
Study and Development of Air Monitoring and Purification System

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ABSTRACT

We all know air is basic necessity for mankind but it is getting polluted by the various activities being conducted by humans on the daily basis. The concept of air monitoring is old but an important concept for us. Air pollution monitoring starts from traditional ways to the most sophisticated technologies. Today the air quality inside the building is worse comparable with the outside. Considering this situation in mind air monitoring is not enough we also need to purify it for our own benefit to stay healthy. New technologies are really beneficial in order to get analyzed air quality data and find solution to the issues that are arising by air pollution. The main aim and goal of this paper is to highlight some of the new technologies which can be used to analyzed, monitor and purify the air, how effective these technologies are and to study the important researches in this particular area.

Keywords-IoT (Internet of Things), air quality, Real Time monitoring, European Commission (EC), U.S. Environmental Protection Agency (EPA), CWSN (Wireless Sensor Network).

1. INTRODUCTION

Monitoring is basically systematic approach of analyzing and studying anything. In the similar way environmental monitoring is analyzing and observing the condition of environment. For the healthy human life we all require to breathe in clean and pure air. In the modern time industrialization is at boom to fulfil the requirement of people. Transportation, along with the smokestack industries and homes are the major reason of air pollution. Increase in traffic leads to greater amount of pollutants in the air. Therefore, to track the effect of this pollution on environment and health it is necessary to track the level of pollution in the different areas. There are various pollutants in the air such as mixture of solid and liquid suspended particles in the air and various gases like NO₂ or CO, O₃ etc. Today diseases like cancers, emphysema, bronchitis and asthma have become very common. Therefore to tackle this problem we need air monitoring system and to purify air to a certain level we need air purification system. The purpose of air monitoring is not only collect data but also provide useful information which can be used by scientist and various organisations which would help them to manage environment (Kadri *et al.*, 2013). The main aim of air monitoring and purification system is to record the concentration of pollution and purify the air to a certain level so that people can become healthy.

2. NEED OF MONITORING

Clean air is vital source for each and every human being. Today air pollution has reached to such a high level that it has starting causing severe diseases and damages. Therefore to control this parameter firstly we need to have air monitoring system, so that we get to know about the air pollutants and pollution rate which may assist us in controlling the same at the right time. There are various causes of air pollution such

as smoke from automobile, chemical discharge from industries etc. Gases like CO, SO₂, NO₂ and traffic related pollutants emission are effecting directly on human life. As per the latest report of USA REPORT, pollutants in the house is so much hazardous that it could kill the person living in the house which means, pollutants inside the buildings are higher than outside the buildings (Jolly *et al.*, 2019). To recover from this issue we need to apply huge efforts to improve the air quality of indoor and outdoor altogether and therefore we need to detect the air quality and purify it for safe and healthy environment.

3. AIR QUALITY INDEXING

Air pollution rate are measured and analyzed according to based on criteria in different country in the world. Several agencies were present in the world like (EPA) U.S. Environmental Protection Agency, WHO (World Health Organization), EC (European Commission), MEP (Ministry of Environmental Protection) and EDP (Environmental Protection) have established a several number of air pollution analysis of different standards.

With the help of the Air Quality Index (AQI) can be categorised air pollution. AQI is acting as a tool which provides us with the categorized air pollution data and provided information on the quality of air by calculating the pollution data and presenting it in form of to an analyzed report. Different countries use a different type of AQI to interpret air quality. An AQI is useful in various ways such as easy interpretation of air by the public (Sharma *et al.*, 2014).

Existing AQI Indexing - Air Quality Index values help to divide the air pollution situation into categories. Some AQI given below:

Air Quality Index (AQI) Values	Levels of Health Concern	Color
When the AQI is in this range:	..air quality conditions are:	...as symbolized by this color:
0 to 50	Good	Green
51 to 100	Modrate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

Figure 1: Existing Air Quality Indexing

4. RELATED WORK - MONITORING TECHNIQUES

Existing air monitoring model was done with the help of computerized tomography mechanism, which is reported a 2D map of pollutants. This method incorporated a single laser source at the centre of area and these laser beams rotated around in circle and cover all circumference of circle.

The beam is acting as a mirror in the circular region and strikes towards to ground cover all circular planes. This mechanism tries to minimise transmitted laser energy and enhance the coverage range area that contains several pollutant source (Robert *et al.*, 1979). Another approach of monitoring the air pollution is via GPRS sensors which has been developed, implemented and there after tested. This system consists of microcontroller and pollution server with internet connectivity. It provides real time data of pollution level as well as the location in large metropolitan area (Yajie *et al.*, 2008).

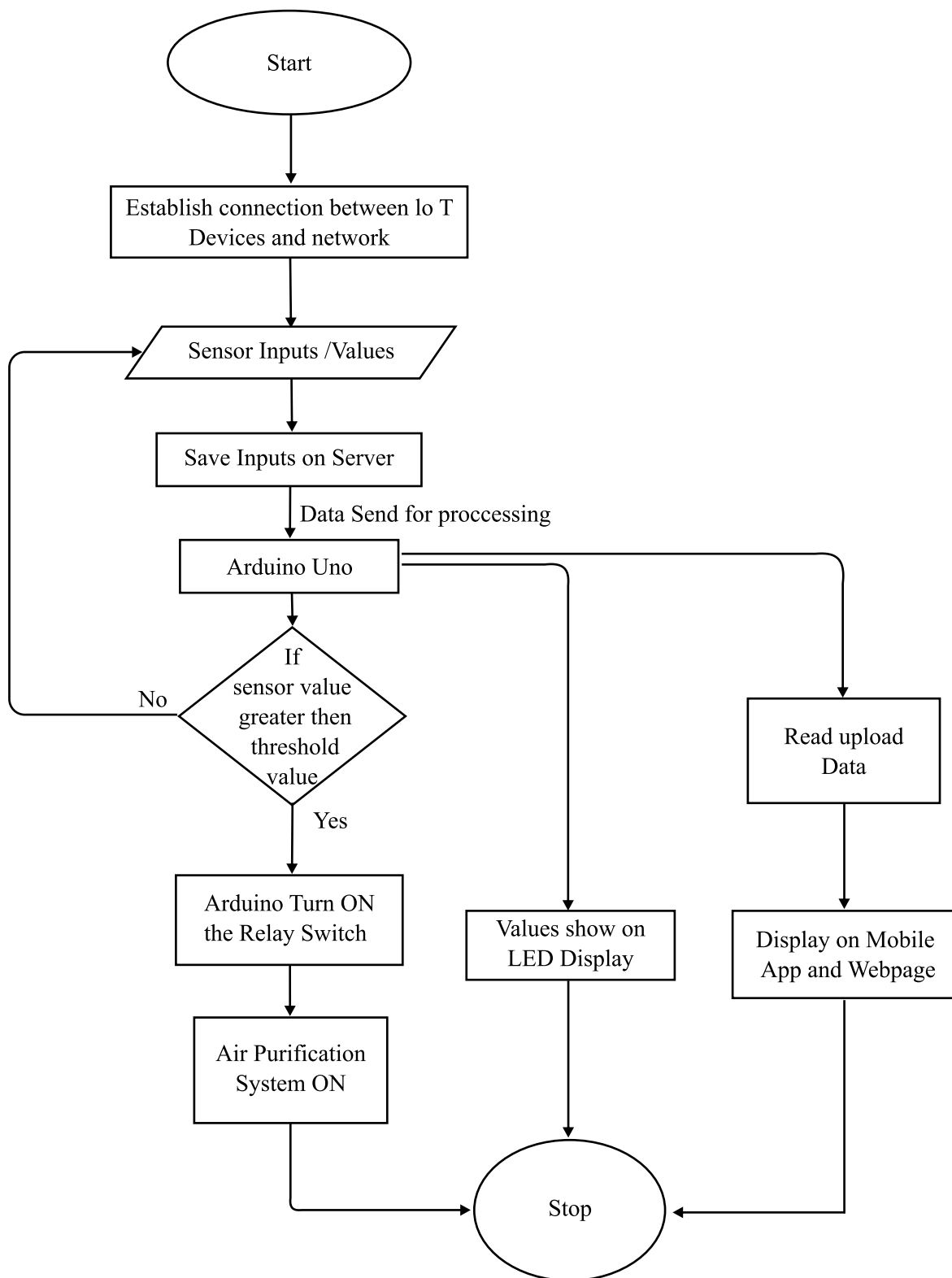
With the help of recent engineering techniques monitoring is being done with use of sensor nodes which are connected to the internet and various other devices and sensors. These sensors are controlled by the microcontrollers such as Arduino. In this technology sensory node can be placed anywhere, so that they can sense data and send it to the servers for further operations.

5. PROPOSED SYSTEM

Taking the present scenario into consideration we have proposed a model for an Air Monitoring and Purification System. This System consists of Arduino based on monitoring and purification of the air. This proposed model aims to detect the air pollution level and perform the necessary operations to make pure air with the help of various filters. The technology that is being used in this project is IoT (Internet of Things) with other communication and sensing technologies. This single-board development environment, which provides user alteration, to read uploaded data from sensors and allows controlling different devices. Here we used the ESP8266 Wi-Fi module with an AT command library which is less costly. It allows the Arduino to connect to the internet through wi-fi connection. Moreover, ESP8266 has a full TCP/IP protocol stack integrated on the chip (Pradeep *et al.*, 2018).

To measure the air quality we have used the gas sensor that is connected to the Arduino which is a microcontroller. As the gases are sensed by the sensor, data is sent to the server for calculation, and then it performs the necessary operations (AQI, 2019; Aghighi *et al.*, 2015; Aghighi *et al.*, 2014). If the air quality is higher than the AQI standard then relay will switch ON and purification process will be started. In the purification we will be using different filters (such as HEPA filter, Pre filter and Carbon filter) to filter the air. As soon as the air quality inside the room is normal according to the AQI the machine attain its ideal state (Ahn *et al.*, 2006; AIR-CARE, 2016).

Flow Chart The working of proposed model Air Monitoring and Purification System flow chart is described in figure 2. In this model IoT device is connected to the network devices with the help of sensor. Arduino Uno devices analyze the air quality if sensor value is greater than threshold value then air purification system is on.

**Figure 2:** Working Flowchart of Air Monitoring and Purification System

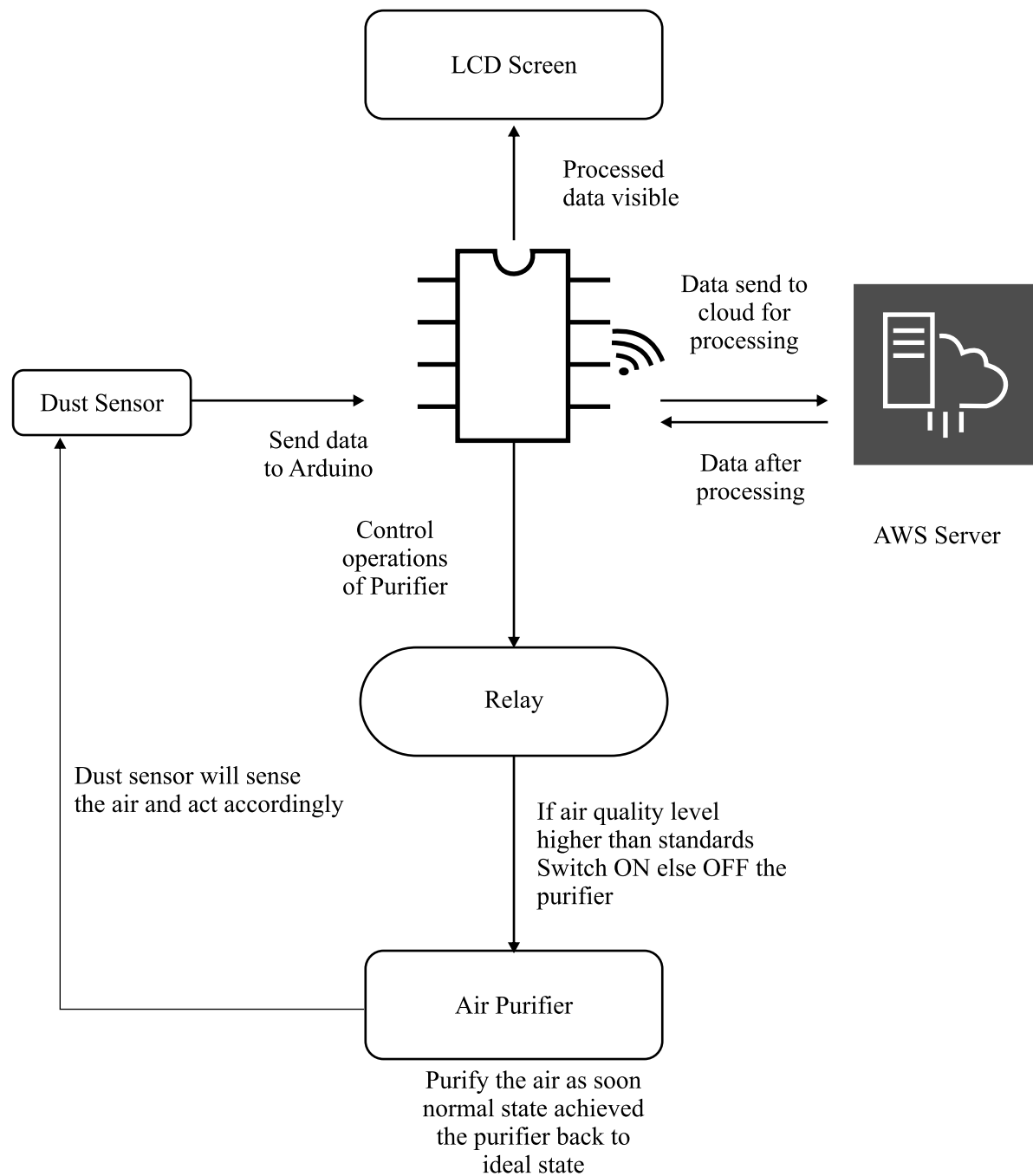


Figure 3: Work flow of proposed model

6. CONCLUSION

To analyze the air pollution level with MSN and IoT technology, it has several benefits over the traditional method. Wireless sensors are low-cost components. These sensory nodes are easy to setup and provide analyzed real-time pollutant data. To monitor the pollution level inside the house is a difficult task and requires various other devices for proper management but this system can do all these activities

in a better and efficient way. The system can monitor and purify the air at the instant. Benefits of this system are this is cost-efficient as well as energy-efficient as relay has been used to conserve the energy. This system is fully automatic; there is no required for human intervention. Along with this, monitoring of air pollution level can be done through the web portal which provides all the figures at a glance.

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