

Industry Protection System Using IoT

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Abstract

Internet of Things (IoT) plays a very significant role in the new generation of industrial automation systems. The popularity of IoT is increased rapidly in the last few years because it has created opportunities for research, innovation and business transformations. Today more than half of major new business processes and systems have incorporated some of the other elements of the IoT. The data generated by diverse IoT devices has opened new opportunities for data analytics as well. IoT applications need to be optimized, real-time analytics techniques to infer events for automatic decision making. Smart Sensors, machines, and network data play a major role in the success of IoT. IoT is also widely adopted in smart cities by developing intelligent systems, such as smart office, smart transportation, smart healthcare, and smart energy. In a smart city, smart devices including mobile devices, public transport and daily home appliances are used for data collection. Many real-life things like home appliances, emergency alarm and vending machines can be connected through a wireless sensor network and controlled remotely.

With the evolution of wireless sensor network and communication technology, it becomes feasible for the IoT environment to integrate sensor devices to communicate smoothly for information sharing from different platforms conveniently. IoT analytics make things smarter and intelligent.

Smart and Intelligent stuffs helps us in making Automatic systems with the least interference of human to it, which leads to the real power of AI.

Data acquisition devices sense and transmit data using WSN solutions, such as Bluetooth, RFID, Wi-Fi and GSM, to systems for further analysis in order to improve the standard of living [6][7]. IoT network can be divided into three components: Sensors Network, Communication Network and Analysis Network. The recent developments of different sensors and communication technologies have helped in developing IOT tremendously.

IoT Analytics network, which does Data Analytics, is also important in the fame of IoT systems because they involved in the decision-making process to bring transformation in business and individual. IoT analytics use different algorithms, techniques and tools as any other analytics that can run in the cloud. IoT analytics has input from a variety of sources like streams of sensor data, environmental data sensors and other entities. Accurate and timely processing of this data requires cutting edge algorithms and processing platforms. It also involves attention to security, communication, data storage, application integration, governance and other considerations beyond analytics.

Keywords: - IOT, Sensors, Arduino, Protection System, Threshold values.

INTRODUCTION

The IoT based industry protection system using Arduino is an integrated system designed to protect industries from losses due to accidents using the Internet of things. Gas leakages may lead to fire leading to huge industrial losses, instant fire detection is needed in case of furnace blasts. Also, low lighting in industries may create improper work conditions increasing the probability of industrial hazards. The system makes use of Arduino to achieve this functionality. The

system makes use of a temperature sensor along with light and gas sensors to detect fire, gas leakage as well as low lighting to prevent accidents and industrial losses. The system consists of light, gas and temperature sensors interfaced with Arduino along with an LCD screen. The sensor data is constantly scanned to record values and check for fire, gas leakage or low light, and then this data is transmitted online. The wifi module is used to achieve internet functionality. The Thingspeak server then displays this information

online to achieve the desired output. Also, whenever the temperature rises above the threshold value, the technician working on the machine will be notified so he/she can take appropriate measures.

Workplace safety from the past hundred years has been improved. We have studied how things have changed from past till present from the journal “100 Years of Occupational Safety Research: From Basic Protections and Work Analysis to a Multilevel View of Workplace Safety and Risk” by David A. Hofmann, Michael J. Burke, and Dov Zohar. In the mid-1900s, the main focus was on worker fatigue. One experiment on working hours by William Mather at Salford Ironworks in Manchester, England, from 1893 to 1894 demonstrated that a 48-hr workweek resulted in increased productivity in relation to the 53- or 54-hr workweek. A study in Germany by Ernst Abbe, the owner of Zeiss Optical Works, who introduced the 8-hr workday, confirmed Mather’s hypothesis that productivity gets increased as long working hours were reduced. This advanced the understanding of the relationship between worker fatigue and the occurrence of accidents. In 1913 e, Münsterberg (1913) conducted a study of accident and injury prevention. From this

research, Münsterberg established standards for completing the simulation and, in effect, the first personnel selection standards for worker safety. Although in the mid-1900s, the main focus was on how work conditions contributed to the occurrence of accidents, injuries, illness, and death. There was the Pittsburg Survey that served as a model for the analysis of work conditions in relation to work safety. This survey leads to one of the first workers' compensation protection laws in the United States in 1910. Now the focus was on equipment design to achieve a better fit with the workers; this approach was used to increase human reliability and reduce system failure modes. As the 20th century continued to unfold, the field of work safety moved towards studying the worker and the worker’s environment. As the technology is getting developed, there comes new term automation, which decreases the risk of accidents in the factories.

In the Fourth Industrial Revolution, i.e. Industry 4.0 is the era of smart machines, trigger actions and control each other without human intervention. Industry 4.0 includes Cyber-physical system, The Internet of things (IoT), Cloud computing, etc. The IoT can be used in industries to protect it from losses accidents such as

gas leakages and fire. Over the years, the biggest improvements in safety have resulted from the elimination of repetitive tasks by the new emerging technology, which has reduced human efforts.

LITERATURE REVIEW

Nowadays, in Industries, we make use of large and costly machines for doing so many works. Many accidents take place in industries due to gas leakage, fire, etc. Such accidents with the machines will lead to loss of life. To prevent such accidents, we made a system based on IoT, which is capable of detecting fire, smoke and temperature of the room with the help of sensors. The IoT based industry protection system using Arduino is an integrated system designed to protect industries from losses due to accidents using the Internet of things. For this project, we have studied some papers, which are as follows.

[1] Ashwini, Prateeksha U Shanbhag, Pranitha Preema Crasta, Shreeraksha. P, Prof. Pragathi Hegde in “Survey on IoT Industry Protection System Using Arduino” has explained that the Internet of Things (IoT) plays a key role in the new generation of industrial automation systems (IASs). Evolving IoT standards, if effectively used, may address many

challenges in the development of IAS. However, the use of the IoT and the REST architectural paradigm that IoT is based on is not an easy task for the automation engineer. In this paper, a model-driven system engineering process is adopted for IASs, and it is extended to exploit IoT standardization efforts in IEC 61131 based system. IoT is considered as an enabling technology for the integration of cyber-physical and cyber components of the system and humans, bringing into the industrial automation domain the benefits of this technology. A UML profile for IoT is exploited to automate the generation process of the IoT wrapper, i.e., the software layer that is required on top of the IEC 61131 cyber part of the cyber-physical component to expose its functionality to the modern IoT IAS environment. A prototype implementation and performance measurements prove the feasibility of the presented approach.

[2] International Journal of Advanced Research in Computer Science by Sapna Jain and M Afshar Alam – “Comparative Study of Traditional Database and Cloud Computing Database” Volume 8, No. 2, March 2017, this paper gives a comparative analysis of the latest technology called “Cloud Computing database” or “database-as-a-service”

(DBaaS) called Relational Cloud which is causing a major shift in the Information Technology industry with the traditional databases.

Relational Database Management System which has been used since many years. Cloud Computing is a new technology that has been developed to virtualize IT systems and to access the needed applications on the Internet through web-based applications. This means no IT costs for hardware or servers. As compared to the traditional way of building an IT environment is to buy servers, hardware, licenses and to install the software. This is a long and costly process involving many infrastructure demands and long deployment cycles. This fully IT internal model may be commonplace, but IT as we know it today is being replaced by newer technologies.

[3] Hindawi Publishing Corporation, International Journal of Distributed Sensor Networks proposed a review article, “A Survey on Sensor-Cloud: Architecture, Applications, and Approaches”, which explains, Nowadays, wireless sensor network (WSN) applications have been used in several important areas, such as healthcare, military, critical infrastructure monitoring,

environment monitoring, and manufacturing. However, due to the limitations of WSNs in terms of memory, energy, computation, communication, and scalability, efficient management of a large number of WSNs data in these areas is an important issue to deal with. There is a need for a powerful and scalable high-performance computing and massive storage infrastructure for real-time processing and storing of the WSN data as well as analysis (online and offline) of the processed information under context using inherently complex models to extract events of interest. In this scenario, cloud computing is becoming a promising technology to provide a flexible stack of massive computing, storage, and software services in a scalable and virtualized manner at a low cost. Therefore, in recent years, Sensor-Cloud infrastructure is becoming popular that can provide an open, flexible, and reconfigurable platform for several monitoring and controlling applications. In this paper, we present a comprehensive study of representative works on Sensor-Cloud infrastructure, which will provide general readers with an overview of the Sensor-Cloud platform, including its definition, architecture, and applications. The research challenges, existing solutions,

and approaches, as well as future research directions, are also discussed in this paper.

[4] *Journal of Mathematics and System Science- Isak Shabani, Amir Kovaçi and Agni Dika* in “The Benefits of Using Google Cloud Computing for Developing Distributed Applications” has told that IT as a dynamic field changes very rapidly; efficient management of such systems for most of the companies requires handling tremendous complex situations in terms of hardware and software setup. Hardware and software itself changes quickly with time, and keeping them updated is a difficult problem for most companies; the problem is more emphasized for the companies having large infrastructure of IT facilities such as data centers which are expensive to be maintained.

Many applications run on the company premises which require well-prepared staff for successfully maintaining them. With the inception of Cloud Computing, many companies have transferred their applications and data into cloud computing-based platforms in order to have reduced maintenance cost, easier maintenance in terms of hardware and software, reliable and securely accessible services. The benefits of building

distributed applications using Google infrastructure are conferred in this paper.

[5] *Ulrich Hoefer, Daniel Gutmachera,* "Fire Gas Detection," *Procedia Engineering*, Volume 47, 2012, have explained that most but not all fires emit smoke aerosols at some point during the combustion process. Therefore most conventional fire detectors are based on the detection of smoke by light scattering. As every fire is emitting specific gases, it is reasonable to upgrade photoelectric fire detectors or even replace them for specific environments with gas sensor-based technologies. In this paper, we present some gas detection technologies which have the potential to be able to amend or replace existing systems for use, especially in residential fire detectors. But here, some restrictions apply when using gas sensors. Among others, these are low cost, low power and long term requirements. We identified advantages but also some challenges of gas detection technologies by testing colorimetric gas sensors, gas-sensitive field-effect transistors and metal oxide sensors. As most technologies are not completely selective to the target gas and as there is no "the" fire with one specific mixture of combustion gases, it is helpful to combine different sensing elements in sensor arrays

where algorithms using pattern recognition methods like PLSDA, PCA etc. can be used to increase the prediction reliability and the false alarm robustness. Here we focused on typical combustion gases like CO, CO₂, NO, NO₂, NH₃ and H₂.

[6] *Niranjana, R. and Hemalatha T.*, “An autonomous IoT Infrastructure for forest fire Detection and Alerting System” has explained how an uncontrolled blaze occurred by weather, wind, and dry underbrush can burn acres of land and consume everything in their paths which cause significant damage to natural and human resource. The objective of this work is to design an IoT based system that can detect the fire as early as possible before the fire spread over a large area and to prevent poaching. In our proposed system, Raspberry pi is integrated with a couple of sensors and camera. Our systems consist of a fire sensor which is used for fire detection, a PIR sensor for intruder detection with the help of image processing and a humidity sensor for temperature detection. If any catastrophic event occurs, the system will immediately send the alert message along with a picture of the affected region and device location.

METHODOLOGY

The system consists of the following technology used:

Node MCU: Node MCU is an open-source firmware for which open-source prototyping board designs are available. Both the firmware and prototyping board designs are open source. The board is built on the Express if Non-OS SDK for ESP8266. It uses many open source projects. Due to resource constraints, users need to select the modules relevant to their project and build firmware tailored to their needs.

The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards.

Temperature sensor: A temperature sensor is an electronic device that measures the temperature of its environment and converts the input data into electronic data to record, monitor, or signal temperature changes. There are many different types of temperature sensors.

Motor: An electric motor is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and electric current in a wire winding to generate force in the form of torque applied on the motor's shaft.

7805: An LM7805 Voltage Regulator is a voltage regulator that outputs +5 volts. An easy way to remember the voltage output by an LM78XX series of voltage regulators is the last two digits of the number. An LM7805 ends with "05"; thus, it outputs 5 volts.

LCD screen: A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical devices that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly, instead of using a backlight or reflector to produce images in colour or monochrome.

ThingSpeak: ThingSpeak is an open-source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP and MQTT protocol over the Internet or via a Local Area Network. ThingSpeak enables

the creation of sensor logging applications, location tracking applications, and a social network of things with status updates. ThingSpeak was originally launched by ioBridge in 2010 as a service in support of IoT applications.

ThingSpeak has integrated support from the numerical computing software MATLAB from MathWorks, allowing ThingSpeak users to analyze and visualize uploaded data using Matlab without requiring the purchase of a Matlab.

BLOCK DIAGRAM

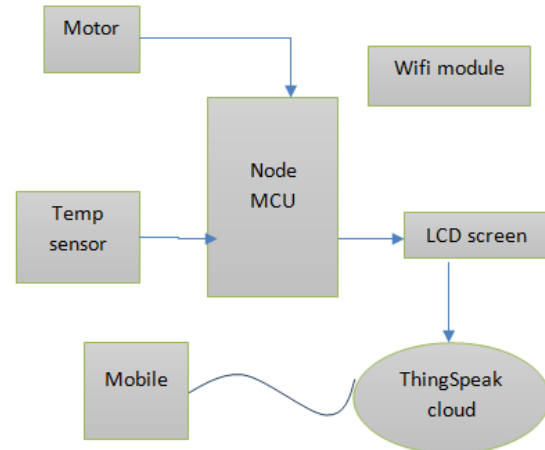


Figure 1

WORKING OF THE CIRCUIT

In the proposed system, the main concern is to implement and design a multi sensor-based IoT platform for monitoring the fluctuating temperature, disrupted power supply, i.e., voltage, gas leakages etc. The main focus of this system is preventing

any accidents which may take place due to the above factors, which may cause heavy losses to the industry. The system takes its power from the 7805 connected. On receiving the power supply, the motor or the machines in the industry start working.

After sensing data, it is sent to the cloud, which is represented in the form of a graph on Thingspeak; also, the continuous data is displayed on the LCD screen. The default temperature set in the code is 40 degree Celsius. When the system exceeds this temperature, the relay turns the transistor off, due to which the increase in temperature is stopped and also the motor stops working. As and when the motor stops working, the adverse effect which may occur due to the increase in temperature on the machine is prohibited. Many dimensions such as temperature, voltage, gas have united this system for real-time monitoring.

Another consideration in this research is based on cost-effective sensors for relative humidity, temperature measuring, voltage measuring, gas leakage sensing. This proposed system provides a special advantage where every sensor connected with an input pin within a central unit based microcontroller for sensing quality parameters value. The proposed central

unit based microcontroller system ensures that it can be easily expanded, customization and allows customization options as user requirements, simple, accurate result, easily maintenance and cost-effective, SMS alert is sent to the authorities regarding the outhold of values detected by the sensors.

If the authority does not take any actions system automatically stops the motors. This system is also monitored using IoT, the internet of things. Whenever the parameters cross the limits, the values are updated. These updated values can be viewed anywhere and anytime by opening the link given through the internet on Thingspeak. The inputs from sensors given are interfaced with IoT and made available online all the time, so anyone who has the link can view the condition of the parameter.

CONCLUSION

Commonly, industries overlook peripheral difficulties, which further can source extensive physical damages. Industries and manufacturing units should consider these concerns and undertake security and safety measures to ameliorate such situations. With the advancement in technology, it is expected that the availability of the internet is everywhere.

We are developing an industrial application using Internet of Things (IoT) technology. An IOT based protection system aims to resolve all the concerns regarding the safety of the industry. This type of system can help in industrial automation. The self-reliant system will make all the necessary intelligent decisions. The hazards caused due to the passing of the threshold value will curtail tremendously. The system ensures the monitoring of situations and alleviating the number of mishaps.

FUTURE SCOPE

The IOT based protection system can be further expanded by providing additional facility to the industry person with the help of Android app for achieving an even better control and monitoring of the industry. Also the use of various components to control operations without significant intervention from humans and to provide automatic control performance.

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