IOT BASED AIR AND SOUND POLLUTION MONITORING SYSTEM- A REVIEW

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ABSTRACT: This article proposes and analyse a system which is used for air and sound pollution monitoring. The system is fully Internet of Things (IOT) based and highly desirable in field of pollution control. In this system we can detect the level of pollution (Air or Sound) time by time. The article explains the different units such as hardware and software used in the proposed system and also explains the modelling and working of the basic components used in the proposed system such that IOT and its working, Microcontroller(Arduino Uno R3) and its architecture, Gas sensor and its features, Sound sensors and its specifications and ESP8266 Wi-Fi Model.

KEYWORDS: IOT, Air and Sound Pollution, Arduino Uno, Air and Sound sensors, Wi-Fi Model.

I.INTRODUCTION

The main objective of IOT Air & Sound Monitoring System is that the Air and sound pollution is a growing issue these days. It is necessary to monitor air quality and keep it under control for a better future and healthy living for all. Here we propose an air pollution as well as sound pollution monitoring system that allows us to monitor and check live air pollution as well as sound pollution in an area through IOT. Project uses air sensors to sense presence of harmful gases/compounds in the air and constantly transmit this data. Also, it keeps measuring sound level and reports it. The sensors interact with Ardiuno which processes this data and transmits it over the application. This allows authorities to monitor air pollution in different areas and act against it. Also, authorities can keep a watch on the noise pollution near schools, hospitals and no honking areas, and if system detects air quality and noise issues it alerts authorities so they can take measures to control the issue. Some future consumer applications envisioned for IOT sound like science fiction, but some of the more practical and realistic sounding possibilities for the technology include: Receiving warnings on your phone or wearable device when IOT networks detect some physical danger nearby such as Self-parking automobiles, automatic ordering of groceries, automatic tracking of exercise habits and other day-to-day personal activity including goal tracking and regular progress reports. Network Devices and the Internet of Things All kinds of ordinary household gadgets can be modified to work on IOT system. Wi-Fi network adapters, motion sensors, cameras, microphones and other instrumentation can be embedded in these devices to enable them for work in the Internet of Things. Home automation systems have already implemented primitive versions of this concept for things like light bulbs, plus other devices like wireless scales and wireless blood pressure monitors that each represents early examples of IOT gadgets.

In June 2013 Pravin J et al.[1] Proposed an industrial pollution monitoring system using lab view and GSM. This method is to form a system for reading and monitoring pollution parameters and to notify pollution control system when one of them factors goes greater than industry standards with using a mechanism of GSM and Lab-VIEW [1][2][3]. In 2014 Souvik Manna et al. [4][5][6] Proposed a vehicular pollution monitoring using lot. Here, mixture of Wireless Sensor Network and Electrochemical Toxic Gas Sensors and the use of a RFID tagging system to monitor car pollution records anytime anywhere. In 2014 a method was designed to implement an efficient monitoring system through which the required parameters are monitored remotely using internet and the data gathered from the sensors are stored in the cloud and to project the estimated trend on the web browser. A solution for monitoring the noise and CO levels i.e., any parameter value crossing its threshold value ranges, for example CO levels in air in an area exceeding the normal levels etc., in the environment using wireless embedded computing system is proposed in this paper. The solution also provides an intelligent remote monitoring for an area of interest. In this paper, we also present a trending results of collected or sensed data with respect to the normal or specified ranges of parameters [7][8]. In 2015,a real time monitoring of three gases are simulated in real environment.by Shadrach Tunde, Akinkaude kowawole [9].Gases that are monitored in this implementation are Carbon monoxide, carbon dioxide & Sulphur dioxide. In this simulation, these three gases are successfully tested in the areas and then extended the simulated results to update in web. As the technology increase, the degree of automation (minimizing the man power) in the almost all sectors are also increases. Wireless Sensor Networks (WSN) is gaining the ground in all sectors of life; from homes to factories, from traffic control to environmental monitoring. The air pollution monitoring system contains sensors to monitor the interested pollution parameter in environment. They simulated the three air pollutants gases including carbon monoxide, carbon dioxide & sulphur dioxide in air because these gases decides the degree of pollution level. They also applied the approach in various applications like leaking cooking gas in our homes, to alert the workers in oil & gas industry to detect the leakage etc. This simulation creates the awareness in people in cities [9]. In 2016 Navreetinder Kaur, Rita Mahajan [10] carried out work for pollution monitoring system in wide area for making the smart environment. Different techniques and algorithms were used. Architectures, applications, and related design issues are discussed. In this work, smart environments represent the trend towards increasing automated environmental monitoring with association of the wireless sensing devices to environmental events and phenomena Learning Activity Models for

Multiple Agents in a Smart Space for modeling and automating resident activity in multiple-resident intelligent environments, using passive sensors to identify the individuals and their activities in an intelligent environment is presented [10]

IOT:

Fig 1: IOT World

The IOT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, virtual power plants, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Experts estimate that the IoT will consist of about 30 billion objects by 2020. Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine (M2M) communications and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices (including smart objects). "Things", in the IoT sense, can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, cameras streaming live feeds of wild animals in coastal waters, automobiles with built-in sensors, DNA analysis devices for environmental/food/pathogen monitoring. These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices. Current market examples include home automation (also known as smart home devices) such as the control and automation of lighting, heating (like smart thermostat), ventilation, air conditioning systems, and appliances such as washer/dryers, robotic vacuums, air purifiers, ovens, or refrigerators/freezers that use Wi-Fi for remote monitoring. Examples also include Smart cities, fitness and health monitoring, Industrial automation for gathering of data.

II.SYSTEM MODEL AND COMPONENT ANALYSIS

I. Block Diagram:

Proposed system can detect the harmful gases and Excessive noise. This system is new concept which can detect both Air and Sound pollution. The sensor we are using here is MQ135 as air and Microphone as sound sensor. Sensor MQ135 is air quality sensor which is used to detect the harmful gases like NH3, CO, CO2 and SO2. The MQ135 sensor is sense the condition and gives the signal to the system. The air and sound pollution monitoring system consist of Gas sensor (MQ135), Sound sensor, Arduino microcontroller, ESP8266 Wi-Fi module and cloud etc.

The block diagram for the working of the Sound and air pollution monitoring system is as following:

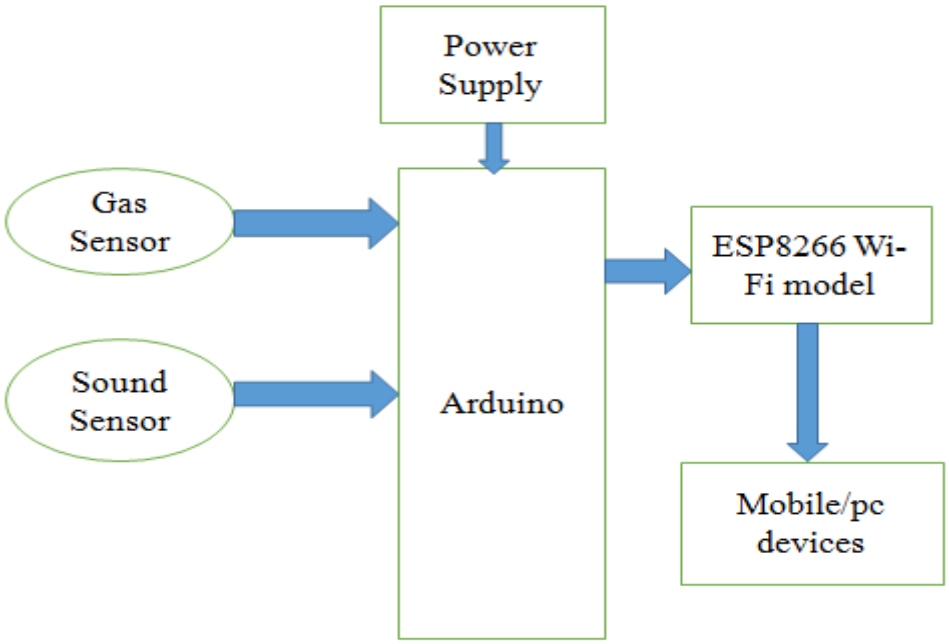

Fig 2: Block Diagram of Proposed System

The sensor we are using here is MQ135 and Microphone sound sensor. Sensor MQ135 is air quality sensor which is used to detect the harmful gases like NH_3, CO, CO_2 and SO_2. The MQ135 is used to measure the air quality of the atmosphere. Microphone sensor shows the noise value in dB. Here we proposed a system in which the Arduino is the heart of the system. The atmospheric condition is checking by the sensors all the time. When the sensed value reaches to the threshold point then sensor gives that information to the Arduino.

After that Arduino check all sensor value. Arduino then process the values and gives the signal to the webpage. This system is based on the Arduino and all the processing is takes place in Arduino only. Wi-Fi module is providing the network connection to the computer for sending the information to the public.

This allows authorities to monitor air pollution in different areas and act against it. Also, authorities can keep a watch on the noise pollution near schools, hospitals and no honking areas.

II. Components Analysis:

1. Arduino controller: Arduino Uno R3 microcontroller. It is the most flexible hardware platform used based on ATmega328P which can be programmed according to the function where it is to be used. It has 6 analog inputs, 14 digital input/output pins(6 pins of these can be used as PWM outputs) , a USB connection, a 16 MHz quartz crystal, SPI, serial interface, a reset button, a power jack and an ICSP header.

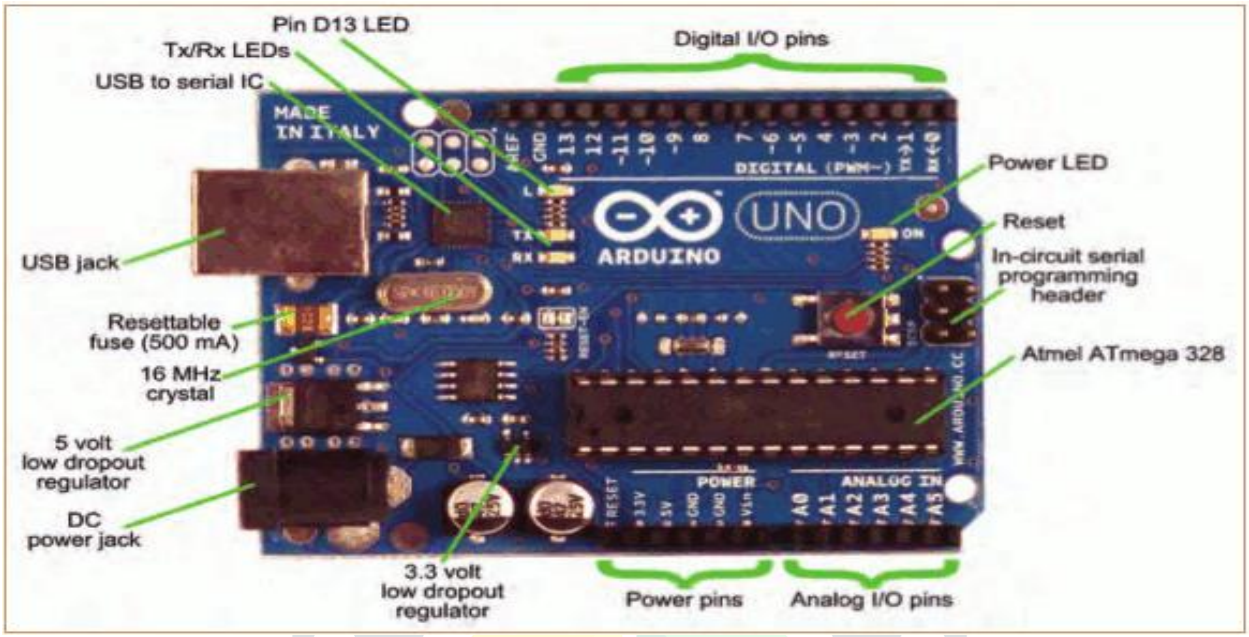

Fig 3: Arduino Uno board

It is the primary component of the framework. In addition, it is an open source microcontroller device with easily accessible software/hardware platform and is compatible with many sensors available. Everything needed for its working is present on the board; we only require a USB cable to directly connect it to the computer or give power using battery source or AC to DC adapter to get started.

Also, it is not expensive and can be assessed with free authoring software i.e. IDE. With the availability of a large no. of source codes over the internet, the programming of Arduino becomes easy. The online growing community backing Arduino consists of programmers like us that share their examples for others to make it a more reliable platform

Parameter	Value
CPU type	8-bit AVR
Performance	20 MIPS at 20 MHz
Flash memory	32 kB
SRAM	2 kB
EEPROM	1 Kb
Pin count	28-pin PDIP, MLF, 32-pin TQFP, MLF
Maximum Operating Frequency	20 MHz
Number of touch channels	16
Hardware Q-Touch Acquisition	No
Maximum I/O pins	26
External Interrupts	2
USB Interface	No

2. Gas Sensor: Sensitive material of MQ135 gas sensor is SnO2, which has lower conductivity in clean air. When the target combustible gas exist, the sensor's conductivity is higher along with the gas concentration rising. MQ135 gas sensor has high sensitity to A Sulfide and Benze steam, also sensitive to smoke and other harmful gases. It is with low cost.

Specification of MQ135

- Operating Voltage: 5V DC.
- Type: Analog & Digital.
- Pin:1-O/P,2-GND,3-Vcc
- Detecting Type: Air Quality.
- Sensitivity to Ammonia,Sulphide and Benzene steam.
- Detecting Range: 100-1000ppm

Feature:

- Good sensitivity to Harmful gases in wide range.
- High sensitivity to Ammonia, Sulfide and Benze.
- Long life and low cost.
- Simple drive circuit

Fig 4: Gas sensor(MQ135)

3. Sound Sensor: The sound sensor module provides an easy way to detect sound and is generally used for detecting sound intensity. This module can be used for security, switch, and monitoring applications. Its accuracy can be easily adjusted for the convenience of usage. It uses a microphone which supplies the input to an amplifier, peak detector and buffer. When the sensor detects a sound, it processes an output signal voltage which is sent to a microcontroller then performs necessary processing.

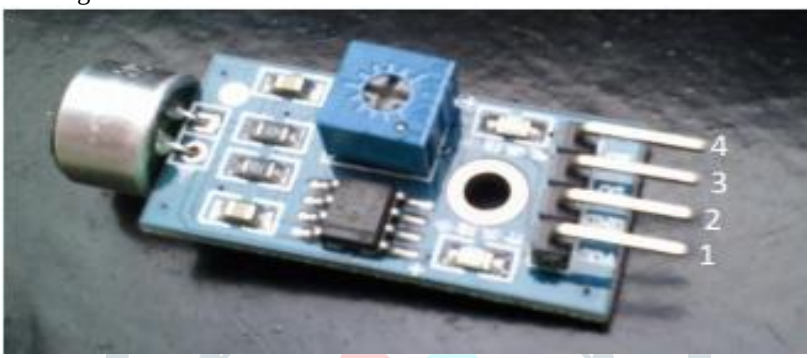

Fig 5: Sound Sensor and its Pin-Out

Specification of Sound Sensor:

- Operating voltage 3.3V-5V
- Output model: digital switch outputs (0 and 1, high or low level)
- Voltage Gain 26dB
- Microphone Impedance 2.2kΩ
- Microphone Frequency 16.20 kHz

Pin Configuration:

1. VCC: 3.3V-5V DC
2. GND: ground
3. DO: digital output
4. AO: analog output

4. ESP8266 Wi-Fi model: ESP8266 is an impressive, low cost Wi-Fi module suitable for adding Wi-Fi functionality to an existing microcontroller project via a UART serial connection. The module can even be reprogrammed to act as a standalone Wi-Fi connected device

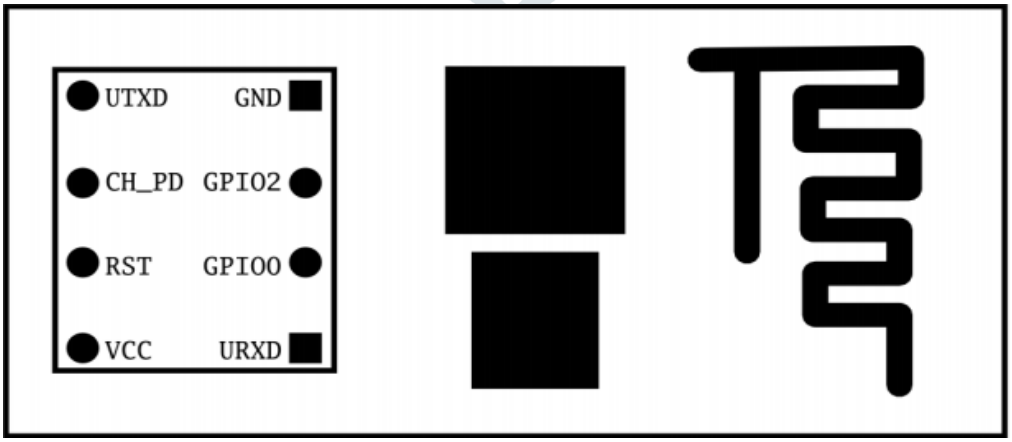

Fig 6: Wi-Fi module and pin out (ESP8266)

Specification and Pin-Out of Wi-Fi module:

- 802.11 b/g/n protocol
- Wi-Fi Direct (P2P)
- Integrated TCP/IP protocol stack
- Integrated PLL, regulators, and power management units

- +19.5dBm output power in 802.11b mode
- Integrated temperature sensor
- Supports antenna diversity
- Power down leakage current of < 10uA
- Integrated low power 32-bit CPU could be used as application processor

III. Algorithms and Software:-

1. Proteus: The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and electronic technicians to create electronic schematics and electronic prints for manufacturing printed circuit boards. It was developed in Yorkshire, England by Lab center Electronics Ltd and is available in English, French, Spanish and Chinese languages.

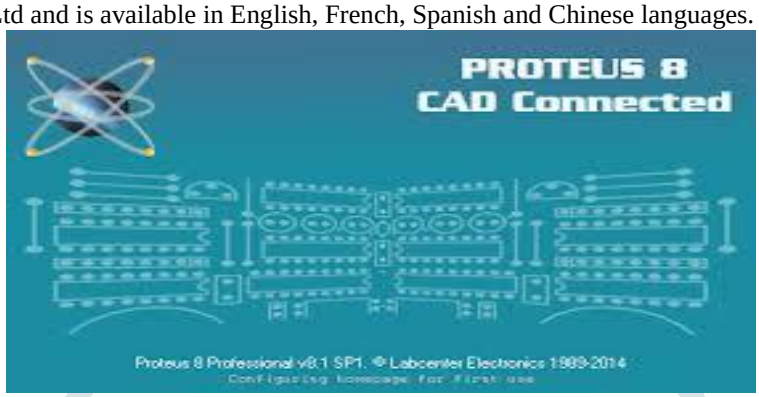

Fig 7: Proteus8 software

2. Arduino IDE: A program for Arduino may be written in any programming language for a compiler that produces binary machine code for the target processor. Atmel provides a development environment for their microcontrollers, AVR Studio and the newer Atmel Studio. The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus.

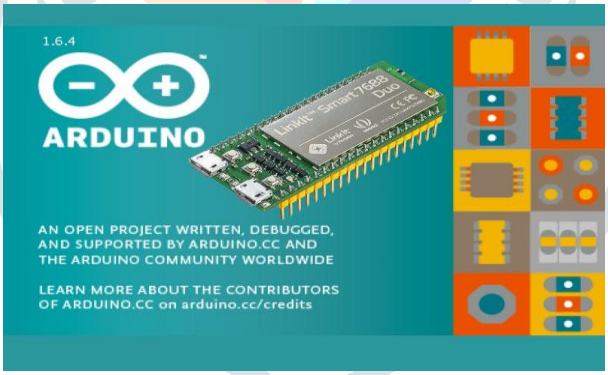

Fig 8: Arduino Software

III.APPLICATIONS AND ADVANTAGES

1. Applications:

- Industrial pollution monitoring.
- Public places.
- School area.
- Environmental Section.
- Installed in Vehicles.

2. Advantages:

- Remotely we can Monitor Pollution.
- Cheap In Cost.
- Data can be used to control pollution.
- Small in size.
- Data is useful for government Health departments.

IV.CONCLUSION

Thus the article explains the basic structure and system design for IOT based air and sound pollution monitoring system. The article also explains the basic blocks and components used in this system. It's a complete case study for the proposed system design. The system is very much helpful for real time air and sound pollution monitoring. The System can be applied at remote areas and can be used to control pollution. The proposed system is cheaper in cost and smaller in size and it can be applied in industries as well as public sectors.

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