

IOT BASED INDUSTRIAL MONITORING AND FAULT DETECTION SYSTEM

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Abstract - Internet of Things (IoT) is rapidly increasing technology. IOT is the network of physical objects or things embedded with electronic software, sensors, and network connectivity which enables these objects to collect and exchange data. IOT then deals with bringing control of physical devices over the internet. In this project, we are developing a system which will automatically monitor the industrial applications and generate Alerts/Alarms or make intelligent decisions using the concept of IoT.

A number of sensors are deployed in our project to monitor industrial parameters like temperature, pressure, gas, etc. These parameters were carefully selected on the basis of the potential hazards they can cause to the normal working of the industry machine. The sensors used in our project are Temperature sensor DHT11, Gas sensor MQ9, Flame sensor LM393, Accelerometer ADXL335, Ultrasonic sensor HC-SR04, and PIR sensor. These sensors will collect their respective data and then send the same data to NodeMCU ESP8266 which also acts as a wifi module.

Key Words: IoT, Sensors, Alerts/Alarms

1. INTRODUCTION

Technology development is an unending process and hence it is necessary for us to be well equipped and aware of the new upgrades in the technology. These technological changes have thus brought ease in the daily human life. Automation has become the need of the day. Today all the data, system is available on internet and the web technology is growing very fast. Embedded system with web technology provides remote management and controlling of embedded device via network interface Internet of Things (IoT) devices are controlled by web controller or E- controller which is a bunch of embedded system and software stack, which is the most renowned method for web development over the world. Remote login and monitoring by building a distributed web control system with the help of web pages built in web application is now used instead of using big servers systems for monitoring, managing and handling data. These kinds of web control system with IoT are characterized by: Energy Saving, Comfort, and Efficiency. Our basic objective is to apply the Internet control system to the Internet of things, such that the customers can use the application from any place around the world with the help of Internet facility.

1.1 Problem Definition

Sensors are a key component of the fault detection system because they provide all the information the system will have to deal with, although in some cases information coming from production management systems can be useful. In some cases those sensors can be shared with other tasks such as control or supervision and they are included in the machine or plant during its design. But in most cases predictive maintenance is not taken into account during the design of the machines and new sensors are usually required. This occurs specially when predictive maintenance must to be applied to old machines because they start to be a bottle neck in the plant due to their unexpected faults.

1.2 Scope of the project

Automated factories and processes are too expensive to be rebuilt for every modification and design change – so they have to be highly configurable and flexible. To successfully reconfigure an entire production line or process requires direct access to most of its control elements – switches, valves, motors and drives – down to a fine level of detail. The vision of fully automated factories has already existed for some time now: customers order online, with electronic transactions that negotiate batch size (in some cases as low as one), price, size and color; intelligent robots and sophisticated machines smoothly and rapidly fabricate a variety of customized products on demand.

2. LITERATURE SURVEY

The core of any predictive maintenance system is a fault diagnosis system able to detect failures not only when they are happening, but also a pre-failure behavior. It is an advanced solution for the supervision level of the factory where in most cases only SCADAs and alarms based on variables values are considered. One of the main advantages of predictive maintenance is its ability to provide useful information to the human supervisor showing what the real state of a plant or machine is and helping him in the planning of the factory operation. It is also capable of substituting the human operator in some systems taking decisions such as stopping the operation in case of a critical fault or scheduling maintenance operations.

The lack of historical data is the main problem that must be solved when designing the decision making component. It can be sometimes a problem to decide what the optimal classification method to use is, and it is always an added

difficulty to fix the parameters of the system. Usually conservative strategies are used. This leads to a great number of false alarms during the initial phases of the predictive maintenance system implementation. Human experts supervision and knowledge is one of the main supports for a good design of the decision making system and its configuration.

3. DESIGN METHODOGY

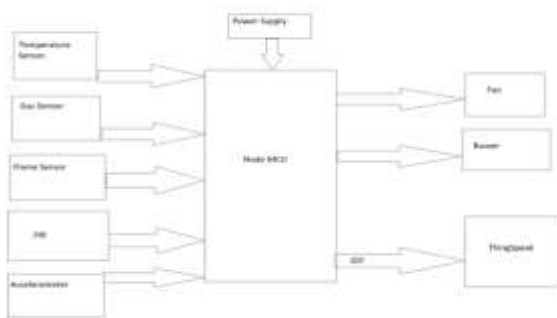


Fig -1: Block Diagram of the system

IoT Based Industrial Monitoring and fault detection system sends the signal from different sensors to the microcontroller – ESP8266. The micro-controller then sends the data over the internet.

ESP8266 is a microcontroller with Wi-Fi capability. It consists of 4MB of flash memory, System clock speed of 80 MHz, 64 KB of SRAM and an on-chip Wi-Fi Transceiver. It is used to connect to a Wi-Fi network and make TCP/IP connections and send data.

In case a fire takes place, the gas sensor and the temperature sensor would detect the presence of smoke and temperature changes and send the information to the ESP8266. The micro-controller is connected to the buzzer and LCD Display. ESP8266 is programmed to turn ON the buzzer when the temperature sensor detects a temperature greater than the threshold value. This value can be programmed as needed. When the threshold value is reached, the buzzer is turned ON. At the same time, the LCD would display informative messages regarding the current situation. As soon as the buzzer is turned ON, the data from the micro-controller will be sent to the IoT platform.

Since the data is available live on the ThingSpeak IoT platform, immediate action can be taken. Similarly, an accelerometer is used to detect faults or wear and tear in rotator machines. A notification or an email will be sent to the overseer or the manager to bring attention to it.

The PIR sensor is used for security purposes. If a person is detected where he is not supposed to be like the power room or even some trespassing, the buzzer alarm will be sounded.

3.1 Sensors

Sensors play an important role in our project as they form the basis for studying the various Industrial parameters and then applying the knowledge of their changes to decide a threshold value for the same. Keeping our project title in mind we handpicked a number of sensors which are currently being used in the industrial applications or are precise enough to be used in further developments.

Following is the list of sensors used:

Table -1: Sensors used in the project

SENSOR	SPECIFICATION
Gas Sensor	MQ9
Flame Sensor	LM393
PIR Sensor	HC-SR501
Level Sensor	HC-SR04
Accelerometer	ADXL335
Temperature & Humidity Sensor	DHT11

3.2 Fault indication and prevention mechanism

Our project aims to study the industry parameters and also provide some small scale automated prevention if any of the mentioned parameters start deteriorating the plant. Thus components like fans, LEDs, buzzer are also interfaced with the main controller for preventive action. The LEDs and buzzer are used to raise an alarm for potential fire break out or any gas leakage. A fan will be helpful for providing cooling action and can also act as an exhaust if there is gas leakage. Along with all these applications we also plan to tackle a worst case scenario where the nearest fire station will be intimated when things go out of hand and there's fatal risk to life and property.

4. ADVANTAGES AND DISADVANTAGES

4.1 Advantages

- 1) Real-time data is available
- 2) The information regarding the plant operation can be obtained even miles apart from it
- 3) Reliable and consistent data
- 4) Manual errors can be avoided

4.2 Disadvantages

- 1) Damage caused which beyond the sensor's capacity still prevail
- 2) Data can't be accessed on time if there are any internet issues

5. CONCLUSIONS

Through this project, we plan to get hands on knowledge on the trending technologies of "Embedded System" and "Internet of things". The idea of "Industrial parameter Surveillance and Fault detection" was selected with a view of studying about the various industry variables, keeping track of their changes and then deciding the threshold for the same through NodeMCU and sensors. If these parameters deviate from the threshold they passes potential hazard to the plant and the whole industry as well. Therefore we have also included some fault detection and prevention actuators like fan, exhaust, LEDs, buzzers. The role of IOT in our project is the data collection and communication over the internet. We also use the ThingSpeak software for database collection. We hope our project is useful enough to be deployed in the industries across India, and actually save life and property from accidents and hazards which are left ignored by the industry workers/users.

For companies in the manufacturing and logistics sectors, the new era of instant demands can be better met through more use of Industrial Internet of Things (IoT). The Industrial Internet of Things involves the use of IoT technologies in manufacturing processes and across supply chains. Alongside data from devices and sensors, Industrial IoT strategies should incorporate machine learning and big data technology, harnessing that combination of existing sensor data, machine to machine (M2M) communication and automation technologies to provide more insight back to the business.

6. ACKNOWLEDGEMENT

On the very outset of this abstract, we would like to extend our sincere and heartfelt obligation towards all the personages who have helped us in this endeavor.

We are ineffably indebted to our supervisor Mr. Yogesh Pandit for conscientious guidance and encouragement to accomplish these many advancements in the project. We are also grateful towards the panel judges who enlightened us about the obstacles which may arise in the due course of the project and thus leading us in the right path. Also, it is with great pleasure that we acknowledge our sincere gratitude towards the college for the allowance of the facilities under the Electronics Department which are required for the project.

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