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Research paper

IOT Based 360° Industrial Guard System

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Abstract

Industrial Safety is very essential and vital as it securely shields human life, predominantly in immense risk areas such as nuclear power plants, flammable oil and gases, perilous chemical, aircraft and mining industries where even a minor fault can be calamitous. Therefore, it is crucial to maintain a safe and healthy working environment with enhanced security. The proposed system ensures complete security to the industry through various applications such as detecting overheat in machine, overload detection, gas leakage detection, valve breakdown detection and employee alcohol consumption detection through various sensors and the alerts are generated by buzzer and LCD. And it can be monitored and controlled by remote user at remote place through IOT.

Keywords*— *IOT(Internet of things), LCD(Liquid Crystal Display), Sensors.

1. Introduction

The role of Industry is tremendously vital in the economic development of under developed countries like India with enormous man power and large and varied resources. Also, more than 1.1 million people die from one or the other type of industrial accident globally which creates the tremendous need of industrial safety. The major causes of these hazards are unsafe machinery & equipment, unreliable alert systems, psychological conditions and employer's dangerous work habits. A severe industrial injury or death changes lives forever and causes unrepairable loss to all concerns.

In spite of definition and implementation of various industrial workplace rules and regulation, most of the undesirable accidents take place due to human error such as lack of attention, under the influence of alcohol, drowsiness, etc. Even though there are many monitoring mechanisms to reduce these type of accidents, they never assured a complete remote monitoring of the workplace.

IOT technology makes industrial safety more cost efficient by reducing the cost of compensation, medical-aid, factory inspection and immeasurable loss of human and other industrial resources. Everything is made available in pocket through smart phones. It is essential to modernize the management of monitoring and control activities in home or industry to save immeasurable loss of humans and resources.

This paper focuses on the above problems and provides remedy in terms of user friendly design and implementation of 360 ° Industrial guard system guarantees complete protection and precise problem identification through active detection, alert and control of machine overheat, voltage overload, leakage of gas, valve breakdown and employee alcohol consumption based on various sensors such as alcohol sensor, pressure sensor, gas sensor, temperature sensor, CT coil and IOT technology. By enforcement of 360° Industrial guard system possible threats and risks at industry level can be dropped dynamically.

2. Related Works

[1]. Wireless Sensing Systems for welfare of sewer laborers.

This paper focus on environmental pollution monitoring and safety mechanism for sewer laborers. The system monitors hazardous gas leakage and its concentration along with heartbeat of laborers. If both the gases along with pulse detector exceed the normal level then an warning alarm is

generated and a warning message is sent to authorized administrator and nearby health center to provide immediate medical assistance to the affected laborers.

[2]. Microcontroller based low cost gas leakage detector with SMS alert.

This paper majorly focuses on preventing the gas leakage at industry level through a device that can automatically detects and stop gas leakages of gases

such as LPG. The system uses a gas sensor to detect and alert the remote user immediately via SMS through GSM Module

[3]. Noninvasive Biological Sensor System for detection of drunk driving

The system completely intends to diminish the mortality rate due to highway and road accidents caused due to human faults like influence of drugs, carelessness and drowsiness by designing inviolable system developed to find people driving under the influence of alcohol by measuring human-biological signals brain signal waves, pulse rate signal waves and heart beat rate by using frequency time series analysis to work out to distinguish between normal and delirious states of an individual as the base concept of the integral sensing control system. The system consists of an air-pack sensor installed in an vehicle driving seat to monitor and record the pulse rate signals to estimate the behavior of the drivers.

[4]. Intelligent Security System for residential & Industrial Automation

This paper leans on High resistance grounding (HRG) concept which is a proven technology for upgrading electric fidelity for lots of industrial and viability services such as used in organic fuel-based chemical, automobile, and power plants. Many such amenities need the elevating fidelity for production and operational reasons. The system involves with the possibility of the three recurring errors occurring in the environment of an industrial plant: Three phase, phase-to phase and ground faults. These faults are resolved by using high resistance grounding and other modern strategies such as bus insulation. HRG reduces electrical threats to a very high level at industries.

[5]. Improved electrical safety through high resistance grounding (HRG).

This system involves in enhancing the security applications currently implied at industries and homes by utilizing remote monitoring and controlling mechanisms and wireless services. The system design includes modules like detection, robotics and diagnosis. It is also built with various sensors and wireless interface for data transmission. The system takes responsibility to detection of undesired events and sending images by email and alarms the user point with a SMS.

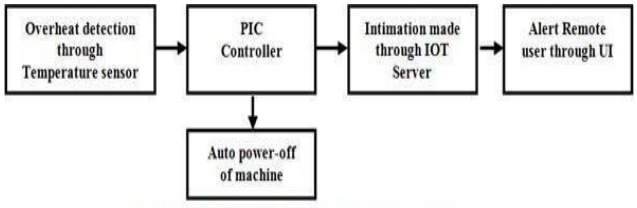

Fig2 Data Flow Diagram for Overheat detection

3. Proposed System

This paper intends to develop a complete Industrial guard
system that enables the user to remotely monitor the industrial workplace environment through Internet of things.

A. Sensor Package

Our system's sensor package consists of a temperature sensor that senses the overheat caused at the machine, a pressure sensor that monitors the valve pressure and breakdown, a gas sensor that senses leakage of gases and a alcohol senor to detect the worker's consumption of alcohol.

B. Pic Controller

In our system PIC 16F877A acts as the central controller that manages most of the functionalities of the system such as sensor reading, alerts and control. This is a lower power, high performance controller suitable for the embedded control application.

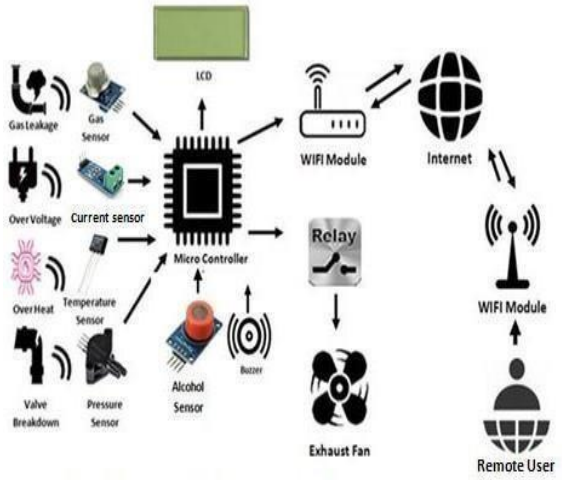

Fig1 System Architecture Diagram

C. Node Mcu Module

Our system uses Node MCU module, which is a firmware on ESP8266. It is an interactive inexpensive and open source portable wireless chip with complete TCP/IP stacks and controller potentiality. It takes responsibility for transferring the sensor readings to the web service.

D. Remote Application

In our system, the IOT based remote application acts as the user interface through which user monitors the workplace entities and receives alerts on problem detection and control.

4. Integral Methodology

Our system is a less expensive, user friendly and requires less effort to install and it also reduces various threats at industrial level. The system assures 360 ° Industrial safety by the following features:

[1] Machine Overheat Detection and control

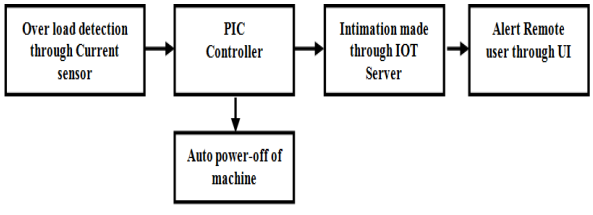

Fig5 Data Flow Diagram for Over Load Detection

On Detection of machine overheat through the temperature sensor, the system alarms the workplace employees through a buzzer and alerts the authorized remote user through user interface based on IOT server and simultaneously it leads a auto turn- off action of the machine.

[2] Gas leakage detection and control

On Detection of gas leakage through the gas sensor, the system alarms the workplace employees through a buzzer and alerts the authorized remote user through user interface based on IOT server and simultaneously it leads a auto turn-on action of the exhaust fan for air circulation.

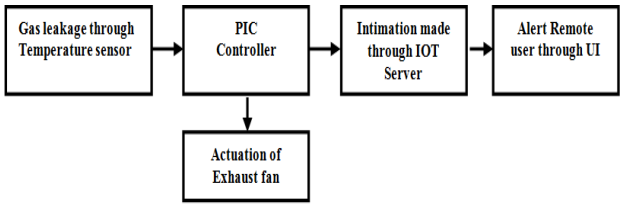

Fig3 Data Flow Diagram for Gas Leakage detection

[3] Valve breakdown detection and control

On Detection of valve breakage through the pressure sensor, the system alarms the workplace employees through a buzzer and alerts the authorized remote user through user interface based on IOT server.

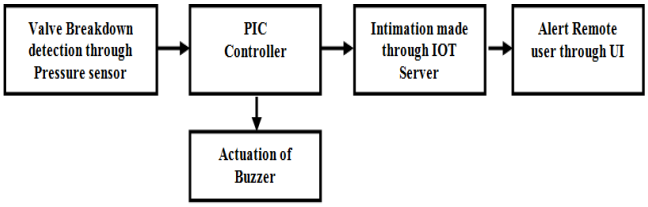

Fig4 Data Flow Diagram for Valve breakdown Detection

[4] Over Load detection and control

On Detection of machine overload through the CT coil, the system alarms the workplace employees through a buzzer and alerts the authorized remote user through user interface based on IOT server and simultaneously it leads a auto turn-off action of the machine.

[5] Alcohol Consumption detection and control

On Detection of alcohol consumption detection through the alcohol sensor, the system alarms the workplace employees through a buzzer and alerts the authorized remote user through user interface based on IOT server and simultaneously it leads a auto turn-off action of the concerned machine.

[6] Sensor status update through LCD

The current status of each sensor such as on/off alerts and alarms are also reported at the LCD for other employee's awareness.

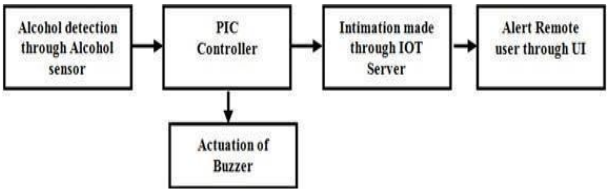

Fig6 Data Flow Diagram for Alcohol Consumption detection

5. Implementation

Our system is based on low cost and user-friendly mechanism which requires less effort to install and it also motivates the employees to work in a safe environment. The below fig8 illustrates the pictorial representation of our system installation in which the sensor package that includes gas sensor, alcohol sensor, pressure sensor, CT coil and temperature sensor are fixed at the respective machine and valves. After sensing the undesired event, the sensors intimate the PIC controller which simultaneously alerts the authorized user via IOT, alerts the employees via buzzer and initiate the relevant programmed action such as auto turn on of exhaust fan in case of gas leakage, auto turn off machine in case of overheat or overload detection, buzzer in case valve breakdown and current sensor statuses are updated at the LCD for the awareness of other employees. This system focuses on enhancing the remote monitoring and control of workplace also reducing the risks and threats at industry level to a great extent.

Fig8 System Implementation Mechanism

6. Results and Discussion

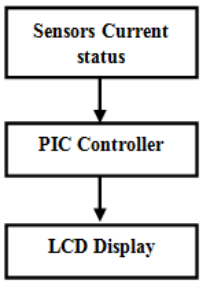

Fig7 Data Flow Diagram for Sensor status update

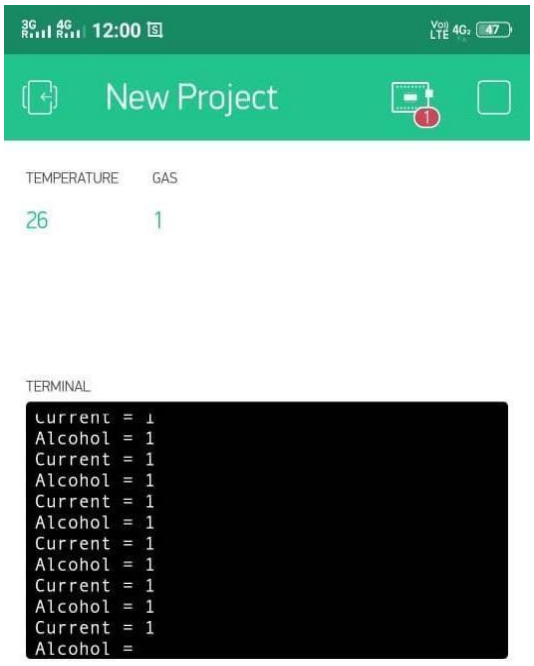

Fig9 Screenshot of remote application

As a result, the authorized user can remotely view the sensor status from anywhere using blink application configuration. The below given screenshot is the output screen enabled for the authorized user from where all updated sensor status can be viewed as depicted inFig9.

7. Conclusion

In a nutshell, Industrial sector is a vast vital sector that immensely impacts on economy of each citizen of the country, either directly or indirectly. Our system majorly intends to eliminate the problem of constant manual monitoring and reduces the various possible risks of the industrial workplace through IOT based remote android application in a cost-effective manner. This type of system also teaches workers how to work in a safe environment and makes workers feel safe and happy.

8. Future Enhancement

IOT has the potential to simplify and modernize the correct prediction of upcoming dangerous failures. Most of industrial problems are addressed and managed well through our system. The future enhancement can be focused by improving the present system with additional sensors, more dynamic user interface with real time interactive modules and voice alert modules that intensify the user's protection and practice on Industrial workplace.

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