

Sample Title Page of the FYP-I Project Proposal Report:



COMSATS University Islamabad, Lahore Campus
Department of Electrical and Computer Engineering

Sample FYP-I Project Proposal Report

Project Title

Web-Based Air pollution monitoring system

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Abstract

As the increase in industrialization and urbanization. We can see the exceptional surge in air pollution. Currently, we are unaware of trends in air pollution and most importantly SMOG issue faced by Lahore every winter for the last 4 years, still, we are figuring out the main reason for SMOG. Air pollution noteworthy effects on community health and economy especially cities. We are taking the first step to address these issues which will help us in the future to solve the problem. We will recognize the abnormalities in different. These devices will help us to understand the magnitude of this issue, so people can know the severity of the problem. We are required to make a monitoring system which is according to our country standards.

The Objective is to implement air quality monitoring sensor system using wireless sensor network which can be deployed in the form of network to get the a holistic view of the problem. The focus of this project is to develop modular devices that will help us to collect data regarding air quality. The proposed system will collect the real-time data of the air pollution and help us to get to the root of problem.

1 Introduction

1.1 Overview

One of the crucial environmental concerns of today's world is air pollution. Apart from degrading the natural resources and environment, it severely affects human health. The short and long term effects range from respiratory diseases, headache, anxiety, fatigue, irritation of the eyes, nose, and throat – to permanent health effects like asthma, cancer, bronchitis, heart and lung diseases, pneumonia, nervous system damage. According to the estimates of the Global Burden of Disease Study, approximately 4.2 million premature deaths resulted from outdoor air pollution globally, in 2015.

Nowadays the air over the world has become contaminate with gases caused by industries and automobiles. The number of death rates due to their pollution is growing rapidly in metropolitan areas. The adverse health impacts of air pollution exposure are extremely condemning in urban areas, which are population centers, also hotspots for pollution discharge.

The rapid development of motor vehicle activities and industrializing operations, Pakistan is facing high level of urban air pollution, as well as other adverse socio-economic, health, environmental, and welfare impacts. According to the estimates of WHO Global Health Observatory, in Pakistan, about 30 deaths per 100,000 occur due to indoor air pollution, while 25 deaths per 100,000 occur due to outdoor air pollution. [1] An average adult inhales and exhales approximately 7 to 8 liters (1/4th of a cubic foot) of air every minute. It totals 11,000 liters of air (approximatively) per day. That is why it is salient to measure the quality of air an individual is inhaling, especially for a person who is facing some respiratory problems. [2]

1.2 Air Quality Index (AQI)

Air quality refers to the condition of the quality of air surrounding us. The release of a high level of chemical pollutants into the atmosphere due to the burning of fossil fuels and the manufacturing processes has a drastic impact on air quality. Depending on human activities and some natural phenomena, there can be several air pollutants. The AQI is based on the measurement of these pollutants present in the air. The pollutants that are accounted for the majority of air pollution worldwide are particulate matter ($PM_{2.5}$ and PM_{10}), Ozone (O_3), Nitrogen Dioxide (NO_2), Sulfur Dioxide (SO_2), and Carbon Monoxide (CO) [3].

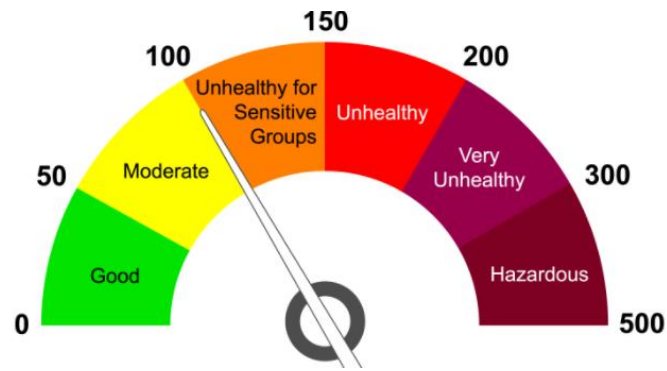


Figure 1: Standard Air Quality Index

- **Good:** Air quality is reasonable in this range.
- **Moderate:** Air quality is suitable although it may be a distress for people who have a unique sensitivity to air pollution.
- **Unhealthy for Sensitive Group:** Adverse health effects may be experienced by people with lung or heart diseases. Children and elders may also be affected. The overall public may not be affected.
- **Unhealthy:** Adverse health effects maybe be experienced by everyone and members of the delicate group may experience more serious health effects.
- **Very Unhealthy:** The entire population is likely to be affected. Any outdoor activities should be avoided.
- **Hazardous:** All outdoor activities must be avoided as severe health effects maybe experienced by the entire population.

1.3 Health Hazards due to Air Pollution

One of the most severe urban air pollution exists in Pakistan, capable of damaging human health significantly. According to WHO, air pollution is responsible for an estimate of 4.2 million deaths per year,

- 29% lung cancer cases,
- 43% of chronic obstructive pulmonary disease,
- 25% of ischemic heart disease cases,
- 17% acute lower respiratory infections,
- 24% of all deaths from stroke [4].

Pakistan ranks 2nd in the world's AQI ranking. According to the report published by the medical journal, Lancet in 2015 around 22 percent or more than 310,000 deaths in Pakistan are caused mainly by air pollution [5]. Outdoor air pollution accounts for more than 22,000 deaths while indoor air pollution accounts for more than 40 million cases of acute respiratory infections and 28,000 deaths per year [5].



Figure 2: Pakistan ranking 2nd in World's AQI Ranking

1.4 Lahore Smog

Punjab is facing a public health emergency of smog Lahore being in the most critical situation. Lahore is the second-largest city and the most polluted city in Pakistan. Recently it has been covered in a heavy blanket of smog [6]. Starting from October to February, it worsens the air quality in Lahore imposing a high threat to the lives of more than **12 million** people. Rapid shoot in multiple health-related problems due to Smog as it is hazardous to health, is leading to the rise of concerns about the long-term devastating effects on public well-being. An increase in vehicles, deforestation, urbanization, and industrialization has contributed to the rise of this emergency. [7]

Lahore	130	#Unhealthy 9x above safe limits
Peshawar	63	#Unhealthy 4x above safe limits
Islamabad	42	#Unhealthy for Sensitive Groups
Karachi	40	#Unhealthy for Sensitive Groups

Figure 3: AQI in major cities of Pakistan

1.5 Problem Statement

Air pollution is one of the most common environmental problems that can be ignored. Inhaling polluted air for a long time harm human health in several ways. The evaluation and calculation of air pollution level are set up on standards which are present in every country in the world. Established air quality monitoring methods are expensive. So a cheap, remote, and

real-time air pollution monitoring system is a need of the hour, that gives more accurate data results and require less human interaction in risky areas.

According to the Environment Protection Department of the Government of Punjab (EPD) [8], the data is collected once a day with 4 devices that are recently working for pollution monitoring, but they do not give much sufficient and reliable results. This data can not be analyzed to detect a problem. Our monitoring system will test the air quality of different areas with authentic results. This will allow users to know which area of the city has more or less pollution so they can choose their routes accordingly.

1.6 Objectives & Goals

- To deliver the cheap solution for the problem faced by EPD.
- To make modular devices that are portable.
- The system should be scaleable to the National level.

1.7 Deliverables

- Web-based application.
- Modular devices

2 Methodology

The methodology we will be following to implement a cloud-based system to detect and analyze air quality is presented briefly in this section. A cloud-connected wireless network for air pollution monitoring system has been implemented. The block diagram of the network is shown in figure 4, which is comprised of three different sections: sensors on microcontroller, AWS cloud system, and website.

Block Diagram

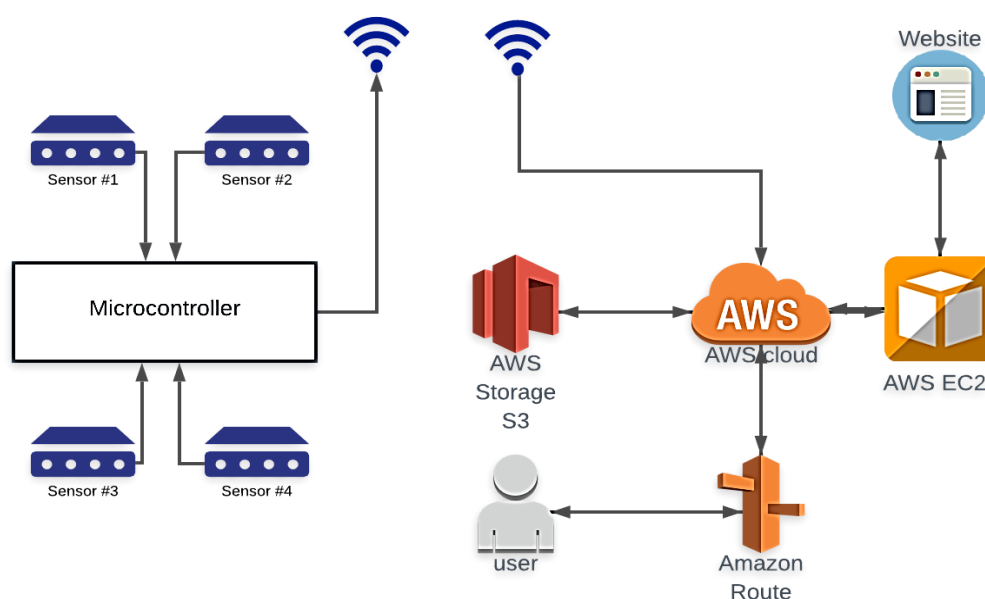


Figure 4: Block diagram of the Project.

In the first stage, air quality monitoring will take place. Air contains a mixture of dust particles, liquid, and solid particles, and gases like CO, CO₂, NO, and SO₂. The collection of data will be done through a microcontroller with multiple sensors that will help to access the pollution extent and measure different gas concentrations in certain areas.

Once the data is collected it will be sent to the cloud server, it is in charge of receiving the data and providing specific services. From the provided data the AQI of the area will be calculated. Then, it will be used for updating the statical graphs and trends observation. Finally, the last section deals with the end-user layer i.e. website. The graphs and data will be updated on our website. All people will be able to see the collected data live. This allows citizens to take suitable precautions when needed. The methodology can also be observed from the following flowchart in Fig 5. The hardware and software requirements for this project are mentioned below:

2.1 Hardware Requirements

- Microcontroller
- Sensors

2.2 Software Requirements

- Application for Controller
- Sensor Libraries
- Cloud Computing

2.3 Flowchart

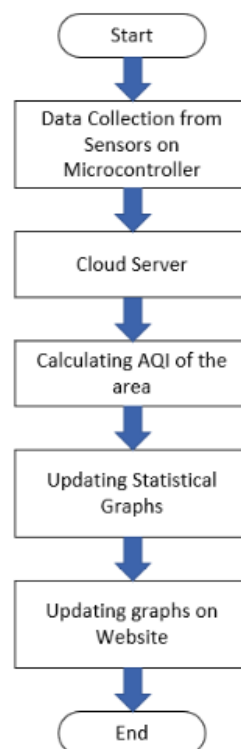


Figure 5: Flowchart of the Project

2.4 Gantt Chart

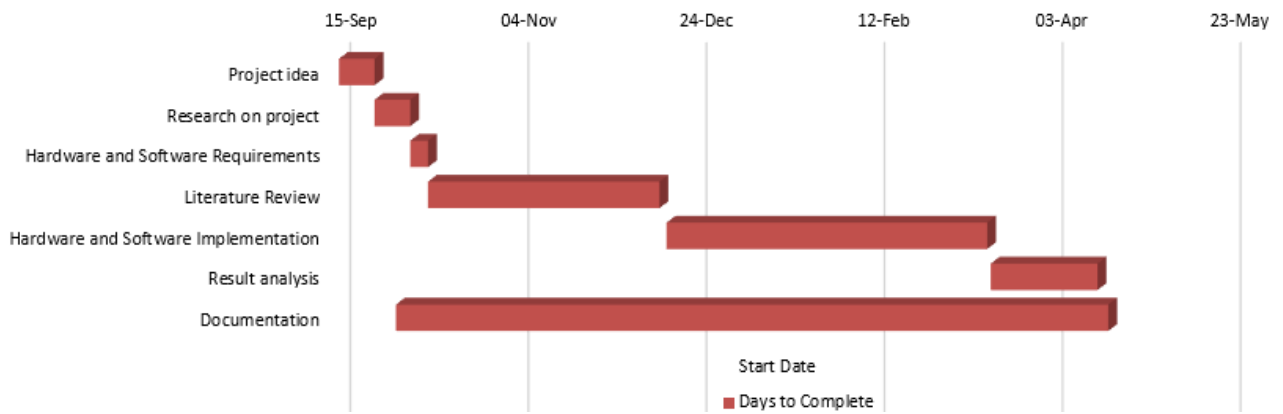


Figure 6: Gantt Chart of the Project

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