Int. Conf. on Signal, Image Processing Communication & Automation, ICSIPCA

Noise and Dust Particle Detection and Measurement

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***Abstract*— This work is a part of advancement in air and noise pollution measurement system. Air and noise pollutions are the major problem faced by people every day. In that the main causes are noise and dust particles. In developing countries like India, the vehicle usage increases day by day and hence the road traffic also increases causing the air and noise pollution. The pollution analysis can be done by using the smart noise sensor and dust sensor (GP2Y1010AU0F). The microphone is used to detect the noise signals. Noise produced by the different zones such as industrial zone, commercial zone, residential area and silent zones are measured and results are compared with the standard threshold values. The dust particle concentration is measured. The concentration of the particulate matter reduces the air quality hence by using the dust sensor it can be determined. The particulate matter (PM) with different size can be detected. The PM10 and PM2.5 are the two different particulate matters. The high concentration of this matter can cause the low air quality. So, awareness is created and alert the people..**

***Index Terms*— SNA, PM.**

I. INTRODUCTION

Sound is something which disturbs the normal activity such as working, reading, and sleeping etc. As per the World Health Organization “Noise is recognized as a major threat to human being”.

The main causes of noise pollution are transport system that is road traffic noise in the town area. Construction of buildings, streets and highways cause a more noise, due to the usage of bulldozers, air compressors, loaders, dump trucks, and pavement breakers. Industrial noise is also the major part of the noise pollution.

Smart noise meter is used to sense and measure the noise existing in the air. Which include both transmitter and receiver section. In transmitter section microphone act as a sensor and senses the surrounding noise. This sound signals are then converted into electrical signals. Then the signal is fed into the ADC pin of the launch pad and it will be received at the receiver.

Dust particles are Small, dry, solid particles projected into the air by natural forces, such as wind, volcanic eruption, and by mechanical or man-made processes such as crushing, grinding, milling, drilling, demolition, conveying, screening, bagging, and sweeping. Dust particles are typically in the size range from around 1 to 100 µm in diameter, and they settle gradually under the impact of gravity.

Dust is the airborne pollution occurs in the gassy forms (airs and fumes) or as aerosols. Aerosols are existing in the form of airborne dusts, sprays, mist, smokes and fumes. There are two forms of particulate matter.

Grenze ID: 02.ICSIPCA.2017.1.25

Particulate matter10 (PM10) and particulate matter2.5(PM2.5). Particulates of size less than 10um PM10 can come to be into the lungs and they can reason for the serious health problems.
Particle less than 2.5µm diameter are also known as "fine" particles. These fine particles include the dust particles produced by the motor vehicles, power plants, residential wood burning, forest fires, agricultural burning and some industrial process. PM2.5 contains more toxic and hazardous organic pollutants. Which will cause the greater impact on the human health.
Particle size between 2.5µm and 10µm are called "coarse" dust particles. Sources of the course dust particles are grinding or crushing operation and the dust produced by the vehicle travelling.
GP2Y1010AU0F Dust sensor is used to measure the dust particles present in the air. This module is design to detect the particles of size above one µm that is it can detect the smoke particles, pollen, house dust particles, sprays and fumes. The sensor produces the forced introduction of the sampling air and measures the distribution of the reflected light by particles. This measurement is then converted into PWM output signal.

II. Literature Review

The low-cost instrument for environmental particulate investigation. This paper signifies the airborn particulate measurement and detection. The main aim is evaluation of scattered light by particles under the illumination. This idea is a cost efficient over the simplicity of the calibration. The goal line of this plan is to obtain the simple and inexpensive instrument [1].
The air quality monitoring which mainly consists of Particulate matters of PM2.5 and PM10. The high concentration of these particles degrades the air quality. This trick contains the AERONET (aerosol robotics network) radiometer, LIDAR (light detector and ranging) and a PM sampler [2].
The integrated monolithic sensor system for air borne particulates. The integrated CMOS monolithic sensor systems for the detection of on chip capacitive micrometre airborn particulate matter (PM). This chip is based on the 32-channel lock-in architecture which allows the dust collection area of 1.15 mm2. Sensing electrodes are fabricated on the CMOS chip [3].
Geographic information system(GIS) is mainly applied in traffic noise prediction to manage the spatial data and to realize the visualization of the noise levels. The common method used is to sum up the noise levels of all the road logarithmically and it is time consuming. To speed up the calculation process the method to filter the road segment using GIS is proposed in this paper [4].
Integration prediction of traffic noise. To modelling traffic noise and selecting corresponding noise control measures it is necessary to know functional relations between noise emission and certain numbers of traffic restrictions. The purpose of this article is to study the situation in Crotone (Italy) and develop a model to predict the noise based on the data collected [5].
Estimation of the road traffic noise in urban area. This paper estimation of noise produced by the traffic is calibrated with survey data which is a medium size town. The procedure is based on the distance between the buildings present in the roadside with the legally established noise limits. Noise is measured in terms of equivalent noise. Here the road traffic is distinguished into general model and specific model [6].

III. Proposed Method

The fig1 shows the block diagram of the noise and dust particle detection and measurement in air.GP2Y1010AU0F Dust sensor is used to measure the dust particles present in the air. This module is design to detect the particles of size above one µm that is it can detect the smoke particles, pollen, house dust particles, sprays and fumes. The sensor generates the forced inflow of the sampling air and measures the dispersion of the reflected light by particles. This measured particle is taken as the dust density and the density is measured inters of mg/m³.
Smart noise meter includes both transmitter and receiver sections. In transmitter section microphone acts as sensor that sense the surrounding noise that is, sound signal then it converts into electrical signal.
The output of microphone is given to ADC pin of launch pad. it processes the received signal in correct manner, then processed data is transfer through the Wi-Fi to receiver side. In receiver side the data is either displayed or viewed through mobile since mobile also has inbuilt Wi-Fi.

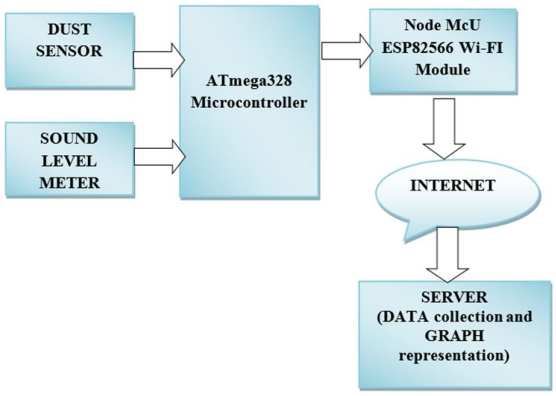

Figure 1: Block diagram of noise and dust particle detection and measurement in air

IV. SIMULATION/EXPERIMENTAL RESULTS

The results of the proposed design is shown in fig2 and fig3. The dust sensor analog output is taken and it is converted into dust density(mg/m³) and graph of dust density v/s time is extracted.
The noise sensor output is converted interms of dB and the graph of noise v/s time is extracted. In both cases the the data is stired in server and it can be used for the analysis purpose. The midpoint(peak pollution rate) can be calculated. This analysis will give the awareness of the environmental pollution

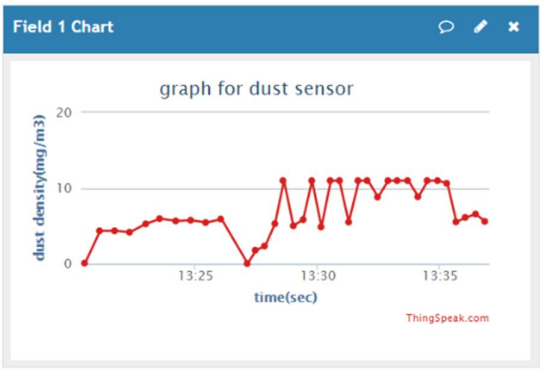

Figure 2: graph of dust density v/s time

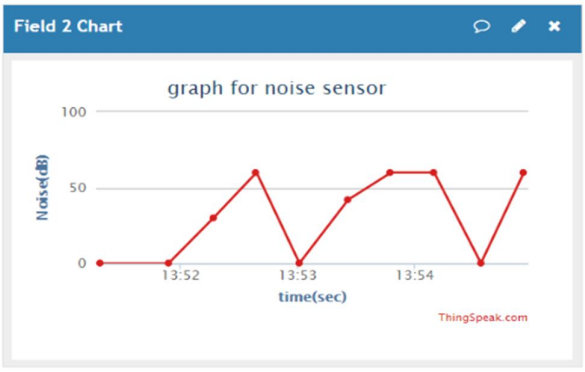

Figure 3: graph of noise v/s time

V. CONCLUSION

The proposed system provides the pollution analysis by using smart noise meter and dust sensor. The noise varies as per the different areas. The threshold will give the reference. The particulate matter concentration can be measured and the result can be stored. The analysis is done by comparing the results during day and night in different zones. The awareness can be created in the people.

FUTURE SCOPES

From the existing system, we can expect the monitoring system based on the people demand. It will give monitoring and controlling of all physical phenomena. By controlling the pollution based on the analyzed result we can reduce environmental pollution in future days and can implemented in cities.

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