Smart Toxic Gas Analyzer Using IoT AR

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Abstract— Nowadays, people are affected by harmful gases in the environment. Poor environmental conditions can lead to severe health problems. Toxic pollution corrupted in water, soil, and air is harmful or poisonous. Harmful gas leakage accidents are the main reason for workers death in Industries which work mainly using chemicals. Contamination comes in many forms, and it infects people differently, in ways that may not be immediately noticeable. This system is made for people safety applications. This project aimed to monitoring toxic gases in deleterious environmental and industrial places for safety applications based on Internet. The proposed system is to monitoring harmful gases like Carbon Monoxide, Methane, Air quality, Flammable gas, Humidity and Temperature using Sensors, which connected with Arduino. The data are send to Laptop through the serial port which are displayed on the screen. The values and hazards are display on the mobile application.

Keywords: Air Quality Monitoring, Sensors, Arduino, Mobile Application, Unity, Vuforia

I. INTRODUCTION

Air pollution mainly caused due to the presence of particular matter, harmful materials and biological molecules in earth atmosphere. It has adverse impact on living organisms such as humans, animals, food crops and can also damage built a natural environment. It may result in allergies, harmful diseases such as cardio vascular diseases, lungs diseases and cause death. Sometimes deadly gases like Carbon monoxide (CO), Methane (CH4) may be present. The earlier studies [1,2,3] is based on GSM based application to alert the person by a text message whenever harmful gases are detected.

Developed an tool to Transmit data in studies [4,5]. The tool provides the provision to monitor the quality of air by detecting the harmful gases present in the atmosphere. The pollution level can be monitored remotely using PC or smart phones. The study [6,7,8] explains about how to transmit the data to clouds and receive via the PC or mobile application which we created. [9,10] explains how to make the device to be portable and make it use at random places.

Therefore, the simple system proposed to monitor the harmful gases in hazardous environment. The work presents to monitoring toxic environment conditions like temperature and relative humidity. The collected data transmitted from sensor to mobile phone using Bluetooth. The parameters monitored like CO, temperature and humidity and data transmitted to mobile. The work described presents to monitoring urban environment using sensors. The parameters like temperature, humidity, atmospheric pressure, ambient light. Due to human error and machine failures etc. gas leakage accidents occur often but ceases many workers in to deathbeds. Gas leakage and detection of gas leakages and harmful gases in and around industries and can be effectively handled by using sensors. Here we developed a basic model for detection of harmful gases and measurement of harmful gases on a self-calibrated ppm scale and notifying in the mobile application.

II. LITERATURE SURVEY

R.Rajalakshmi and J.Vidhya (2019), describes Toxic Environment Monitoring Using Sensors Based on Arduino. When the parameter level exceeds the threshold value, the mobile will alert the user through GSM. The discovering and observing of poisonous gases are taken as alert for the user.

Akshatha S and Jayaram M N (2019), describes Air quality and Dust level monitoring using IOT. It use various sensors and server to design an efficient air quality monitoring system without effecting the natural environment and provide live updates to avoid conflicts. The output shows the variations in the atmosphere temperature leads in variation of formaldehyde, dust and humidity. So, from the results we can clearly notice that the quality of air in atmosphere.

R.Rajalakshmi and J.Vidhya (2018) described Survey on Toxic Envirinment monitoring using Sensors, which collects the data from different sensors and interfaces with the Wi-Fi. The sensors in real-time and transmitted to a cloud server will monitor environmental data. The data can displayed to users through a web-based application. The device will alert the user via a mobile application when an emergency condition is detected using GSM.

Ashwini M. S., P. Ganesh, Dwarakanath G. V.(2019) described Air pollution monitoring system using node MCU and air quality Sensors. In this, the pollution level can be monitored remotely using PC or smart phones. The data is store in cloud and can be accessed remotely.

III. METHODOLOGY

Sensors (CO, Methane, Temperature and Humidity, Air quality) are connected with Arduino to get the environmental values. The values get from the sensor and send to the local web server. The AR mobile application is created using unity which gets data from the local server and display the air quality data and hazards.

The automation is done using hardware components, which enables wireless communication and can control the behavior of sensors. Arduino is responsible for controlling sensors such as Temperature and Humidity sensor, Air quality Sensors and Gas Sensors. Arduino sends signals to each sensor to perform specific action or retrieve data from a specific sensor. The data sent from the microcontroller is sent to the PC application, which send data to webpage.

The integration of networking and storing the data in the internet is more efficient and safer. In this system, real-time monitoring is done with the help of mobile application, which can monitor the parameters like Temperature, Humidity, flammable gases and PPM of Air Quality of the

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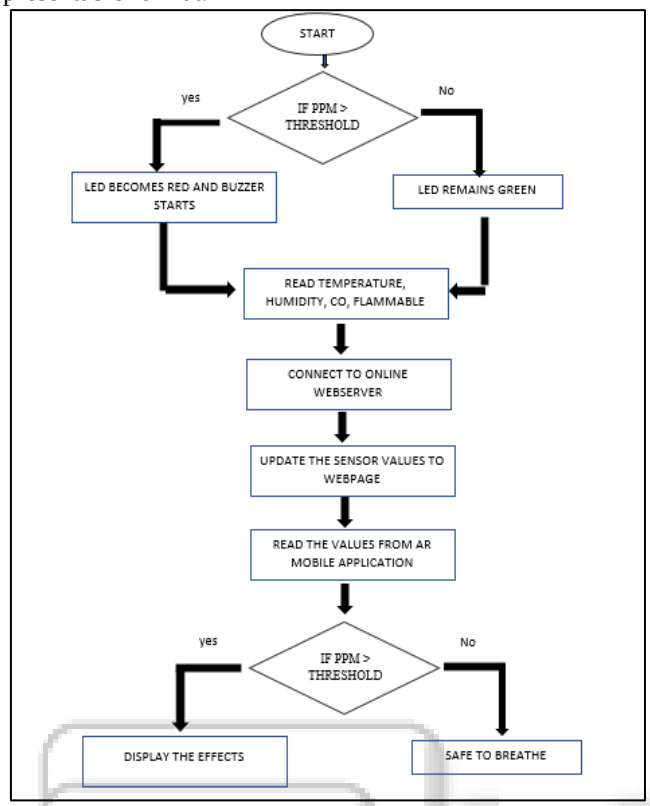
remote location. The system can represent the data in a presentable format.



Flow diagram of Smart toxic gas analyzer using IOT AR

IV. HARDWARE MATERIALS

A. Arduino UNO Board

The Arduino UNO which is used in Smart toxic gas analyzer.

Arduino Uno is a microcontroller board based on the ATmega328P.

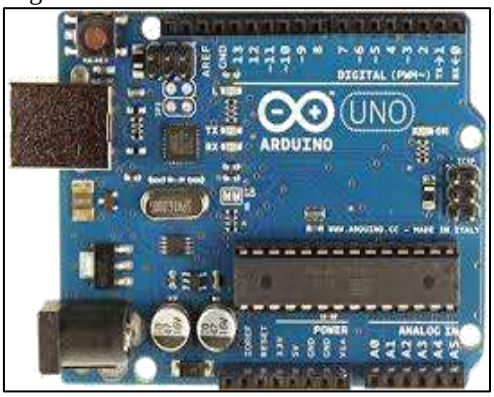


Fig. 4.1: Arduino board

It has 14 digital input/output pins, 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller.

The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

B. Carbon Monoxide Sensor (MQ9)

Carbon Monoxide Sensor (MQ9) is a sensor that is sensitive to effects of CO. CO is a very dangerous gas, which is odourless, colourless, and tasteless, so it cannot be smell, seen, or tasted. CO is measured in parts per million (ppm).The average level in homes is 0.5-5ppm.

Fig. 4.2: MQ9 Sensor

Each year, several thousand American workers are killed outright from carbon monoxide exposure, making the poisonous gas one of the most dangerous and widespread industrial hazards. Carbon monoxide causes more deaths than any other toxic agent except alcohol. At least another 10,000 workers suffer from the debilitating effects of high-level exposure. Millions more are subject to low-level, long-term carbon monoxide exposure, the effects of which are not well defined.

C. Temperature Sensor (DHT11)

DHT11 is a Humidity and Temperature Sensor, which generates calibrated digital output. DHT11 can be interface with any microcontroller like Arduino, Raspberry Pi, etc. and get instantaneous results. DHT11 is a low cost humidity and temperature Sensor which provides high reliability and long term stability.

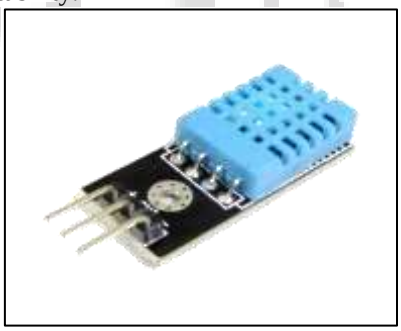


Fig. 4.3: Temperature Sensor

Temperature Sensors is a device, usually an RTD (resistance temperature detector) or a thermocouple, that collects the data about temperature from a particular source and converts the data into understandable form for a device or an observer.

D. Air Quality Sensor (MQ135):

Air quality sensor for detecting a wide range of gases, including NH3, NOx, alcohol, benzene, smoke and CO2. Ideal for use in office or factory. MQ135 gas sensor has high sensitivity to Ammonia, Sulfide and Benze steam, also sensitive to smoke and other harmful gases.

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Fig. 4.4: Air Quality Sensor

MQ135 Gas Sensor module for Air Quality having Digital as well as Analog output. Sensitive material of MQ135 gas sensor is SnO2, which with lower conductivity in clean air.

E. Smoke Sensor (MQ2) and Flammable Sensor

MQ-9 gas sensor using gas-sensitive materials with lower conductivity in clean air tin oxide (SnO2).

Fig. 4. 5: Smoke Sensor (MQ2) and Flammable Sensor

High and low temperature cryogenic loop detection mode (1.5V heating) to detect carbon monoxide sensor conductivity increases with the increase in the concentration of carbon monoxide gas in the air, high temperature (5.0V heating) detection of combustible gases methane, propane and cryogenic cleaning adsorption of stray gas.

V. SOFTWARE DESIGN

Embedded 'C' language is more predominantly device used to the code for interfacing all sensors and modules To Arduino board. The Arduino Integrated Development Environment (IDE) tool is prone to debug the developed.

A. Unity

Unity is a cross-platform game engine developed by Unity. Technologies used to develop video games for PC, consoles, mobile devices and websites.

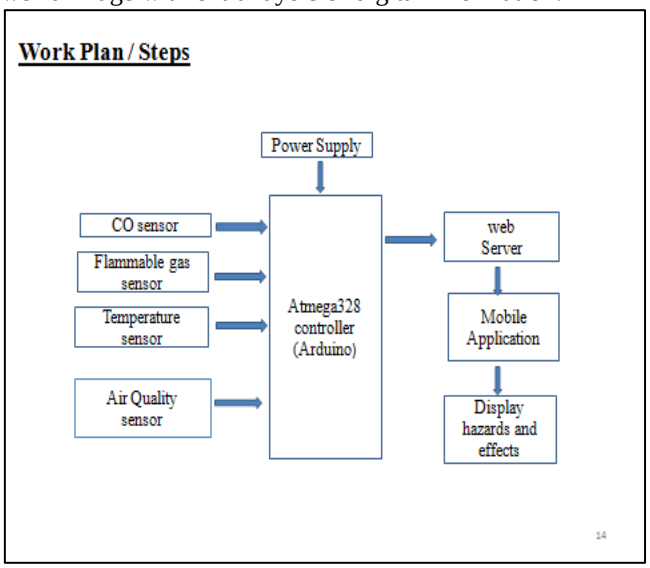
B. Vuforia:

Vuforia is an augmented reality software development kit (SDK) for mobile devices that enables the creation of augmented reality applications. It uses computer vision technology to recognize and track planar images and 3D objects in real time.

C. Augmented Reality:

Augmented reality (AR) is an interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, haptic, somato sensory and olfactory.

In fundamental terms, the expression Augmented reality, often abbreviated to AR, refers to a simple combination of real and virtual (computer-generated) worlds. Given a real subject, captured on video or camera, the technology 'augments' (= adds to) that real-world image with extra layers of digital information.



Work plan of Smart toxic gas analyzer using IOT AR

VI. SYSTEM IMPLEMENTATION

A. Hardware Output

The four mentioned sensors are connected to the Arduino board, which gets data from environment and send to the PC application via USB cable. The sensors are configured according to the room temperature. The connected sensors are assigned with particular threshold. If reaches above the assigned threshold, the buzzer will ring and in the red led for danger indication will switched on.

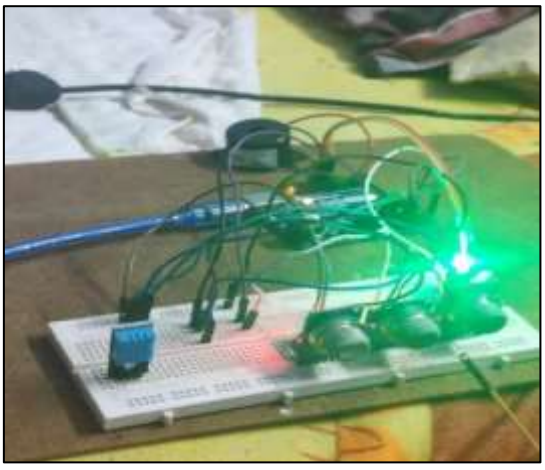


Fig. 6.1: Hardware output

The image shows that the setup is tested under normal condition. The green light indicates the environment is clear and without polluted.

When the setup is under smoke, the red light is switched on and buzzer is alarmed successfully.

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B. Software Output

Fig. 6.2.1: Data send through Internet

Fig. 6.2.2: Software Output

The application "Data Receiver" is created by unity in order to receive the data from Arduino. The received data is transmitted to the webpage, so that the user can access the data from any place. The php is created to receive the data from the application, which is connected with Arduino. The received data will be stored in a text file. Whenever new data received by the php file, the older data from the text file is replaced with the new data.

The Augment reality mobile application is created to get the data from the text file created.

The application can be updated every second. Based on the data received from the application, the preventive measures and first aid will be displayed.

VII. Conclusion

This paper aimed to monitoring toxic gases in deleterious environmental conditions for safety applications. The proposed system is to monitor harmful gases like Carbon Monoxide, Flammable gas, Air quality, Humidity and Temperature using sensors which are connected with Arduino. The data are send to an mobile application which are displayed on the screen. The values and hazards are displayed on the mobile app. It is portable, so we can used in industries as well as domestic purposes.

VIII. Future scope

This system is user friendly and cost of the product is affordable. This system is monitoring only five parameters and hence can be expanded by considering more parameters that cause the pollution especially by the industries. Many pollutants do not have sensors that sense them if available they are very expensive and hence building sensors for different parameters might be a future and very challenging task. The developed system consumes too much power, so we can use solar power as an external source of energy in future and it will definitely improve the reliability of the system.

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