Modern Tree Plantation System Based on IoT

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Abstract—**The disruption in the ecosystem and the atmosphere surrounding it by different pollutant categories, it can be cited as environmental pollution and when these pollutants are present in the air in form of chemicals or compounds in excess in the air it is adduced as air pollution. In this paper a method has been proposed to reduce the CO_2 level in the environment. The proposed method is pretty straight forward, where the level of emission will be detected with the help of MQ135 sensor. Once it is found that the emission of CO_2 is more than the normal level, the soil type of those affected places will be tested by SEN-00200 sensor which will be monitored remotely. Based on the soil type, the appropriate type of plants which reduces the harmful gases will be determined in the long run. This work also proposes an eco-friendly environment by tree plantation in mass scale to make the environment more aesthetic and elegant as auxiliary.**

Keywords—: IoT, Greenhouse effect, CO_2 Reduction, Increasing breathable O_2, Tree Plantation.

I. INTRODUCTION

Internet of Things (IoT) is captivating and grabbing the attention of general mass as it is collaborating and interacting with people by allowing different types of sensors for different purposes which are equipped with different types of characteristics and properties that makes the day to day lives of people much easier [1]. IoT allows and enables an intelligent network that is used to connect all real life objects to the internet for the objective of exchanging information with a view to communicate through the information sensing devices by the use of mutually agreed protocols. IoT enabled devices maintain connectivity of objects that are physical to the internet with a view to detect, scan, analyze, monitor and control the behavioral pattern to gain efficiencies and create ultimate new capabilities. The device is designed to be implemented on the urban city roadside soil where the transport is highly active and the air is most polluted for its betterment. People are becoming more and more city forwarded as cities provide better facilities, better employment and a better standard of living. As a result the cities are becoming more and more densely populated which is causing urbanization to accelerate at a very high rate. With this, the construction of industries roads and transports are increasing as well. As a result of this, in particular the increase of vehicles is causing the air to become polluted and losing its balance of elements as it can be seen Carbon dioxide (CO_2), Ammonia and other gases are being produced. This is having an adverse effect on the people living in these densely populated areas and are facing different day to day health problems. The Department of Environment has furthermore set national encompassing air quality rules for these poisons. The air quality for the most part exacerbates during summer and gives indications of progress during storm. With little to no efforts being made to change or actions to be taken for this situation for the better, much rather ignoring it, while at the same time focusing on only urbanization. The proposed IoT based device will prioritize on preventing and diverting this problems without disrupting the flow of the overall system. A very simple but effective device to regulate the balance of the air elements culminated from a concept that required not only air but also it being made a connection to the soil and with focused combination to produce an output that will effectively remove the risk as well as have a chance to turn the situation around. IoT based tree plantation- a smart, cost effective, easy to use and efficient, has been created in fusion of two separate devices. The proposed Air pollution prevention system aims to focus on a particular areas that has high concentration of air pollution and CO_2 aka the routes involving rush of vehicles, traffic jams and congestions and plant trees on the road side's, based on the type of soil. Trees will have to deal with reduced CO_2 and other harmful gas. Air quality will transform into more breathable for humans as well as making it naturally aesthetic and elegant as a subsidiary part of the proposed project.

II. RELATED WORK

It is a known fact that traffic emissions are a significant source of air pollution. Pirjola *et. al* scrutinized about the emissions of gases that are occurring on highways, roads and different routes from vehicles [2]. Schwartz *et. al* clarifies how dangerous the air pollution is and what ways it is capable of causing harm to human bodies especially to the elders [3]. Kaur *et. al* discusses about the exposure studies when compared to those inside vehicles—the vehicle shell provided no protection to the passengers. Proximity to the pollutant sources makes a significant impact on 'exposure concentration levels' experienced [4]. Hatzopoulou *et. al* additionally states, roadway emissions are dispersed and afterwards the ambient air concentrations are connected with individuals' time-activity patterns. [5]. According to Liu one of the key factors of Global Greenhouse effect gas emissions is CO_2 [6]. Due to emission from vehicles which are powered by liquid fuels such as patrol, octane, diesel etc. causes huge amount of CO_2 to be released in the air. As it is harmful for the people living around in that atmosphere but if considered as a differential factor to be taken on a larger scale, this can easily be clarified as a global level threat [7]. Yamamoto

revised and declared that air pollution as a risk factor for cardiovascular disease in South Asia [8]. Kant *et. al* [9] discussed about the diagnosis and monitoring sensors for air quality. Setiawan *et. al* [10] discussed about a device that is capable of measuring the air quality. C. E Zimmer and R. I Larsen also focused on maintaining and calculating air quality and its control [11]. Rolf expressed his opinions upon then need for a new legal environment as to oppose the current polluted environment that is growing at a rapid rate [12]. The need for machine learning [17] for soil fertility and plant nutrient management can play a significant role [13]. In order for the tree species [14] to increase their diversity [15] of fine root productivity through increased soil [16]. Also to absorb CO_2 as well as to be able to survive [18] in the roadside environment [19], the plants need to able to survive the particular environment [20]. K. Patil developed a model to be of worth for agricultural as in planting trees to be taken in to consideration. Thus according to the soil type, particular trees will be selected for solution to the specified problem.

III. PROPOSED METHODOLOGY

Our proposed method includes the overall flowchart of implementation process and required components for the whole process.

A. Flow chart of implementation process

As observed from the flowchart, first it is required to scan the input from environment with the help of MQ135 sensor. After that- based on the reading from the sensor it will decide whether the air is polluted or not and finally based on the
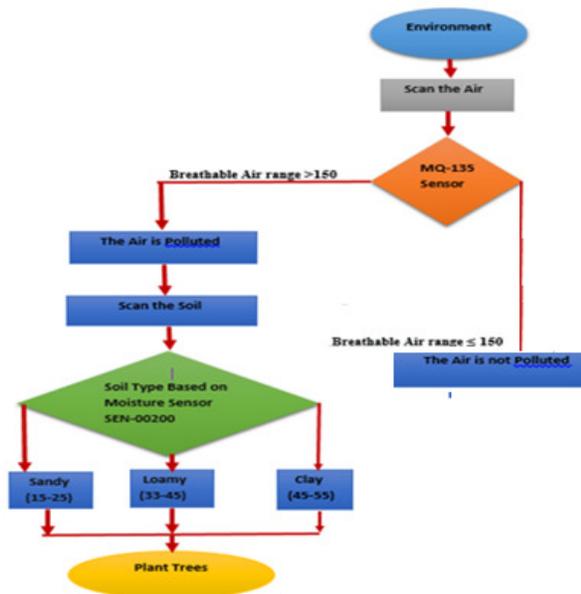

Fig. 1. Flowchart for the implementation

feedback from moisture detection sensor, it will decide and implement tree plantation accordingly. The whole process is shown in Fig.1 above.

The environment is getting increasingly polluted day by day because of urbanization and industrialization. If this situation can be improved in a natural way then it will be beneficial for both the environment and people living in it. First it scans the air to check whether it is polluted or not using our Air Probe which has the air particles sensor (MQ-135). If the probe

returns a lower value than 150, then it can be perceived that the air is not polluted. But if the probe returns a higher value (>150) then it will be considered as polluted. Once the polluted weather is detected then our soil appraiser sensor SEN-00200 will check the soil type. According to the moisture range it will determine whether the soil is sandy, loamy or clay. Based on soil type, specific types of tree will be planted.

B. Component list

The required components to implement the system is listed below in table-1:

TABLE I.   COMPONENT LIST

SN	Component	Quantity
1	Arduino UNO [21]	2
2	Solderless Breadboard	2
3	Moisture Sensor SEN-00200	1
4	MQ-135 Sensor	1
5	USB cable	2
6	Jumper wire	10

As our prime concern is to develop a proto-type with low-cost, so MQ-135, SEN-00200 and Arduino UNO are used to develop the complete system.

IV. IMPLEMENTATION OF PROTOTYPE

The implementation process is divided into two major portion. They are-

- **The Air Probe**: To scan the air of excessive CO_2 and other harmful elements   Like NO_2, NH_3, Benzene, Smoke etc.

- **The Soil Appraiser**: To distinguish soil type to plant the sort of trees that are appropriate for that specific soil type.

The prototype consists of the following hardware-

A. Arduino UNO

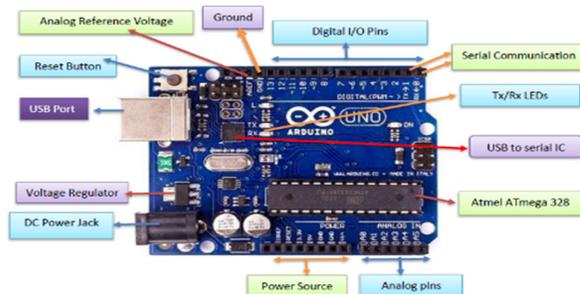Arduino UNO is a widely used equipment that is open-

Fig. 2 Arduino Uno

source and has a programming unit, that can be used to build highly effective networking and communication based applications, having a single-board microcontrollers and microcontroller units for building automated contraptions. The corresponding IDE (Integrated Development Environment) is available for free download at (www.arduino.cc) as shown in fig. 2:

The UNO could be a microcontroller board supported the ATmega328P [Microcontroller (8-bit,16MHz,32 KB Flash,1 KB EEPROM, 2KB SRAM)]. It has 14 digital input/output pins (of that 6x will be used as PWM outputs), 6x Analog inputs, a 16-megahertz quartz, a USB affiliation, an influence jack, Associate in Nursing ICSP header and a reset button.

B. Air Quality sensor :MQ-135 sensor

Using Arduino, Breadboard and the MQ-135 sensor the air for pollution will be scanned and it will be able to detect the safety parameters and check whether the air is breathable or not. Arduino, Breadboard and the MQ-135 sensor can scan the air for pollution and able to detect the safety parameters and whether the air is breathable or not. It is found out that the range should be between 80-150 to be breathable. If the sensor reads values more than the specific range 150 it alerts that there is pollution in the air. If Breathable air range: GOOD>150<BAD.
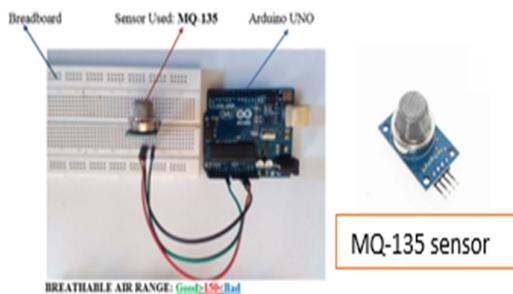

Fig. 3 Air Quality Check with Arduino Uno

The connection setup should be done on the following way: Arduino UNO analog pin A_0 is connected to the Sensor pin A_0 and arduino uno 5V is connected to the Sensor pin V_{cc} and arduino uno GND is connected to the Sensor pin GND

C. The Soil Appraiser

Using Arduino and the SEN-00200 sensor, the moisture/humidity of the soil can be detected in order to detect it's type whether it is sandy, loamy or clay. Now if our sensor reads the value between 15-25 the soil is sandy. For clay and loamy soil the range is between 35-45 & 45-55 respectively. Further it classified the trees that are best suited soil wise to be planted in order to eradicate the air pollution and reduced CO_2.

The connection setup is done using arduino uno analog data pin A0 with the sensor pin SIG and arduino uno 5V is connected to the sensor pin Vcc. Now arduino uno GND is
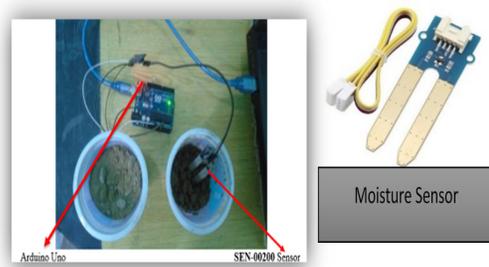

Fig. 4 Soil type checker

connected with the sensor pin GND.

D. Workflow diagram of soil moisture sensor to detect soil type

The workflow diagram of the soil moisture sensor is shown below in fig. 5 where the values are first measured using the sensor and stored the raw value. Once the raw value is stored, it is required to map the raw value within the range of 0-400 which will help us to deteremine the moisture level. Finally the type of soil is determined.
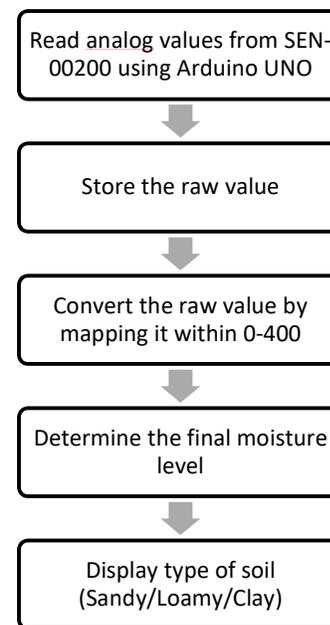

Fig. 5 Workflow diagram of soil moisture detection

E. Types of soil

From the data obtained from our grove sensor. It determines the soil type easily.

Fig. 6. Types of Soil

Likewise it arranged the trees that are most appropriate to be planted so as to annihilate the air contamination and diminish CO2. These are given below in table II:

TABLE II.   SOIL TYPE BASED ON TREE PLANTATION

SN	Soil type	Suitable Tree
1	Sandy Soil Avergae (10-20) meter height	• Paramatta wattle • Lightwood • Forest sheoak • Red spotted gum
2	Loamy Soil Avergae (15-20) meter height	• Royal poinciana • Ashoka • Palm • Poplar
3	Clay Soil Avergae (10-30) meter height	• Ash • Birch • Bur oak • Magnolia

V.   RESULT ANALYSIS

First, the air will be scanned to check if it's clean or not utilizing our air probe which has the air particles sensor. If the probe returns a higher value than 150 then it is required to perceive that the air is polluted. The air quality is determined in different locations of Dhaka during the day time and got the following values shown in table III:

TABLE III.   DETECTION OF AIR POLLUTION LEVEL

SN	Location	Measurement Time	Measured Value
1	Sukrabad Bus Stand	11:42 a.m.	201
2	Dhanmondi 32 (lake side)	05:15 p.m.	138
3	Mohammadpur (Bosila)	07: 31 a.m.	152
4	Science Laboratory More	10:52 a.m.	169
5	Dhaka College Field	01:10 p.m.	142
6	Dhaka University	06:30 p.m.	131

SN	Location	Measurement Time	Measured Value
	(infront of senate building)		
7	Azimpur Govt. Colony	03:40 p.m.	141
8	Lalbagh Fort	05:20 p.m.	136
9	Ramna Park	08:10 a.m.	122
10	Curzon Hall	04:30 p.m.	139
11	Shilpokola Academy	06:05 p.m.	143
12	National Parliament House	10:17 a.m.	152

Mostly, it is observed that the value is higher at day time in traffic congested area. It was not possible to check the soil types for the all places. But mostly the values were within the range of 35-55 which refers to either clay or loamy type soil. The soil is collected from different places with high pollution and tested the moisture level at the lab. The test setup is shown in fig. 7.

Fig. 7. Test setup for soil moisture level

Few of the sample results are shown below in table IV:

TABLE IV.   DETECTION OF SOIL TYPE

SN	Location	Moisture Level	Soil Type
1	Dhanmondi 32 (lake side)	37	Clay
2	Mohammadpur (Bosila)	41	Clay
3	Dhaka College Field	46	Loamy
4	Dhaka University (infront of senate building)	42	Clay
5	Azimpur Govt. Colony	43	Clay
6	Ramna Park	44	Clay
7	Curzon Hall	39	Clay

So based on the moisture level, the appropriate trees cn be planted to reduce the air pollution.

VI.   CONCLUSION

Finally, it is concluded that the CO_2 emission level varies during the different periods of the day. High level of air pollution is detected in congested traffic areas due to presence of more CO_2 by emissions from different kind of vehicles and streets with very less number of trees. The whole situation can

be improved if more trees can be planted in different areas. In our case priority must be given for the places like Sukrabad bus stand, Science Laboratory More, Mohammadpur (Bosila) and son on. As the soil types are clay in 90% cases. So trees with longer height must be given priority for plantation. It will reduce the pollution and convert the air into breathable oxygen.

The GSM shield is used to get the data remotely via remote server [22], [23] so that the whole progress can be monitored from anywhere of the world and take necessary steps accordingly. In this way, it monitors any place to measure the air quality level and plant the trees accordingly to reduce the CO_2 level naturally.

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