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INNOVATIVE MASK - A Better Alternative for Traditional Masks with Advanced Features

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***Abstract*—The basic function of a face mask is to prevent the external microparticles present in the air (Dust or Micro-organisms). Masks are used during pandemic as well as in many different places where breathing in open air puts a person's health at risk. Masks used in our daily life are mostly traditional and uncomfortable. With the primary protection they provide, they are not only less secure but also there are some side effects, the most noticeable ones being suffocation and sweating Innovative mask solves this problem by using existing technology and considering certain conditions, it does not have any side effects that traditional masks have on a person's health. Innovative mask is capable of supplying continuous filtered air as per user's needs while simultaneously monitoring user's health aspects and surrounding air conditions.**

Keywords—Arduino, Face mask, Healthcare, Microphone, In- novative mask, IoT, Sensors, Ventilation.

I. INTRODUCTION

The year 2020 will always be remembered due to corona virus disease (COVID-19) in the human history. Within initial few months, COVID-19 had become a community health crisis all around the world. Until an effective vaccine was developed and made fully accessible, the temporary solutions to protect people and limit the spread of the virus included using a face mask, maintaining personal cleanliness, and social distancing. Although certified face masks had become one of the essentials, the governments had imposed restrictions on exports, which increased the shortages of masks and raw materials across the globe. Due to the panic, there was hesitation and disinformation about face masks. The lack of reusable masks had resulted in people sanitizing the used masks and making domestic masks as emergency solutions which are not trustworthy. Making the face masks reusable, anti-virus and degradable had become the crucial needs of society and opened doors for new opportunities and challenges during this unprecedented time. In this research, we explain the necessary features, assembly methods, and possible improvements of a type of innovative mask and highlight it's significant role in limiting epidemics similar to COVID-19.

Even without considering pandemic we know that masks are being used by humans since the 19th century for different occasions, but they are not designed to be used for a long time with comfort and also while they filter air, they also make it difficult to breathe air in when the user performs any physical task, especially those which require more energy and our heartbeat as well as breathing rate increases. There are few alternatives available that can filter air better than normal masks, but they are neither affordable nor comfortable and also, they cannot be used in our day-to-day life.

Innovative mask is an alternative that can ensure proper ventilation while usage which is not possible in normal masks. In order to apply the available technology, the mask has been designed in such a way that it can regulate airflow and maintain ventilation according to the user's breathing intensity. Innovative mask also takes a step forward by integrating sensors which will monitor some of the user's health aspects and the surrounding air. This mask includes one-fourth times the material used in conventional masks. So, total waste from the material of masks will be reduced to a large extent.

II. HISTORY/ BACKGROUND

Masks are used in different parts of medical sectors since the late 19th century. At that time, masks were usually produced from layers of cotton gauze, sometimes an additional layer of impenetrable material was used [1]. The main function of these masks was to avoid the transfer of respiratory globules from and to the user. Masks progressively became comprehensive since 1918-19 (influenza pandemic) when they were used to protect medical experts, workers, and patients from infectious diseases outside of the operating space. Disposable paper masks started replacing medical masks during the 1930s and were broadly made of synthetic materials for one-time use in the 1960s [2].

During the SARS epidemic in Hong Kong, the number of people using masks was around 61.2% to more than 90%. Although studies do not conclude whether other diseases can be prevented by the use of masks which depends upon the perceived threat of the pandemic, but diseases can be delayed, contained, or at least infection attack rate can be reduced [3]. During the ongoing COVID-19 pandemic, the usage of various masks has become the primary approach to protection. It is observed that face masks do not allow droplets containing viruses to pass through them. Although, there is no scientific evidence on whether transmission of Covid can be completely prevented by using face masks, studies show that people wearing face masks had lesser chances of getting infected as compared to other people. It is also seen that the transmission of viruses through infected people can also be prevented by using face masks [2].

The COVID-19 pandemic had led to multiple types of research on smart masks. There are various smart mask models which are under development. They use various sensors and IoT technology to improve performance and provide additional features apart from filtration such as monitoring various health aspects. Smart masks are not a common preference among general consumers but there are few basic models available on market [2].

III. DESCRIPTION OF INNOVATIVE MASK:

Innovative mask is a face mask that protects the user from harmful microparticles by using replaceable filters and main- tains optimum ventilation according to the user's need while keeping the user updated about his/her breathing intensity statistics, few health aspects and air conditions inside mask. Description can be divided into four main parts which are:

A) Concept of Innovative mask, B) Methodology, C) IoT-based applications, D) Programming code of Innovative mask.

A. Concept of Innovative mask

Traditional masks have filtration inefficiency, and they cause many issues like sweating, discomfort, and suffocation. Most of the masks are not suitable for being reused, hence they create harmful biomedical waste if not recycled properly. The concept of innovative mask came into existence to counter previously mentioned problems. Innovative mask prevents harmful micro-particles from entering inside the mask efficiently. It has a custom design that is comfortable as it leaves space between the nose and the inner layer of mask. Various components that are used in this mask function as a unit to provide continuous filtered fresh air supply according to the breathing intensity of the user by performing intake and exhaust. This mechanism provides comfort and sufficient air to breathe, eliminating the drawbacks of traditional masks. Additional to this working the sensors and IoT technology can be used to monitor and display the user's real-time breathing intensity, heart rate, and blood oxygen level data on the device by connecting the mask to any internet source with the help of Wi-fi connectivity.

B. METHODOLOGY

- Assembly of Innovative mask:

Assembly of mask consists of hard shell with two fans (one for intake and one for exhaust of air) mounted on it. Further, ESP32 (DOIT ESP32 DEVKIT V1) Wi-Fi Bluetooth mod- ule, microphone, DHT11 sensor, MAX30102 sensor are placed on inner side of shell whereas, Li-Po battery, MT3608 voltage booster, TB6612FNG motor driver, switch, connecting wires and on the outer side. A filter holder is used to keep the filters at a fixed position elevated at a small distance above the fans. The microphone is appropriately distanced from user's nose and connected to the ESP32 module via connecting wires. Switch connects battery to the voltage booster and ESP32 module providing proper power supply to the entire circuit. A motor driver is connected to multiple components.

- Working of Optimum Air Ventilation control module

A switch is used to close or open the circuit of Innovative mask. After it is closed, the battery power is supplied to the voltage booster which increases the supplied voltage from 7.4 V to 12 V, since fans require higher voltage. Also, the switch activates the two fans. Air drawn into the mask by the intake fan firstly passes through external filter where it is filtered. Then the air exhaled by user is drawn out of the mask by exhaust fan. After passing through fan, this air is filtered by external filter. Both fans are mounted at an angle that allows air drawn in by the intake fan to be directed towards the user's nose and air exhaled by the user to be directly drawn out by the exhaust fan. Primarily, microphone senses the breathing intensity of the user and sends this breathing intensity data continuously to the Esp32. Breathing level of the user can be slow, medium, or fast and so the corresponding output values of readings would be continuously returned by microphone. ESP32 module is the most important component of this mask as it controls and directs all the components used in the mask. It is programmed to take input from sensors, process the data received, and then instruct other components to work according to the decision made. After receiving the input values from microphone, Esp32 module processes them to determine the optimum speed of the fans for that corresponding set of readings. Then it directs the motor driver module to set the speed of fans to the predetermined optimum speed. This is a cyclic process which maintains continuous air flow inside the mask, iterating unless the switch is opened.

- Overall effect of working:

As a result of Optimum air ventilation control module, the Innovative mask can sense the breathing intensity of the user and adjust the air flow inside the mask by adjusting speed of both fans. This makes breathing easier without having a shortage of air supply in any condition and without the risk of inhaling impure air. Additionally, MAX30102 and DHT11 sensors are connected to Esp32 module inside the mask. Some aspects of the user's health

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and the inside conditions of the mask can be monitored by using these sensors. MAX30102 sensor collects the heart rate data and blood oxygen level data of the user, whereas DHT11 sensor detects the temperature and humidity levels inside the mask. All the values of the user's breathing intensity, heart rate, and blood oxygen level, along with temperature and humidity data inside the mask can be displayed to the user by using Blynk IoT platform. This entire operation is powered by a 1000mAh Li-Po battery.

C. IoT-based applications

SP32 contains a Wi-Fi module that is used to connect the Innovative mask with the user's device. This allows the transfer of data from mask to the smartphone. ESP32 is programmed by using Arduino software to find and connect to the respective internet connection via Wi-Fi connectivity. ESP32 sends the live data of user's breathing intensity, temperature, and humidity inside the mask, heart rate, and oxygen level of the blood acquired through all the respective sensors to the Blynk IoT server. Blynk IoT server sends the data further to the Blynk IoT platform. This application then displays the data in simplified form on the device. This graphical representation of data makes it easier for the user to understand the changes in his breathing levels.

D. Programming code of Innovative mask

- **Explanation of Code:**

A. Line number 1 to 116:
  i. Include libraries.
  ii. Initialize libraries.
  iii. Assigning pins of ESP32 microcontroller.

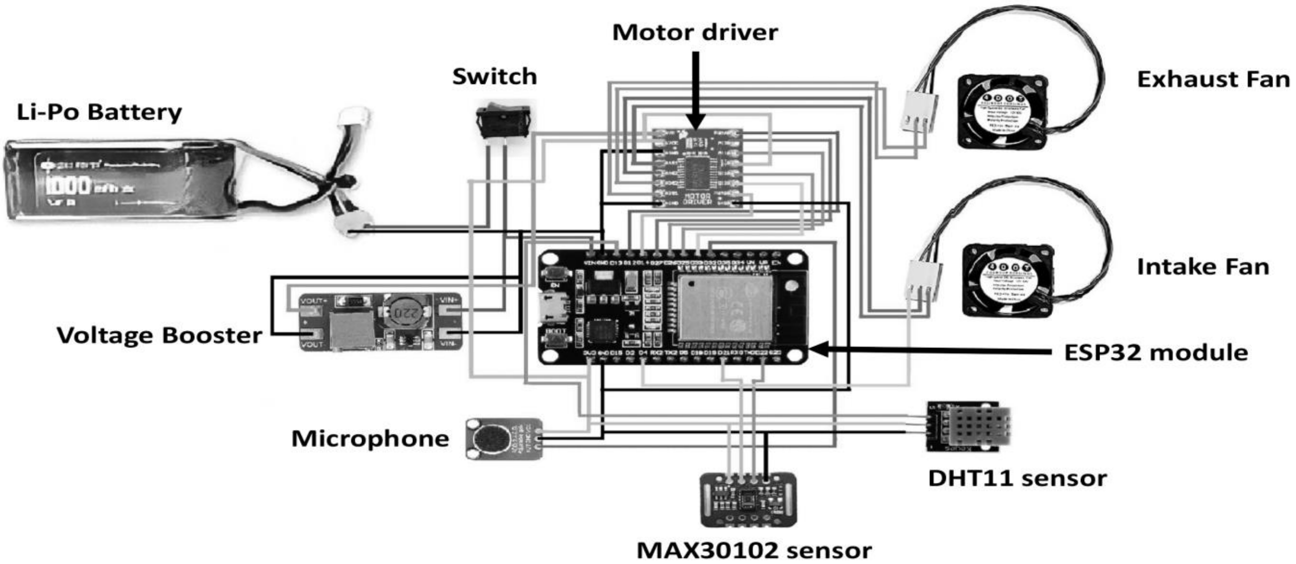

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Fig. 1. Circuit diagram representing connections of all components mentioned in the assembly.

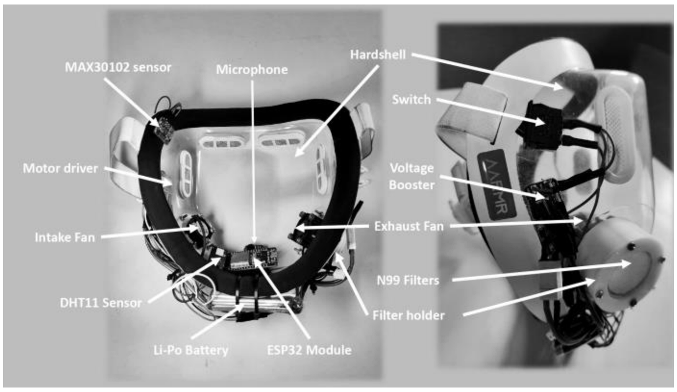

Fig. 2. Components used in Innovative Mask

Fig. 3. Basic air ventilation process

iv. Variable definition.

v. Blynk IoT platform initialization.

vi. Setting up Wi-Fi credentials.

vii. Partly initializing MAX30102 heart rate and body oxygen level sensor.

B. Line number 119 to 161:

i. Beginning of void setup.

ii. Beginning of serial function and Blynk function.

iii. Assigning pin for output data from fans and calling counter function.

iv. Assigning variables as output or input.

v. Initializing MAX30102 sensor.

C. Line number 163 to 280:

i. To run the Blynk function.

ii. Defining variables of DHT11 temperature and humidity sensor.

iii. Reading DHT11 sensor's raw(input) data and processing it to deliver readable data and writing this data on serial monitor and Blynk IoT platform.

iv. Defining variables for sample data collection from the microphone (MAX4466).

v. Reading the input data using analog function and further processing it using the map function.

vi. Setting motors A and B forward using the digitalwrite function.

vii. Using multiple 'if' conditional statements comparing microphone data with predefined data and if the microphone data matches with predefined data use analog write function to run fans at a specified speed (in rpm).

viii. using millis function to convert raw data received from the fan into readable data (speed in rpm).

ix. writing the microphone data on the serial plotter and Blynk IoT platform.

x. calling the function HTSP_sensor for MAX30102 sensor.

D. Line number 282 to 284:

i. Initializing void counter- increments the count every time this function runs.

E. Line number 286 to 371:

i. Running the Blynk function.

ii. reading the raw(input) data from the MAX30102 sensor and processing it to deliver readable values of heart rate and oxygen level in the user's body by externally referring to the bloodstream.

iii. writing the heart rate and oxygen level values on the Blynk IoT platform as well as serial monitor.

iv. After the HTSP_sensor function terminates, the voidloop keeps iterating itself.

- **Code of Innovative Mask** [9]

IV. TESTING

To analyze the system and working of the mask, outputs provided by all sensors were tested in three different conditions in a silent room. User who tested the mask is a young person with no diseases or breathing-related issues. Arduino software is used to program ESP32 for the collection of the input data sent from microphone and other sensors in all conditions. Firstly, we tested the microphone with all other components switched off to check if it is providing accurate output or not. In the second condition, we tested output of the microphone with fans connected to the circuit. In the third condition, we tested the overall working of mask. Processes used to test the working of mask are as follows:

A. Condition 1: Testing of the microphone with fans switched off.

In this test ESP32 inside the innovative mask was directly attached to a laptop through a USB Micro B cable. ESP32 module was coded in order to keep the fans turned off. Batteries were disconnected since ESP32 was being powered by a laptop in this condition. User wore the mask and ESP32 module started transferring readings obtained by the micro- phone to the serial plotter of Arduino software. Readings were recorded for two minutes when the user breathed normally for some time and mimicked heavy breathing for some time. This testing is performed to check the accuracy of microphone and its ability to detect changes in breathing intensity.

B. Condition 2: Testing of the microphone with fans switched on.

In this test, the whole mask was working using external power supplied by the laptop. Laptop was required to display the speed of fans using Arduino software's serial plotter. ESP32 was coded for the proper functioning of mask with fans switched on and to send fan speed data to Arduino software's serial plotter and microphone's data to the Blynk IoT application. Data was sent to Arduino software on laptop via USB Micro B cable and to the Blynk IoT application on the smartphone via Wi-Fi connectivity. User wore the mask, hence ESP32 module started transferring data of the user to the respective software. Readings were recorded for two minutes when the user breathed normally for some time and mimicked heavy breathing for some time. This testing is performed to check below things:

i. To test the performance of the microphone when fans are switched on.

ii. To inspect the variations in the speed of fans in response to the change in readings of microphone.

iii. To check the efficiency of the Innovative mask to transfer data to the user's smartphone.

iv. To examine the ability of Innovative mask to deliver optimum airflow according to user's needs.

C. Condition 3: Testing the functioning of mask with all fans and sensors activated.

This test is performed for inspecting the working of all the components integrated inside the Innovative mask to verify whether each and every component is working properly. All the additional sensors were connected to the circuit i.e. DHT11 temperature and humidity sensor, and MAX30102 Heart rate sensor. In this test, the mask was working without any external power source or connection. User wore the mask and switched it on. This time ESP32 was coded to receive additional data from these sensors and transfer it back to the Blynk IoT application on the user's smartphone. Readings were recorded for two minutes when the user breathed normally for some time and mimicked heavy breathing for some time. After testing all fans and sensors, the battery life was measured corresponding to continuous operation. This is the final test conducted to inspect:

i. The efficiency of DHT11 sensor to track the temperature and humidity inside the mask.

ii. The efficiency of MAX30102 sensor to monitor the heart rate and oxygen level of blood.

iii. The overall working of innovative mask with all the sensors attached to it.

iv. The battery life of the mask when it powers all compo- nents.

V. RESULTS AND ANALYSIS

After testing, results for each test were obtained on the respective application used for displaying data sent by sensors. After data was obtained, it was analyzed to verify the output and functioning of the innovative mask according to it. Results and analysis of all the tests are as follows:

A. Result 1: Output of condition 1.

As the serial plotter of Arduino software was opened it started showing the data collected by the microphone and sent to ESP32 module. Without user wearing the mask readings were nearly constant but when the user wore the mask, readings started to fluctuate as the microphone was detecting breathing of the user. At the time when user was breathing normally, the graph seen on the serial plotter had identical spikes at the time of breathing and during

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heavy breathing,

Fig. 4. Operation of Innovative Mask

spikes became even bigger and more frequent. This test confirmed that the microphone was working properly and was detecting the changes in user's breathing intensity precisely.

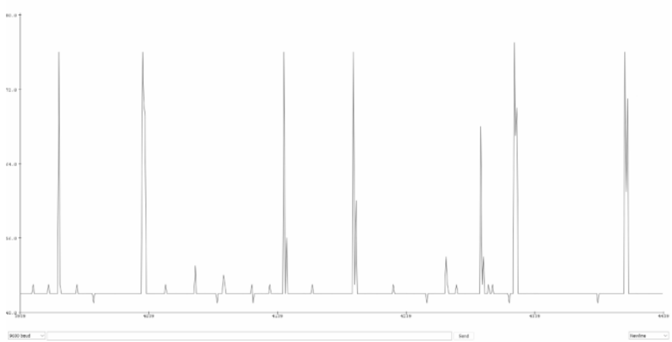

Fig. 5. Output received from microphone on serial plotter (Result 1)

B. Result 2: Output of condition 2.

As mentioned in condition 2, the mask was running on power supplied by the laptop. Arduino software and Blynk IoT application were set up to record the data. After user wore the mask, the microphone started detecting the breathing intensity of the user and sent the output to ESP32 module which was then displayed on the user's smartphone by using Wi-Fi connectivity. Also, the speed of fans changed depending on the breathing intensity of the user. Data of the fan was recorded on a serial plotter of Arduino software which received the data from ESP32 module via a USB Micro B cable. While testing the output provided by microphone and comparing it to the output of fans, it is observed that there was a small delay in the data sent by the microphone to Blynk IoT application. It is also observed that the average value provided by the microphone was slightly higher in this test due to the small disturbance caused by the working of fans. Data recorded on Blynk IoT application showed that the microphone recorded clear spikes whenever the user was Inhaling and exhaling. Serial plotter on Arduino software showed that the speed of fan was changing according to the breathing intensity of user and replicated a similar pattern of increase and decrease in fan speed as compared to the increase and decrease in breathing intensity of user, provided by the microphone on graph.

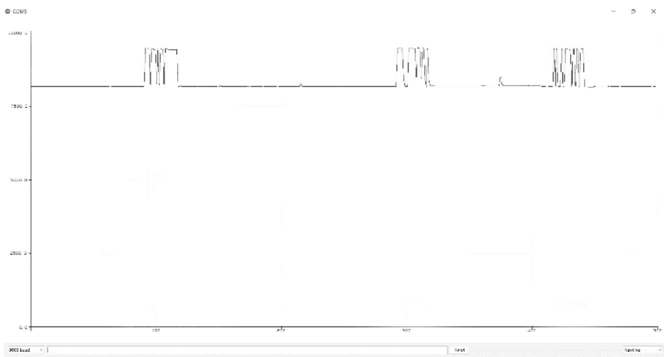

Fig. 6. Output received from fans on serial plotter (Result 2)

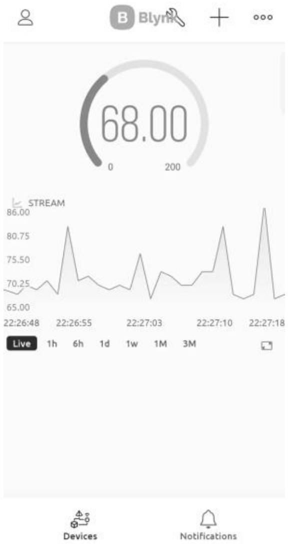

Fig. 7. Output received from microphone on Blynk IoT application (Result 2)

Specific outputs obtained from this test are as follows:

i. The microphone's performance gets slightly affected by activation of fans but it does not have any effect on perfor- mance as outputs are still clear and easily distinguishable.

ii. From the physical experience as well as by comparing both the readings obtained through Arduino software's serial plotter and the Blynk IoT application's graph, it is clear that the speed of fans changes according to the readings obtained by the microphone. There is a fraction of delay between the change in breathing and change in speed of fans but it does not affect the performance of the basic mechanism.

iii. IoT had a small delay in it because it was being transferred via Wi-Fi.

iv. The basic overall working of innovative mask was according to the user's need as it successfully delivered filtered fresh air supply to the user according to his breathing intensity.

C. Result 3: Output of condition 3.

After the user wore the Innovative mask and switched it on, It was working on the power supplied by the 1000mAH
Li-Po battery. There weren't any interruptions or power cuts throughout the test which proves the efficiency of battery used in Innovative mask. For this test, the ESP32 module was sending all the data received from the sensors directly to the Blynk IoT application on user's smartphone. All the readings received from various sensors were displayed on the Blynk IoT software which indicates that all the sensors are working properly. Readings were recorded for two minutes during the testing, in which the basic air ventilation mechanism of innovative mask was functioning properly with all the sensors working along with it. Throughout the testing of Innovative mask, accurate readings were received from all the sensors which provide additional data to the user.

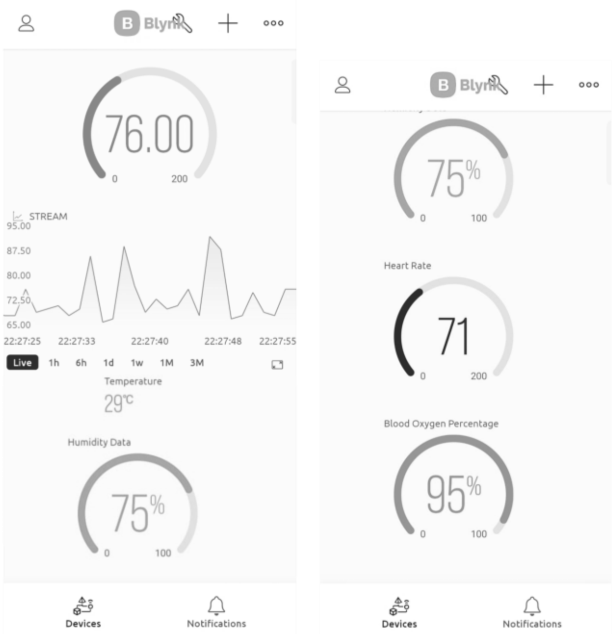

Fig. 8. All outputs received on Blynk IoT application (Result 3)

Specific outputs obtained from this overall testing are as follows:

i. DHT11 temperature and humidity sensor were working as estimated throughout the testing. It provided readings of temperature in degrees Celsius and humidity in percentage inside the mask. The average reading of temperature was around 29 degrees Celsius and the average reading of humidity was around 75%.

ii. MAX30102 sensor also worked properly during the testing. It provided readings of heart rate and blood oxygen level of the user. The average readings of heart rate of the user were between 70 to 100 which is quite practical as compared to the average heart rate of human beings. Readings of the Blood oxygen level of the user remained close to 95% to 97% throughout the testing.

iii. During the testing of Innovative mask, it successfully delivered the filtered air supply to the user according to his breathing intensity. Whenever breathings were at a normal rate, fans decreased air supply and whenever breathing rate increased, air supply to the user was also increased. ESP32 module automatically connected itself to the user's smartphone once the mask was switched on and disconnected when the mask was switched off. voltage booster constantly stepped up and supplied

12 volts to the motor driver which was then supplied to the fans. The motor driver controlled the speed of fans according to the instructions received from ESP32 module in response to readings received from the microphone. ESP32 transferred data of Breathing intensity, temperature, humidity, heart rate, and oxygen level of blood to Blynk IoT software successfully displaying it on the user's smartphone. From all of the outputs received from this test, it is clear that the overall specifications of the Innovative mask are successfully observed in its working.

iv. After testing, it was observed that the battery lasts up to
4.5 hours when the mask is continuously used.

D. Output data in .csv format obtained from Blynk IoT platform:

Output data of the test was obtained from Blynk IoT platform in the form of a .csv file as shown in Fig. 9. Data represented by each column is as follows:

- Column A represents output data of the microphone dB).
- (in Column B represents output temperature readings obtained from the DHT11 sensor (in ºC).
- Column C represents output humidity readings obtained from the DHT11 sensor (in %)
- Column D represents output data of heart rate obtained from the MAX30102 sensor (in bpm).
- Column E represents output data of blood oxygen level obtained from the MAX30102 sensor (in %).
- Column F represents unix timestamp.

	A	B	C	D	E	F	G	H
85	65.25	29	75	71	95	1656608305	0	
86	65.78	29	75	75	97	1656608306	0	
87	66.45	29	75	72	96	1656608307	0	
88	68.38	29	75	78	96	1656608308	0	
89	80	28	75	82	95	1656608309	0	
90	81.75	29	74	77	96	1656608310	0	
91	73.81	29	74	82	97	1656608311	0	
92	67.5	29	75	74	97	1656608312	0	
93	66.27	29	75	76	96	1656608313	0	
94	64.95	29	75	84	95	1656608314	0	
95	65.32	28	75	77	96	1656608315	0	
96	82.85	29	75	71	95	1656608316	0	
97	80.53	29	76	74	95	1656608317	0	
98	75.64	29	75	71	97	1656608318	0	
99	66.05	28	76	80	97	1656608319	0	
100	65.84	28	75	82	96	1656608320	0	
101	63.79	29	75	75	95	1656608321	0	
102	78.45	29	74	71	96	1656608322	0	
103	79.21	29	75	73	97	1656608323	0	
104	69.52	29	75	77	97	1656608324	0	
105	65.41	29	75	83	96	1656608325	0	

Sheet1

Fig. 9. Output data from Blynk IoT platform in .csv file format.

VI. APPLICATIONS

A. In mining sites:

Innovative mask prevents mine dust particles that could lead to respiratory diseases (asthma and tuberculosis) from entering inside the mask. Simultaneously, it maintains continuous air- flow to avoid suffocation, securing miners' health [4].

B. Hospitals and Clinics:

Masks are used to avoid the spread of infectious micro-organisms inside the hospitals, but traditional masks are not efficient. Innovative mask can be used here as it can protect the user from viruses as well as it is comfortable [5].

C. Coal- based thermal power plant:

Innovative mask is more efficient than traditional masks at protecting from harmful gases like carbon monoxide and particles of ash found inside coal-based thermal power plants. All of this is done while maintaining air supply to the user.

D. Desert conditions:

In deserts, winds and sand storms cause the suspension of sand dust particles in the air. These particles cause minor inflammatory changes and degradation of the air–blood barrier structure. Due to sweating in high temperature, wearing tradi- tional masks is not comfortable. Innovative mask can provide comfort and ventilation all while protecting the user [6].

E. Paint industry:

The presence of carcinogens in paint fumes is the primary risk as they can cause cancer. Many paints contain volatile organic compounds (VOCs) such as Toluene and formaldehyde which can damage different organs of body. Innovative mask blocks the harmful chemicals and due to its proper fitting, the fumes can't come in the contact with user's face.

F. Cement factory:

Cement dust is composed of different metal oxides such as silicon oxide, ferric oxide and other impurities which results in respiratory diseases with higher impact and airway blockage. Hence, the innovative mask can be used in this field for improving the work efficiency of workers by reducing their health risk [7].

G. Sandblasting industry:

In the sandblasting process, sand to be blasted and the sub- jected surface contain toxic particles like lead paint, arsenic, beryllium, and cadmium and silica that are harmful to workers. Innovative mask covers the user's entire face and blocks these hazardous substances. Additionally, it protects the user's eyes from being damaged by particles that are suspended in the air.

H. Activities leading to exhaustion:

During daily life, physical exercises and outdoor activities (for instance, mountain biking) increase one's breathing rate and leads to extreme exhaustion. Heavy-duty workers also face shortness of breath. Innovative mask can help in avoiding impure air particles and shortness of breath during exhausting activities.

VII. FUTURE SCOPE:

A. **UVC light technology:** As it is clear that UVC light can kill 99.99% of bacteria and viruses, it has become one of the important methods used to prevent diseases. A miniature version of the UVC light emitter can be connected inside the mask to kill any kind of bacteria or viruses present in the air which is being intaken by the fan. This addition can increase the overall efficiency of innovative mask [8].

B. **Development of a compatible software:** Currently the mask uses Blynk IoT platform which is an open-source platform for IoT, to transfer data from Innovative mask to the user's smartphone. Also, it can send live data with a little delay but it does not provide data storage. To solve all of these problems, a dedicated software can be developed. It will not only provide more functions and controls but also it will be able to store the data sent by the innovative mask. A dedicated app will reduce the delay in data transfer which is seen in the case of generalized open source apps due to web traffic.

C. **Improvements in fans:** Fans that are currently used in the mask are efficient enough to deliver the required amount of air. Innovative mask's functioning can be improved by installing more efficient fans which will make even less noise and will deliver more air flow rate. This improved air flow rate can provide various modes of ventilation to the user, from which they can adjust the airflow rate according to their needs.

D. **Optimization of components size:** The size of currently used components can be reduced to fit them compactly. This will increase the space between user's face and the hardshell of the mask. Also, reduction of components size will improve the visual field of the user even more. The weight of mask can also be reduced by developing smaller components that can deliver similar output.

E. **Addition of sensor measuring oxygen level inside the mask:** Currently, there is no feature informing the user about the fluctuations in oxygen level inside the mask. For this purpose, a sensor that can measure ambient oxygen concentration more accurately and conveniently can be added. This sensor can be integrated into a program in order to warn the user regarding a drop in oxygen level inside the mask beyond a certain limit.

F. **Additionally, programming the mask to act upon emergencies:** Presently, the mask is not programmed to respond to emergency cases like a drop in blood oxygen level, fluctuations in heart rate beyond a normal range, etc. It can be programmed to warn the user about unusual health abnormalities and send a signal to the concerned authority via helpline numbers.

G. **Studying the acquired data for future medical re-search:** Medical researchers could study the stored data concerning health aspects to understand the minute symptoms seen in users infected by specific diseases. Further after certain technological advancements, the innovative mask can be programmed to automatically diagnose those diseases as early as possible.

VIII. Conclusion

This research paper presents the Innovative mask which is a potential solution to most of the problems arising from the usage of traditional masks. Innovative mask is a concept that not only protects the user from harmful microparticles but also provides optimum ventilation to the user. It resolves the issues of suffocation and discomfort. Basically, it is more reliable than traditional masks. In addition to the protection, the mask can help make the user aware of his health aspects. Data gathered from all these sensors is continuously displayed and stored with the help of IoT-based platforms. This whole process makes it convenient for the user to interact with and analyze the gathered data.

This mask is indeed reusable and only the filters need to be changed after a specific time interval as per their usage. It produces a comparatively lesser quantity of material wastage as it includes a lesser quantity of N99 filters which is one- fourth times the whole traditional mask. During the pandemics such as the Covid-19 pandemic, an advanced mask will be preferred over other traditional masks by a higher number of people. Innovative mask is a better alternative as it is more efficient, comfortable, and affordable relative to other reliable masks. This data collected from diseased users can be studied and used for medical research which is based on the early detection and prevention of specific diseases. This mask is most useful for people who work in a surrounding containing harmful microparticles and those who perform heavy-duty tasks as they require continuous fresh air.

Innovative mask provides an enhanced user experience along with convenience. Also, there is ample scope in the future to improve this mask's characteristics and services. Hence, Innovative mask is one of the effective alternatives to traditional face masks and has the potential to replace them completely.

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