

2020

Avatar Renewables IAQ Indoor Air Quality Monitor & Control

BUSINESS PLAN FOR INDOOR AIR QUALITY MONITOR AND
CONTROLLER BY AVATAR RENEWABLES PVT.LTD.
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1.Executive Summary

The atmospheric air and the transmission of it into the indoor spaces where the urban life largely spends their time is changing its composition in an unprecedented way owing to the dynamism of the environment we live in. The quality of air what we breathe in essentially influence our health, cognition and general well-being. The growing demands on statutory compliance on maintaining a healthy, conducive environment to the citizens of the country; implementation of methods to ensure the air quality and a universally accepted index are imperative. Moreover, the monitoring can alone won't provide the solution for the bad quality of the air. Hence Avatar Renewables Pvt.Ltd. has come up with an air quality monitoring directed controller device to ensure the incessant replenishment of fresh air on a need basis thus ensuring nil wastage of energy by the HVAC systems. The prototype is tried and tested in various industries and environments which spearheaded the major theme of this proposal for a commercially viable production model of the prototype which is scalable. The major breakthrough happened post the product got accepted by Indian navy for their ship's air quality management and it became imperative to seek for authorities' assistance to further the development and fine tuning of the prototype to meet the industry stipulated requirements. In the burgeoning market of indoor air quality monitoring (IAQM), Avatars IAQM unit innovation stands out with its unique remotely controlled actuator which can integrate with the HVAC to provide fresh air as well as through MODBUS for its integration to the Building Management System. However, for an innovation to be fruitful the commercial feasibility is imperative and the business plan encompasses on the income expense projections and production plan for the next 5 years post development and a mention of important references which made this innovation a reality.

2.Introduction

Atmospheric Air and Components

By volume, dry air contains 78.09% nitrogen, 20.95% oxygen, 0.93% argon, 0.04% carbon dioxide, and small amounts of other gases. Air also contains a variable amount of water vapor, on average around 1% at sea level, and 0.4% over the entire atmosphere. Air composition, temperature, and atmospheric pressure vary with altitude, and air suitable for use in photosynthesis by terrestrial plants and breathing of terrestrial animals is found only in Earth's troposphere and in artificial atmospheres.

Air Pollution

Air pollution occurs when harmful or excessive quantities of substances are introduced into Earth's atmosphere. Sources of air pollution include gases (such as ammonia, carbon monoxide, sulfur dioxide, nitrous oxides, methane and chlorofluorocarbons), particulates (both organic and inorganic), and biological molecules. It may cause diseases, allergies and even death to humans; it may also cause harm to other living organisms such as animals and food crops, and may damage the natural or built environment. Both human activity and natural processes can generate air pollution

Air Quality Index

An air quality index (AQI) is used by government agencies to communicate to the public how polluted the air currently is or how polluted it is forecast to become. Public health risks increase as the AQI rises. Different countries have their own air quality indices, corresponding to different national air quality standards.

INDIA - The National Air Quality Index (AQI) was launched in New Delhi on September 17, 2014, under the Swachh Bharat Abhiyan.

The Central Pollution Control Board along with State Pollution Control Boards has been operating National Air Monitoring Program (NAMP) covering 240 cities of the country having more than 342 monitoring stations. An Expert Group comprising medical professionals, air quality experts, academia, advocacy groups, and SPCBs was constituted and a technical study was awarded to IIT Kanpur. IIT Kanpur and the Expert Group recommended an AQI scheme in 2014. While the earlier measuring index was limited to three indicators, the new index measures eight parameters. The continuous monitoring systems that provide data on near real-time basis are installed in New Delhi, Mumbai, Pune and Ahmedabad.

There are six AQI categories, namely Good, Satisfactory, Moderately polluted, Poor, Very Poor, and Severe. The proposed AQI will consider eight pollutants (PM₁₀, PM_{2.5}, NO₂, SO₂, CO, O₃, NH₃, and Pb) for which short-term (up to 24-hourly averaging period) National Ambient Air Quality Standards are prescribed. Based on the measured ambient concentrations, corresponding standards and likely health impact, a sub-index is calculated for each of these pollutants. The worst sub-index reflects overall AQI. Likely health impacts for different AQI categories and pollutants have also been suggested, with primary inputs from the medical experts in the group.

Need for Air Quality

Health and Engineering agencies (ASHRAE, NIOSH, US-EPA) across the world have recognized the fact that high levels of CO₂ (carbon dioxide) and VOC (volatile organic compounds) seriously affect human occupational health.

Particulate matters like dust, fibers, pollen, spores, mold can cause serious health hazards.

Studies have also confirmed that cognitive ability of human beings decrease as much as 30%. In view of this, there is a growing trend to have Indoor Air Quality(IAQ) monitors installed in closed offices, houses, buildings, casinos and theaters.

Air Quality in India

India has one of the worst air quality in the world

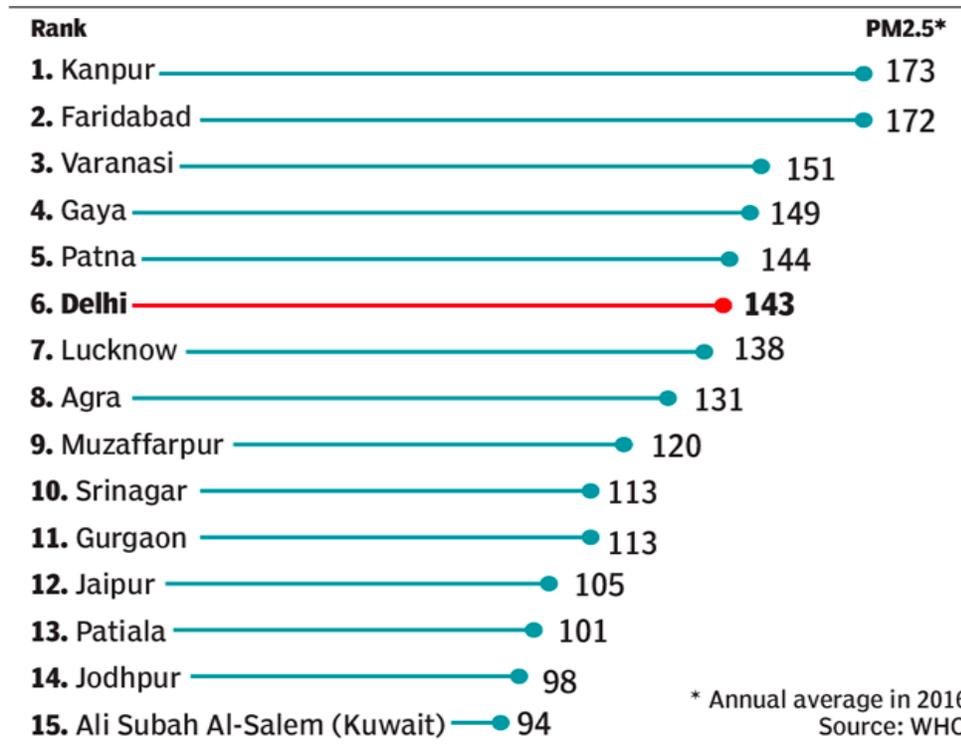
Large number of our population suffer from chronic pulmonary diseases, Asthma and Lung Cancer

This is due to long term exposure of polluted air

Huge cost on the country in terms of loss of health, lives and productivity

Pollution levels are not decreasing

WORLD'S MOST POLLUTED CITIES ARE IN INDIA



Air pollution in Indoor spaces

We can control the air we breathe in our private spaces, a little better than we can control the air outside – after all, we're at the mercy of smoke, fumes from fuel and all sorts of other pollutants once we step outdoors.

Particulate Matter (PM)

One of the key drivers of adverse health effects is fine particulate matter ambient pollution, or PM2.5, which are very small particles that less than 2.5 microns in diameter.

“They can affect both our respiratory and cardiovascular systems and are associated with very serious diseases, including stroke, heart disease, lung cancer, chronic obstructive pulmonary diseases, and respiratory infections.”

With the help of Air Quality Monitors, we are able to narrow down the level of particulate matter (PM2.5) which are tiny particles in the air that reduce visibility and cause the air to appear hazy when levels are elevated.

Similar to PM2.5, monitors can register data for PM10, particulate matter 10 micrometers or less in diameter which is also dangerous to human health if inhaled.

a) Volatile Organic Compounds (VOCs)

VOCs are chemicals and gases that are most commonly found in the **household or indoor living spaces**. It can be anything from a candle to that new furniture you got for your living room. VOCs can also be in your cleaning supplies or in the nail paint that you recently purchased online.

Volatile Organic Compounds (VOCs) have the potential to pollute your indoor air faster than the outdoor air. While the **concentration of the VOCs sources** could vary, it is important to learn about the danger it can pose to your wellbeing.

The common form of volatile organic compounds includes benzene, formaldehyde, and toluene.

Volatile Organic Compounds (VOCs): Inhaling too much volatile organic compounds is dangerous. Exposure to volatile organic compound usually happens when you inhale. When indoor air is exposed to harmful air pollutants, concentration and productivity level of a person decreases naturally. That is when your respiratory health issues also get affected.

Since humans spend 90% of their time living indoors – home and office, inhaling high level of airborne particles is a common way to introduce bacteria in your bloodstreams.

3. Air Quality Monitoring



HVAC AIR QUALITY MONITOR / CONTROLLER

HVAC AIR QUALITY DAMPER CONTROL



Local Colour Touch Screen Controller for Actuator



View and Don Load Air Quality information remotely (Temp, Humidity, eCO2, TVOC, PM 2.5/10, AQI (EPA-Air Quality Index)



Remote Air Quality Sensor (2-wire MODBUS 1km max)

The above sections describe in detail the need of the quality of the air what we breath and a statutory compliance and monitoring mechanism to ensure the air pollution is in the specified limit. One of the easiest and most viable mode of monitoring the air quality is by using sensors and connecting those to electronic display devices which can provide the real time data as well as stored data for past data analysis.

4. Market Potential for the idea

The Global Air Quality Monitoring Systems (AQMS) market is projected to reach USD 6.0 Billion by 2025 with a CAGR of 5.6%. By sampling method, the continuous monitoring method is expected to dominate the AQMS market during the forecast period. The Asia Pacific Region (Japan, China, India, Australia and South Korea) is expected to grow at the fastest rate during the forecast period.

5. Innovativeness of the idea

Even though there are a multitude of products available in the market for the Indoor Air Quality Monitoring (IAQM) there is yet to have a product which has the end to end air quality management capability. With the currently available IAQM products, the quality of air in the confined congested places can be measured and displayed but the ultimate objective providing incessant supply of quality air is not addressed. At this juncture the idea to bring in a device which can monitor the quality of the air as well as integrate with the HVAC systems remotely through Wi-Fi or through MODBUS and integrate with the building management system stands out in the industry solutions so far.

The state of art Avatar IAQ Monitor / Controller is equipped with Arm Processor, quality sensors (US / EU made) TVOC/e-CO₂/Temp/Humidity and PM_{2.5}/10. Different variants of IAQ are available with WiFi, MODBUS. Taking into consideration the recent accident in Nepal (due to CO-Carbon Monoxide), design of a variant model with CO sensor is in progress and corrective action.

The modern world is seldom devoid of any electronic gadget which is not connected to internet. The innovation stands distinct in this idea by having wifi enabled actuators and display options which will assist the user to remotely monitor and control the air supply to any confined area of choice.

Moreover, a mobile application which can get integrated with the electronic device so as to ensure the remote management is also introduced as part of the innovative idea. All these put together makes the monitoring of the vital signs of air quality and the transmission of the air with the touch of screen.

6. About Avatar Renewables

The conceptualization of the idea, the innovation and design took place from the finest minds of the technology start up incubated in Maker Village, Kochi Kerala. M/s Avatar Renewables Pvt.Ltd. is the technology start up in the sustainable energy innovation spectrum focused on developing indigenous custom made products for the day to day needs of the society. Started by a team of Veteran Engineers with a vision to create sustainable solutions for the energy requirements of mankind Avatar Renewables has move ahead with their innovations and the first product (Water Wheel) is awaiting patent for the uniqueness of its design. The newest addition to the innovative list of Avatar Renewables in the Indoor Air Quality Monitor which encompasses the innovative ideas described in detail in section 5.

7. Avatar Renewables Indoor Air Quality Monitor



AVATAR'S IAQM IS WIFI ENABLED,
CONNECTED TO CONTROLLER / ACTUATOR
TO AUTOMATIC FRESH AIR SUPPLY AND
MODBUS TO INTEGRATE WITH BMS

INDOOR / CABIN AIR QUALITY MONITOR / CONTROLLER

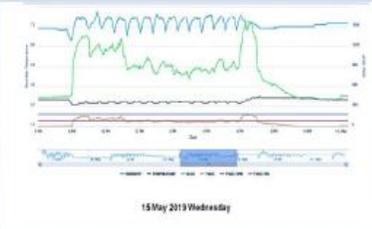


- AVATAR IAQ & CAQ Monitor are state-of-the-art products that can work stand-alone or in conjunction with an existing HVAC system (IAQ), to monitor and control indoor air quality. Helps in efficient air quality management for office rooms, conference rooms, gymnasiums, theatres, shop-floors etc., by automatically controlling fresh air supply and circulation as and when required. Has features for remote management / reporting of air quality (IAQ) and thus maintain high working environment quality and health standards.

NOTE:- AVATAR CAN PROVIDE ENCRYPTION FOR SENSITIVE DATA ON REQUEST



CAQ (CABIN AIR QUALITY) monitor for **automobiles, an off-shoot of IAQ**, can provide air quality readings on its mini OLED display as well as sound buzzer when the VOC exceeds threshold and is powered from the vehicle USB port. Its TVOC sensor can detect ethanol concentration and a built-in proprietary AI algorithm can reasonably well detect high concentrations of alcohol in the cabin. Can be useful in assessing driver alertness and fatigue. It will display as well as log the data with time-stamp into a micro SD Card for later analysis with legends like "good, bad, okay, very bad, warn (alcohol)".



IAQ-MONITOR/SD-CARD LOGGER/CONTROLLER/CHARTING (with TIME-SEGMENTED function)

CABIN AIR QUALITY MONITOR

INDOOR / CABIN AIR QUALITY MONITOR / CONTROLLER



FEATURE COMPARISON – IAQS/CAQ/IAQP/IAQM/ HVAC MODELS

| SRL NO | FEATURES | IAQS & CAQ | IAQP & IAQM | HVAC | REMARKS |
|--------|--|--------------------------|----------------|---------------------------|--|
| 1 | TVOC | Y | Y | Y | 0-1187 ppb (parts/billion) |
| 2 | eCO2 | Y | Y | Y | 400-8192ppm (parts/million) |
| 3 | HUMIDITY/TEMPERATURE | Y | Y | Y | |
| 4 | PM2.5 & PM10 | N | Y | Y | |
| 5 | AQI (air quality index) | N | Y | Y | Based on EPA-US, PM2.5 @ 24 Hr moving average |
| 6 | RELAY | Y (not in CAQ) | Y | Y | |
| 7 | BUZZER | Only in CAQ | N | N | Operates based on threshold setting. Can be muted for 10 minutes by the push button switch |
| 8 | MODBUS SLAVE (over isolated RS485, 2-wire) | N | (only in IAQM) | Y | Maximum 32 nos can be linked to BMS (building management system) or PLC (Max 1 Km distance) |
| 9 | MICROCONTROLLER | *32-bit | 32-bit | 32-bit | *The compact low-cost CAQ uses 8-bit |
| 10 | USER PROGRAMMABLE TIMERS | 3 (not available in CAQ) | 3 | 3 | 0-23 hours in steps of 1 hour. Records and sends data over WIFI only during programmed timings. Useful for company shifts or time-segmented operation. Measurement and local display reading are unaffected. |
| 11 | DISPLAY | 1.3"OLED (0.96" for CAQ) | 1.3"OLED | 1.3"OLED & 2.8"COLOR LCD | The display automatically turns off after 10 minutes. Pressing the push button activates the display. |
| 12 | POWER | USB 5VDC | USB 5VDC | USB 5VDC / 110 to 230 VAC | HVAC model has three sub units (sensor, controller and actuator). Its Linear actuator provides 1000NM torque for large dampers, 8" stroke and is IP54. |
| 13 | RTC (real time clock) | Y | Y | Y | Precision clock +/- 2 minutes/year |
| 14 | WIFI | Y | Y | Y | |
| 15 | LOGGING | Y | Y | Y | With time-stamp (micro SD card) |
| 16 | LOGGING SCAN RATE | *Y | Y | Y | 60 to 700000 Seconds (1 minute to Approx 1 week) *CAQ- 60 to 3600 seconds |
| 17 | THRESHOLD | Y | Y | Y | The high and low TVOC limits can be set by user to activate the RELAY/BUZZER. |

8. Major Break Through

2019 December - Indian Navy southern command has shortlisted Avatar as the certified vendor for the Air Quality Monitoring and Controlling expert and Avatars Indigenous air quality monitoring unit is undergoing rigorous performance stress as per the stringent stipulations of Indian Navy. Custom made changes has been incorporated for the standard Air Quality Model of Avatar so as to meet the specific requirements of Indian Navy. Upon fulfilling the criteria set by Indian Navy the product is selected for deployment in one of the chosen ship of Indian Navy.

9. Development Plan

A 12-month development plan is formulated to produce the 4 types of IAQs (Indoor Air Quality Monitoring and Control Units) for the market needs. The first step in this phase is to conduct a detailed market analysis to gather the requirements of the different industries. We have planned to hire the services of an external consultant who will act as the Industrial Mentor and handhold the team for understanding the market needs, procurement of the materials, design, overall development and testing/calibration activities.

10. Funding Requirements

Avatar IAQ needs further design improvement post detailed Industry requirement fine tuning and further steps has to be taken to finalize the commercially viable product. Below are the requirements for the Design and Development team to come up with a Robust product which will meet the market requirements. The funding requirements are for the development of the products which can function as the prototypes for the mass production planned post the successful commissioning of the plant and finalizing the product variants.

The funding requirements what Avatar is looking for are majorly revolving around the below 3 heads; Technology related, Industrial Mentor Charges and Travel for Industry Analysis. This will include the travel expenses for industry need analysis as well as the expenses which may incur post installation of the developed product on specific selected customer premises for feedbacks, fine tuning and parts replacements.

| Particular / Item | Total Project Cost (Rs. in Lakhs) | Amount GOI Assistance (Rs. in Lakh) | Incubatee Share (Rs in Lakh) |
|------------------------------|-----------------------------------|-------------------------------------|------------------------------|
| Technology related | 15 | 10 | 5 |
| Industrial Mentor Charges | 4 | 3 | 1 |
| Travel for Industry Analysis | 2.5 | 2 | .5 |
| Total | 21.5 | 15 | 6.5 |

Business Plan for Indoor Air Quality Monitor and Control

| Particular / Item | Total Project Cost (Rs. in Lakhs) | Amount GOI Assistance (Rs. in Lakh) | Incubatee Share (Rs. in Lakh) |
|---|-----------------------------------|-------------------------------------|-------------------------------|
| Raw Material Charges | 3.8 | 3.1 | .77 |
| Machine Charges Design & Flow Analysis | 4.8 | 2.6 | 2.2 |
| Electricity Charges | .48 | .39 | .12 |
| Testing and Calibration | 4.2 | 3.1 | 1.1 |
| Rent | 1.72 | .81 | .8 |
| Industrial Mentor Charges | 4 | 3 | 1 |
| Travel for Industry Analysis | 2.5 | 2 | .51 |
| Total | 21.5 | 15 | 6.5 |

We have also done a detailed break up of the Technology related expenses which will largely revolve around the particular/items mentioned in the above table. A major portion of the expenses are expected for the procurement of the raw materials for developing the sample product variants and the machine charges for the design. We have also factored in the Testing and Calibration charges for the product development phase and the electricity and rent charges for the period. Rest of the charges are the representation of the Industrial Mentor Charges and Travel for Industry Analysis charges so as to tally the numbers.

11. Income Expenses Projections for 5 years



| | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|-----------------|--------|--------|--------|--------|--------|--------|
| Income | .03 | 1.4 | 2 | 3.8 | 7.5 | 13.5 |
| Expenses | .36 | .8 | 1.7 | 2.8 | 4.9 | 8.2 |

*All values in inr. Crores

Post the successful completion of the Design and Testing Avatar Renewables plans to foray into mass production targeting a slow and steady growth in the revenue by carefully focusing the production of its 4 most industry suited product line of choice. Towards the end of 5th year post the successful development company plans to gear up its productions to reach the revenues at inr. 13 crores (1.8 Million) which is .03% of the Global Market of the Air Quality Monitor Market. With a unique product which can not only monitor but also control and manage the fresh air supply Avatar Renewables target to scale up and capture the markets achievable share is a sustainable and feasible model.

12. Planned Production Projection for 5 years

| Product | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---------------------|--------|--------|--------|--------|--------|--------|
| Variant/Unit | | | | | | |
| IAQP | 3 | 500 | 750 | 1350 | 2550 | 4000 |
| IAQM | 3 | 200 | 350 | 540 | 1020 | 1600 |
| CAQ | 3 | 100 | 150 | 270 | 510 | 800 |
| IAQMH | 3 | 50 | 75 | 135 | 255 | 400 |

13. Product Documentation



Air Quality Monitor
R8 191107.pdf

14. Industry Segments

1. Travel and Hospitality
2. Healthcare and Fitness
3. Software Development Centers and Shop floors
4. Small and Medium Enterprises in SEZ.
5. Large Convention Centres, Auditoriums and Multiplexes.
8. Consumer and Public Transport Vehicles
- 9) Shop floors using printing machines
- 10) Painting shops
- 11) Synthetic fabric/textile shops
- 13) Bedrooms/living rooms
- 14) Photo studios
- 15) Printing press
- 16) Shopping malls

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