Leveraging IoT for Predictive Maintenance in Industrial Settings

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1 Introduction

This research paper describes the concept of the Internet of Things (IoT) which is the intelligent connectivity of smart devices that can sense and communicate with one another, changing how decisions are made about the physical world. Initially, the IoT concept was implemented in commercial products such as refrigerators and washing machines, and control devices for smart homes. However, as the concept has evolved, other types of products have been equipped with the necessary technology, and many companies are now trying to implement the IoT concept into modern manufacturing systems. The paper proposes a new method for connecting standard industrial devices to IoT ready devices like Arduino or Raspberry-Pi microcontrollers, in order to collect usage data from different production equipment and build a cloud-based predictive maintenance system to simplify factory upkeep.

2 Key Contributions/Ideas from the Author

This researcher paper provides a detailed overview of the various serial communication protocols used in industrial devices. They highlight the main differences between the different communication standards, such as the number of devices that can communicate at the same time, the speed, and the maximum cable length. Additionally, the paper emphasizes that the hardware and software are both crucial when using serial communication.

The main focus is on the most commonly used protocol, RS-232, and its

limitations such as limited cable length and the possibility of noise occurrence despite it is still being widely used considering almost every computer has at least one RS-232 serial port. They also discusses other protocols such as RS-422 and RS-485, and their advantages over RS-232. For instance, RS-422 uses differential electrical signal, thus permitting more devices to use the same bus and greater noise immunity, thus allowing longer cable lengths. RS-485 is an improvement of the RS-422 protocol, as it can handle more devices and it accepts more than one master device as long as only one master device will send data at one time.

Serial Standard	Operation mode	Total nr. of devices	Cable length	Speed	Wires
RS-232	Single Ended	1 Sender / 1 Receiver	15 m	20 Kbits/s	min. 3
RS-422	Differential	1 Sender / 10 Receiver	1200 m	10 Mbit/s	4
RS-485	Differential	32 Sender / 32 Receiver	1200 m	10 Mbit/s	2

Figure 1: Serial communication standards.

The paper also examines the software format of the serial standards, specifically the ModBus protocol, which is widely used in industrial devices. The ModBus protocol enables data communication between several devices connected in the same network. A typical ModBus data packet consists of: a destination station address, function code, data area and cyclic redundancy check (CRC). There are two protocol versions used over RS-485 serial: ModBus RTU and ModBus ASCII.
The authors of this presents a case study that demonstrates the feasibility of a proposed method for connecting industrial machines to IoT platforms. The specific machine used in the case study is an automatic polishing and sanding machine for high gloss lacquered furniture components. The machine has three types of movements and its PLC uses RS-485/ModBus RTU communication standard to control the 3 motor drivers. An open-source IoT platform named Carriots is used to monitor and record the speed and functioning time of all motors for preventive maintenance purposes. The hardware required for this connection includes an Arduino Uno board, an Ethernet shield and a serial RS-485 shield. The Arduino board is used to translate the RS-485 serial commands and send the data to the IoT platform.

3 My views

The research paper presents a new and simple method for on-line monitoring and predictive maintenance of industrial equipment by integrating devices with software and translating different industrial equipment language into web protocols. This method provides a way to efficiently implement predictive maintenance in industrial systems. The case study demonstrates the feasibility of the developed method and how it can be easily applied to any type of industrial equipment. It is important to note that for complex industrial applications, a more robust device, such as a FPGA process computer, may be needed. The research paper highlights the potential for IoT to bring new benefits to the industry and provides a solution for connecting industrial machines to IoT platforms. The method can be implemented in different industries for on-line monitoring and predictive maintenance of industrial equipment, thus increasing efficiency and reducing downtime.
These methods and protocols in hand with cloud can be used for various other application of our daily life as well as on other industrial situations. This will widely help in preventing disaster and other complication in either the workflow of an industry and also provide a sense of security for people in the work environment.

4 Agreeable Statements

- The paper stresses the importance of interoperability, which is dependent on communication protocols and standardization, for a successful and resilient IoT solution.
- The paper states that the manufacturing paradigm is shifting towards predictive manufacturing, and that the role of maintenance needs to be refined as a value creation function for sustainable operations.
- The paper emphasizes the importance of considering both hardware and software when using serial communication. Both go hand in hand and without both operating at its best capability there can be flaws in the system which can lead to damage and disruption of the work environment.

5 Disagreeable Statements

- The paper suggests that Arduino can be used as a translator between industrial machines and IoT platforms as it can handle the web protocols used in IoT communication.
  There are other more compatible and better IoT platforms that can be used to perform the same tasks.

- The paper mentions that fault prediction is a key technology for ensuring sustainable operations and that different fault prediction systems based on IoT are being created.
  This is not true because nothing can replace experience and expertise of humans, but these IoT systems can work in cooperation to better improve the services and maintenance.

- Security can be a huge issue that can be overlooked easily and one must provide stable and strong security measures to avoid manipulation of equipment. This point wasn't mentioned in paper and can lead to a major downfall of this area.

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