advanced data processing and visualization. Machine learning algorithms can be employed to analyze the collected data and identify patterns or anomalies that may indicate potential issues or optimization opportunities. These insights can help optimize machine performance, reduce downtime, and improve overall productivity. The combination of the ESP8266 and Firebase provides a scalable solution. Multiple ESP8266 devices can be deployed across various machines in an industrial setting, and all the data can be centrally managed and processed in Firebase.

V. REFERENCES

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