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INDUSTRIAL AUTOMATION USING IoT & FRCNN

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***Abstract* — The Internet of Things (IoT) refers to the emergent state of the internet. It is a communication platform between humans and machine. The Internet of Things express the physical object network which are embedded with software, sensors and other technologies for communicating with multiple devices over the internet. The use of IoT device has become very effective in technological world. Now-a-days industries are facing major problems like mechanical, physical, chemical, physiological hazards. It observed that main tragedy in industries like noise pollution, toxic gas leakage and fire accident causes the damage to the industries and its employees. Noise causes health issues like high blood pressure, heart disease, sleep disturbances, stress and leads to hearing loss and other environmental activities. In industry the noise pollution is identified using noise sensor and which is controlled by using sound filter module. Fire causes serious damage to the industry. The fire is detected by using flame sensor and alerts to user using buzzer and LED indication. Faster Region based Convolutional Neural Network (FRCNN) is advance of R-CNN. The object detection is done by using FRCNN. It is a deep convolution network. Many of the workers in industries are suffering from lung cancer, Pneumonia, byssinosis by inhalation of the dust particles, so wearing the mask is mandatory one. To overcome these problems, identification of mask in workers face using data science concept with the help of technically proved algorithms with some live clicks from camera is presented. All of the above sensors are connected to the microcontroller and Arduino board.**

Key Words: Internet of Things, Noise Sensor, Gas leakage Detector, Flame Sensor, Data Science, Microcontroller, Faster RCNN Algorithm

I. INTRODUCTION (*HEADING 1*)

This Internet of Things plays a vital role in modern world. Industrial automation is implemented using IoT. Safety is very important consideration in industrial sector. Industrial machinery and processes are composed of electrical devices like rotors, stators, gears, fans, vibrating panels, turbulent fluid flow, impact processes, electrical machines, internal combustion engines which causes noise pollution to the environment. In industry, noise pollution is the major problem, which cause humans to feel noisy during working hours and the noise from the machinery disturb the environment and high noise level causes damage to human ear. Noise is very common pollution in large sectors like iron and steel industry, saw mills, textile industry and many others. Noise generation is due to crushing, drilling, cutting of woods, lathes, grinders as well as textile machineries, printing machine etc. Noise pollution is detected by using the noise sensor.

Fire accident is serious issues in large scale industries which cause damage to human life and properties. Fire incident occurs due to generation of the smoke and increase of temperature during heating process. Fire and smoke sensors are used to detect fire accident. Smoke sensor that senses the smoke before the occurrence of fire. Fire sensor is used to detect the fire and indicated by alarm sound. Then the fire is controlled by spraying the water using the water pump by relay system. Industrial gases are nitrogen, carbon dioxide, hydrogen, helium which is filled into the gas cylinder. These gases are used in the industry like oil and gas production industry, chemical industry, iron and steel industry and so on. Leakages of these gases are harmful to human health and change in environmental climatic conditions. The gas leakage leads to inhalation problems to workers and cause serious health issues like respiratory problem, cancer, mental disorder, unstable in fitness, depression.

Wearing of face mask is mandatory in industry. Because many dust particles which are invisible to naked eye may get enter into the body. Wearing mask is one of the safety measures considered in industry. Face mask detection is done with the help of data science with FRCNN algorithms.

II. LITERATURE SURVEY

Hammod Alquorabah et al. [1] proposed Smart fire detection system with automatic water sprinkler using IoT technology to obtain a average response of 5 seconds to detect the fire and alert the property owner .The continuous reading send over the Wi-Fi modules to the central unit to analyze the data and trigger the water sprinkler. Ubidots platform in the system made the data exchange faster and reliable.

Yakhyokhuja Valikhujaev et al. [2] proposed Automatic fire and smoke detection method for surveillance systems based on dilated CNNs which is fully automation to control the fire and smoke with the help of neural network architecture.

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Md. Shahriar Islam et al. [3] proposed a novel approach to detect face mask using CNN to detect the face mask in secured way and establish better surveillance. It takes an RGB input image from any orientation to obtain output. In this model, the face mask is detected from the segmented images using webcam.

Sneha Sakshi et al. [4] proposed Face Mask Detection System is implemented by python and python script in Tensor Flow and Keras framework. The use of MobileNetV2 architecture has made this model accurate and computationally efficient. The model is able to clearly identify and detect the face mask in real time videos

Panu Maijala et al. proposed an environmental monitoring system using wireless sensor running on classification algorithm and introduced cloud service and noise portal. The sensors transmitted the results to the cloud service and for visualization of the results the portal was used.

Ashish Sutradhar et al. presented a cloud-based dust and noise pollution monitoring system using a wireless sensor network for textile industry. The sensor data is transferred from the production areas to the nearest Wi-Fi zone using wireless transceiver modules. Upload the sensor data to the cloud using the Wi-Fi and graphically visualized.

Sasikumar and Sriramya proposed a forest fire detection model using Arduino. When the temperature is increased then it will automatically displayed on the LCD. The model sends the message to the registered user and buzzer gets activated and intimated to the authorities when flame is increased.

III. EXISTING METHODOLOGY

Before you begin to format your paper, first write and save the content as a separate text file. Complete all content and organizational MQ-5 sensor is used to find smoke and also used to find methane, alcohol. The sensor accuracy is hard to tell because reading is based on converting the voltage into a percentage by using mathematical approach. Temperature sensor measures the temperature level and the accuracy of this sensor doesn't follow a pattern and it compare the results with infrared thermometer but it is not connected to the sprinkler system because the voltage varying formula is used to convert voltage into temperature so the results are affected by time delay.
If the temperature level gets increases or smoke gets detected, then the sprinkler system gets ON or otherwise it continuously takes reading for every 5 seconds.

IV. PROPOSED SYSTEM

This system works to detect masked face during this COVID-19 situation to occupy a big part so as to remodel corona virus from one person to a different person. To detect the face mask, the FRCNN algorithm is employed to obtain higher accuracy and able to detect the mask in time from every possible angle. While someone enters the surveillance area without wearing a mask, then the system provides a security attentive to notify the authority. This paper presents a geminate mask face detector which is able to detect mask and it irrespective of arrangement and train it in an exceedingly proper neural system to induce precise outcomes. It takes an RGB input image from any orientation to obtain output. The main function is feature extraction and sophistication prediction to the photographs within the feature extraction system, the image is sketched and created into a brand new image where the generated image is more efficient than the previous image. During this part, an oversized number of images dimensionally reduce to an efficient representation during which a remarkable part of the image is captured. After doing features extraction in every convolutional layer it gives an output that works better for the image and represents those images as a group of labelled images. In this proposed model mask is detected from the segmented image or using the webcam.
The variety of sensors is used to detect temperature, gas and flame sensor as an input. The readings from the inputs are sent to the user and fire station. Outputs like LED and buzzer indicate fire in the particular unit to control fire by using sprinkler system. For gas detection MQ-6 sensor is used because, the accuracy of this sensor is high compared to other sensors. Noise sensor is used to measure the noise level and control the noise level by using Sound filter module

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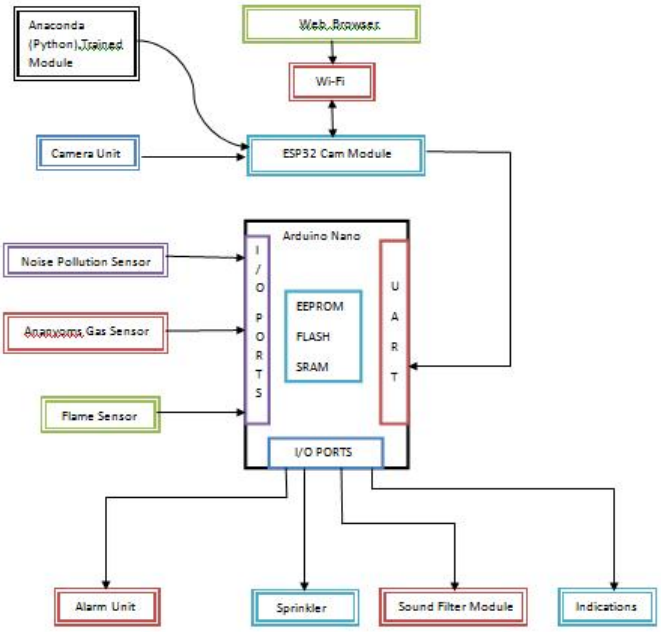
V. BLOCK DIAGRAM



a) Flame sensor

Flame Sensor detects flame by using Infrared sensor outputs. The sensitivity is often adjusted at the quantity of the module. Flame sensors are most sensitive to ordinary light and generally used as fire alarm and other purposes. A tiny low panel output interface is directly connected with the microcontroller IO port. The sensor and therefore the flame must maintain a particular distance (more distance 80cm), so as to not damage the sensor

Figure 2: Flame Sensor

b) Buzzer

A buzzer is an electromagnetic or piezoelectric or mechanical type. The main function of buzzer is to convert signal from audio to sound. The device indicating sound is used for alerting various events. If the voltage is high, the sound is loud. If the voltage is low, the sound is low.

Figure 3: Buzzer

c) Arduino Nano

Arduino Nano is small, flexible and breadboard-friendly microcontroller board and it is based on Atmega328p developed by Arduino.cc. It has 14 digital pins, 8 analog pins, 2 reset pins and 6 power pins .The Arduino Nano is programmed by using

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Arduino IDE. It is a smaller version of Arduino UNO and has same functions. The operating voltage of Arduino Nano 5V and the input voltage vary from 7 to 12V.

Figure 4: Aurduino Nano

d) MQ-6 Sensor

The MQ-6 module is employed in gas leakage detecting equipment in family and industry. This module has high sensitivity to LPG, iso-butane, propane and LNG. It is used to detect the presence of alcohol, cooking fumes, and cigarette smoke. The module gives out the concentration of the gases as an analog voltage like concentration of gases.

Figure 5: MQ-6 Sensor

The module also has an onboard comparator for comparing against an adjustable preset value and giving out a digital high or low which is easily interfaced together with Arduino or Raspberry Pi. This sensor is simple-to-use in Liquefied Petroleum, iso-butane, propane gas Sensor module, suitable for sensing LPG (composed of mostly propane and butane) concentrations within the air. The MQ-6 detect gas concentrations anywhere from 200 to 10000ppm.This sensor features a high sensitivity and fast reaction time.

The sensor's output is an analog resistance. The drive circuit is simple, consisting of power heater coil with 5V, load resistance, and connect the output to an ADC. Sensitive material of MQ-6 gas sensor is SnO2, with lower conductivity in clean air.

When the target combustible gas exist, the sensor's conductivity is higher together with the gas concentration rising. Simple electro circuit converts change of conductivity to corresponding signal of gas concentration. MQ-6 gas sensor has high sensitivity to Propane, Butane and LPG, and also response to gas. The sensor detects different combustible gas, especially Methane with low cost and suitable for various applications.

e) CAM Module

The ESP32 CAM WiFi Module Bluetooth with OV2640 Camera Module 2MP for Face identification is a very competitive small-size camera module that operate independently as a minimum system with a footprint of only 40 x 27 mm; a deep sleep current of up to 6mA and is widely employed in various IoT applications. It is suitable for home smart devices, industrial wireless control, wireless monitoring, and other IoT applications.

Figure 6: CAM module

This module adopts a DIP package and directly inserted into the backplane to comprehend rapid production of products, providing customers with high-reliability connection mode, which is convenient for application in various IoT hardware

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terminals. ESP integrates Wi-Fi, traditional Bluetooth, and BLE Beacon, with 2 high-performance 32-bit LX6 CPUs, 7-stage pipeline architecture. Frequency adjustment range of 80MHz to 240MHz, on-chip sensor, Hall sensor, temperature sensor, etc are inbuilt in this module.

f) Sound Sensor

A sound sensor detects sound waves through intensity and converted into electrical signal. The sound sensor has microphone, amplifier and peak detector. The sensor is used to detect the noise level at the frequency the range from 3 KHz to 6 KHz.

Figure 7: Sound Sensor

g) Wi-Fi Module

The ESP8266 Wi-Fi Module is self contained SoC with integrated TCP/IP protocol stack that give any microcontroller access to Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

Figure 8: Wi-Fi Module

Each ESP8266 module comes pre-programmed with an AT command set firmware. The ESP8266 module is a particularly cost effective board with a large, and ever growing, community. This module features a powerful enough on-board processing and storage capability that enables it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime.

Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is meant to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces; it contains a self-calibrated RF allowing it to figure under all operating conditions, and requires no external RF parts.

VI. CONCLUSION

The Industrial automation methodology will be applied to every industry to reduce man power and for security purpose. There is an immense need of implementing Industrial Automation using IoT. This work demonstrates safety measures for the employees, increase reliability and profitability. The data can be collected through the sensor and these sensed data will transmit through IoT and analyzed by the system to take preventive measures.

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