Project Title: Project Ba-U: Detachable and Upgradable Portable Indoor Air Quality Monitoring System

- **Project Member's Information:**

  * Please note that the first name will be referred to as the main **CONTACT PERSON** for the whole group.

  Group Name: Team Airbenders

  Member's Details:

#	Full Name	Batch & Dept.	Roll	Mobile Number	Email
1	Bidut Sharkar Shemanto	2k19 Energy Science & Engineering	1913027	01521721778	shemantosharkarofficial@gmail.com
2	Shahriar Shatil	2k19 Textile Engineering	1921046	01849656367	shatilshahriar009@gmail.com
3	Sifat Khan	2k19 Biomedical Engineering	1915020	01633004146	sifat1915020@stud.kuet.ac.bd
4	Md Toslim	2k19 Mechatronics Engineering	1931013	01700977464	miraztoslim111@gmail.com

- **Project Proposal:**

1. Overview of Project Proposal: (Within 400 Words)
(i) Background (ii) Problem Definition (iii) Specific Objectives

(i)Background:

In the modern world, safety is crucial, hence it is essential that effective safety procedures be put in place in workplaces and educational institutions.But the current air quality monitoring systems are costly and they can detect multiple gasses,users can not upgrade the system if they need to detect new gas. Designing a air quality monitoring system using microcontrollers which is affordable and easily upgradable is the major goal of the effort.

Ba-U is an IoT based smart air quality monitoring system for home, industrial, medical & indoor uses. Unique feature of Ba-U is the detachable module based gas monitor.There are two parts-1)Mother box and 2)Module boxes. Mother box is the main controlling system,it contains controlling units and basic temperature sensor and LCD display. Module boxes are built with different types of sensors,easy to mount with the mother box.It gives a user opportunity to use sensors according to his needs.User can easily upgrade to other sensors just by mounting different module boxes.

The LCD display continuously displayed dangerous gasses, such as propane and LPG. If these gases are present in excess of the usual amount, an alarm is instantly triggered, and an alert message (SMS) is also delivered to the appropriate person through Bluetooth Module.This automatic detection and alerting system has a number of advantages over the manual technique, including quick reaction times, accurate emergency detection, and a faster spread of the urgent condition.

(ii)Problem Definition:

Bangladeshi PM2.5 concentration exceeds WHO guidelines by over 10 times

Bangladesh placed top in average PM2.5 concentration among 117 nations, according to the IQAir 2021 World Air Quality Report. PM2.5 is a term used to describe airborne particles with a diameter of less than 2.5 micrometers. Due to its propensity to linger in the atmosphere longer than other forms of particulate matter, PM2.5 is more hazardous. With New Delhi (85.0) claiming the top spot, Dhaka (78.1) placed second on the list of regional capital cities for average annual PM2.5 concentration (g/m3).

The total amount of solid and liquid particles floating in the air, including organic and inorganic ones including dust, pollen, soot, smoke, and liquid droplets, is known as particulate matter (PM).A greater concentration is a sign of worse air quality. Areas with a PM2.5 concentration >50 (g/m3) typically go

beyond the WHO PM2.5 standards by more than ten times.

Country	Country Population weighted, 2021 average PM2.5 concentration (μg/m³)
Bangladesh	76.9
Chad	75.9
Pakistan	66.8
Tajikistan	59.4
India	58.1
Oman	53.9
Kyrgyzstan	50.8
Bahrain	49.8
Iraq	49.7
Nepal	46.0

Top 10 polluted countries | Air Quality Report 2021 by IQAir

Air contaminants can reach up to 500 kilometers in a certain location, depending on height. This is a challenge for Bangladesh, because a significant portion of the airborne contaminants are caused by transboundary air movement. Since Bangladesh is surrounded by highly polluted nations like India and Nepal, contaminants are likely to be brought into the city during the monsoon and winter months.

Respiratory illnesses are likely to increase with rising temperature and humidity

A 1% rise in humidity increases the odds of developing a respiratory infection by 1.5 percentage points whereas a 1°C increase in temperature increases the likelihood of getting one by 5.7 percentage points.

(iii) Specific Objectives

1. Making IoT based smart gas detection system
2. Setting up a detachable module that can be replaced as demanded
3. Providing utmost output and control through Ba-U at lowest cost

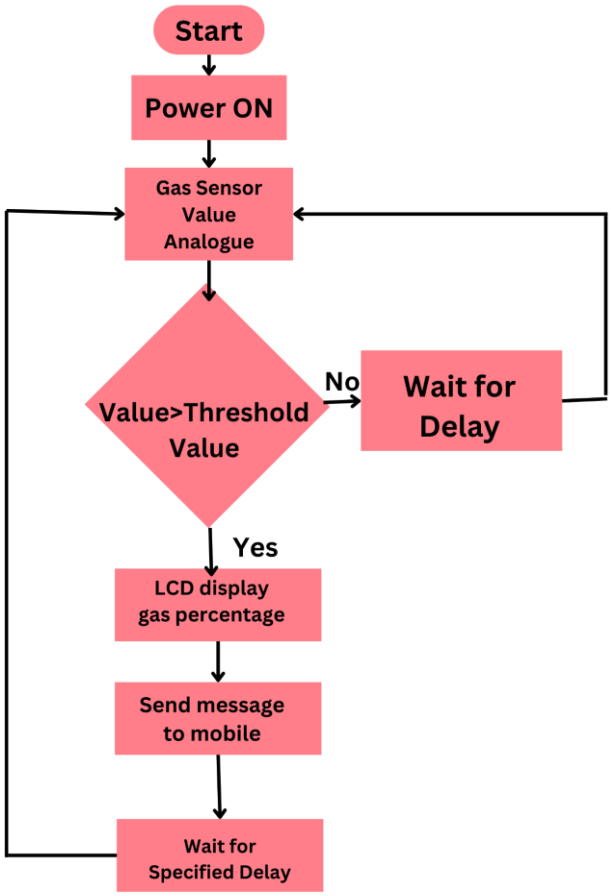
2. Methodology and Work Plan (Within 600 Words)

(i) The theory behind the proposed idea (ii) Model or Implementation Flow Chart (iii) Plan of activities to implement the proposed project

(ii)The the

Readings	PPM
Pros	High sensitivity (detects low concentrations); wide operating temperature range; long life.
Cons	Non-specific (cross-sensitive to other compounds); nonlinear output; sensitive to changes in humidity: subject to poisoning.

(ii) Model or Implementation Flow Chart



(iii)Plan of activities to implement the proposed project

We will print the mother box and the module box using the tool of Fablab which will contain a microcontroller and sensors. We will assemble the parts and write code to run the whole system. We will test the sensors and test the whole system.

3. Expected Results and List of Deliverables (Within 300 Words)

(i) The expected results based on mentioned objectives (ii) List of deliverables after completion of the project

(i)The expected results based on mentioned objectives:

We will be able to build a detachable and upgradable indoor air quality monitoring system.The module box will be easy to mount with the mother box and the system will be connected.With just a few steps user can set up the system.

We will be able to detect Carbon Monoxide(CO),Methen(CH4) using our monitoring system.

Using Further Iterations we will be able to detect Ammonia, Ethylene,Ozone as well.

(ii) List of deliverables after completion of the project

1)We will be able to detect dust particle larger than 0.8µm

2)Able to detect Carbon Monoxide(CO),Methen(CH4)

3)Module boxes will be easy to detach/attach with mother box

4) When you are using the gas detection system, it is possible to have instant results with very high accuracy.

5) If you are making use of the constructed gas detection system, its maintenance cost is very small compared to the modern detection system.

3)The gas alarm system is highly secure, reliable, and tamper-proof.

4) The sensor used in the gas alarm system has an excellent sensitivity combined with a quick fast response time.

5) The gas alarm system also helps in detecting alcohol so it can be used as a liquor tester.

4. Applications and Impact (Within 300 Words)

(i) Applications area (ii) Impact on Society in the context of Bangladesh

(i) Applications area

1.Laboratory Gas Detection

The laboratory can be a dangerous place. From trip hazards, flammable materials and even bio-hazards.

2.Boiler House Gas Detection

Gas fired boiler plant requires careful consideration in relation to gas detection. Boiler plant rooms can range from small boilers in a school/office block to larger installations.

3.Car Park Gas Detection

Underground car park gas detection is commonly fitted for environmental protection and energy cost saving.

4.Medical Gas Detection

Many modern Doctors Surgeries, Dental Practices and Cosmetic Surgeries offer on site procedures

away from hospitals.

5.Hydrogen Gas Detection

As well as being an important industrial gas, hydrogen is becoming increasingly important as a fuel.

6.Process Industry Gas Detection

Chemical processing and petrochemical plant can have a wide range of toxic gas hazards, flammable gas hazards or asphyxiant gas hazards.

7.Textile Industry Gas Detection

Textile processes can produce huge amounts of heat and dangerous gases.

8.Cement Industry Gas Detection

In addition to releasing a significant quantity of CO2 and other gases, the numerous operations in cement factories cause harmful emissions to be discharged into the environment. Gas detectors must thus be placed as a result. For the safety of the workers and the business, plant managers can monitor emissions using gas detection systems to find and track leaks at both low and high levels.

(ii) Impact on Society in the context of Bangladesh

Bangladesh loses about $14 billion a year due to air pollution

According to a survey by Greenpeace Southeast Asia and the Center for Research, air pollution costs Bangladesh $14 billion annually. The projected annual cost of air pollution due to the combustion of fossil fuels is $2.9 trillion, or nearly 3.3% of the global GDP. Additionally, air pollution-related diseases are thought to be the cause of almost 1.8 billion missed days of work globally. This translates into a $101 billion economic loss every year, roughly. This expense represents more than 5% of the GDP for Bangladesh.In addition, exposure to PM2.5 in 2018 was blamed for around 96,000 Bangladeshi children dying before their fifth birthday. In Bangladesh, air pollution reduces a person's average life expectancy by about 2.91 years, with 1.16 of those years being linked to outdoor pollution and 1.53 to interior pollution. Emphysema, asthma, and other respiratory conditions including chronic obstructive pulmonary disease are all linked to air pollution, which can influence the development of the lungs (COPD). Chronic bronchitis has been related to PM and nitrogen oxide.

5. Time Frame, List of Devices and Accessories, Budget
(i) Time schedule for project implementation at Fab Lab KUET (ii) Required devices and accessories with prices (iii) Total Budget
(i)Time schedule for project implementation at Fab Lab KUET Day 1- We have already completed our design in Solidworks and we will print the motherbox and two module boxes using the 3D Printer in Fablab KUET. Then we will assemble the parts. Day 2- We will integrate the IoT & electronics components inside our motherbox & module box.We will also test our product.Then we will present our idea in front of the judges. The whole timeline of the project will require 2 days.

(ii) Required devices and accessories with prices
1)Arduino Uno - 1050
2)DHT 11- 120
3)LCD Display with I2C- 300
4)Bluetooth Module- 350
5)Dust sensor- 890
6)MQ4- Methane gas sensor- 180
7)MQ7-Carbon MonoOxide sensor- 180

(iii) Total Budget
Total Budget-3070 tk