HS202 PROJECT

EXERCISING IN POLLUTED ENVIRONMENT

GROUP-18

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Abstract

One of the greatest threats to humankind is still pollution, which has claimed the lives of approx. 7 million people. Cities like Delhi and Ghaziabad are experiencing an ongoing upward trend in pollution, which is not very good for the health of humans. The investigation of the causes of these deaths is of the utmost significance in light of this concerning trend. We can implement preventative measures and make physical activities safer by studying the various aspects of these deaths. In the course of our project, we investigated the relevant data and proposed a prototype to stop premature deaths.

Since proposing a great innovation requires long stretches of exploration and concentration, in this task report we will try to find imaginative mechanical arrangements and strategy changes to check the damages brought about by doing proactive exercises in unsatisfactory climatic circumstances or contaminated air conditions.

We will go over in detail how these issues pose a serious threat to your health, the method used to identify them, and how to comprehend all aspects of them. After convincingly illustrating the threat and issues associated with these causes, we will delve deeply into the various technological and non-technical interventions that can be used to effect change in a positive direction.

Problem Statement and its Identification

Exercise can lessen your risk of developing significant illnesses like coronary heart disease, stroke, type 2 diabetes, and cancer as well as your risk of dying young by as much as 30%. This claim makes exercising sound like a great task to do, but there's another advantage that you're missing. While exercising in a clean environment is advantageous, doing so in a polluted setting has more of an adverse effect. Our research fundamentally focuses on educating people about their health, the effects of pollution on them, and the adverse effects of exercising in unhealthy environments. By outlining where to go and what to do to keep healthy and prevent diseases, it will guide you towards leading a healthy lifestyle.

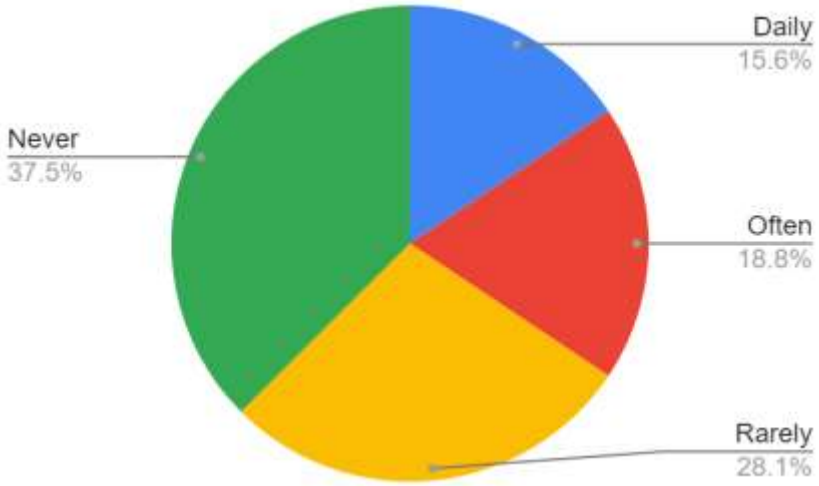
The health sector is a significant industry with plenty of space for improvement. The fact that it directly impacts us, makes it important. If a gap is discovered, it must be filled in as soon as possible. This industry initially drew our attention while we were looking for a gap, and pollution was the main detractor. After investigating this area, we came up with our problem statement.

Methodology

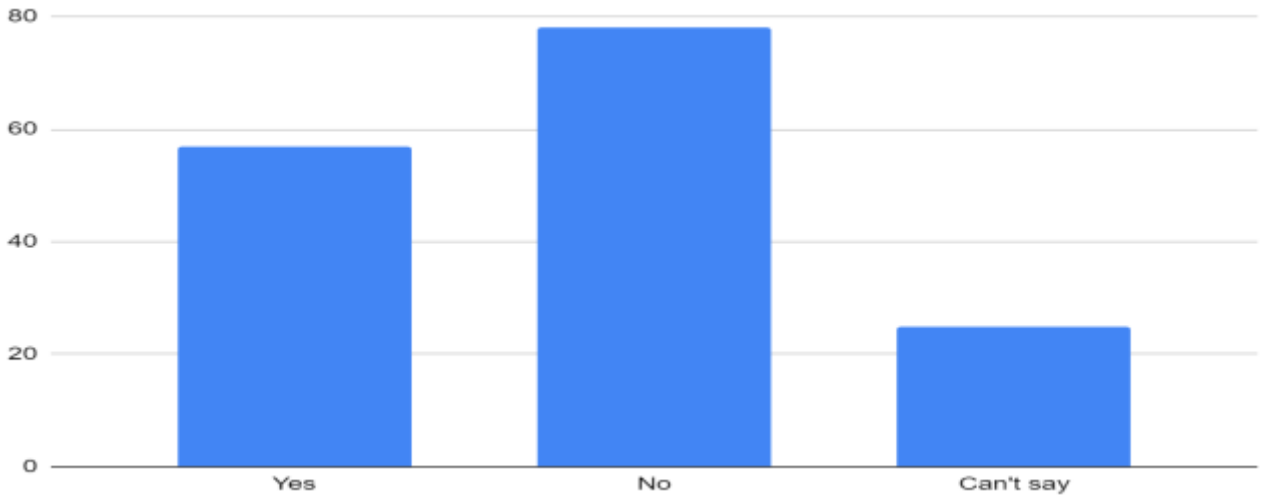
In order to proceed with our project and the prototype, it was important to understand the level of awareness and physical activity of people around us. What people think about exercise and its threats was our major concern. To study all of it, we conducted a survey using the google forms which included questions related to health awareness and our problem statement. Social networking platforms like WhatsApp, Gmail and LinkedIn were mainly involved in increasing the reach of the form. The survey form covered people from different places over India, from different age groups, with different physical activities and medical conditions. People involved in this survey belong to different localities with different atmospheric conditions, which gave our study a strong basis.

Data Analysis

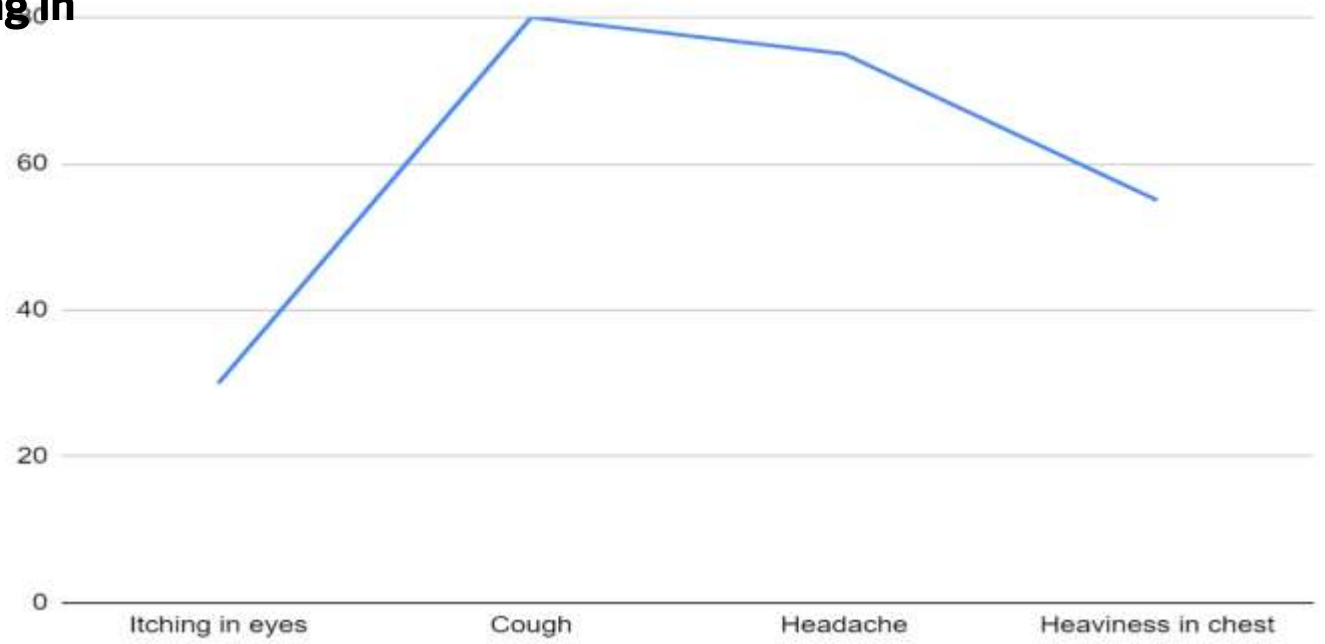
1. How often do you exercise?



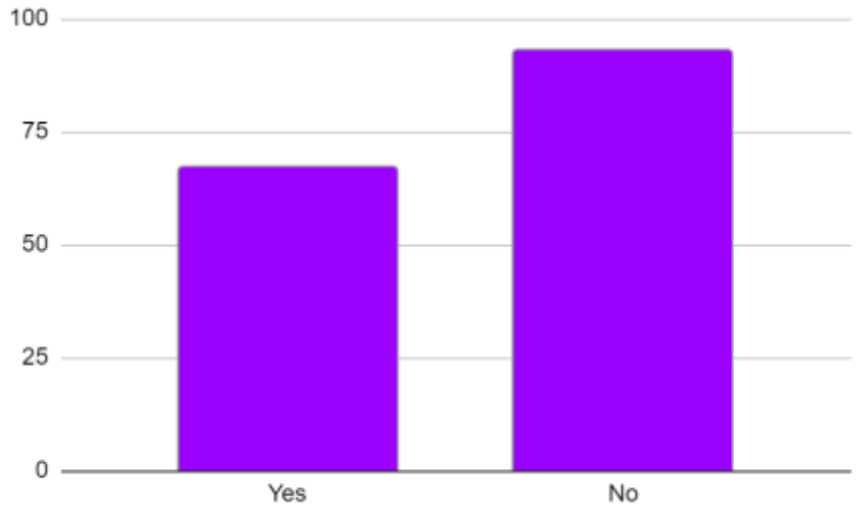
2. Have you ever felt that the atmosphere you are exercising in is not good for your health?



3. Have you ever felt that the atmosphere you are exercising in is not good for your health?



4. Have you ever had to cut your exercise routine short due to pollution-related health issues?



Detailed Description

A healthy lifestyle must include exercise, yet exercising in a dirty environment can be detrimental to your health. In many regions of the world, pollution is becoming a bigger issue, with air pollution playing a significant role. A number of dangerous pollutants, such as particulate matter (PM), ozone (O3), nitrogen dioxide (NO2), and sulphur dioxide (SO2), are present in the air we breathe. Along with other health problems, these contaminants can lead to respiratory and cardiovascular disorders.

These health issues can be made worse by exercising in a dirty environment, especially if you exercise outside in heavily polluted locations. Shortness of breath, chest pain, coughing, and wheezing can all result from even brief exposure to air pollution while exercising.

Chronic respiratory conditions like asthma and chronic obstructive pulmonary disease (COPD), as well as cardiovascular conditions like heart attacks and strokes, have all been related to long-term exposure to air pollution. One of the worst air pollutants is particulate matter, which can be especially dangerous for persons who exercise outside. PM is made up of minuscule amounts of grit, dust, and other substances that can be breathed into the lungs. These particles have the ability to trigger inflammation deep inside the respiratory system, which results in respiratory issues and diminished lung function. Additionally, PM can heighten the risk of heart attacks and strokes and exacerbate pre-existing respiratory disorders like asthma.

Another significant air pollutant, ozone, can be dangerous for individuals who exercise outdoors. When sunlight interacts with other air pollutants like nitrogen oxides and volatile organic compounds, ozone, a reactive gas, is created. Coughing, wheezing, and shortness of breath are symptoms of respiratory issues brought on by ozone. Additionally, it may irritate the eyes, throat, and aggravate respiratory disorders that already exist.

Two more air pollutants that can be detrimental to those who exercise outdoors are nitrogen dioxide and sulphur dioxide. When fossil fuels are consumed, such as in vehicle engines or power plants, hazardous gases such as nitrogen dioxide are produced.

Burning sulphur-containing fossil fuels, such as coal and oil, releases sulphur dioxide, a gas. These two pollutants both have the potential to result in respiratory issues such as coughing, wheezing, and shortness of breath. Additionally, they can exacerbate respiratory disorders already present and raise the danger of heart attacks and strokes.

Current Developments

Presently, there are many applications in our smart phones, as well as in the smart watches, which help us to know about the details of our surrounding, like the temperature, humidity, AQI, etc. But, these technologies do not help us to monitor the pollution of a particular area(of a small scale) and without internet.

Significance of resolving the problem

According to a study, at least 30.7 % of deaths in India can be credited to air pollution from fossil fuels, which implies about 2.5 million people die every year after breathing toxic air. Not to mention the other detrimental effects of pollution like greenhouse effect, global warming, acid rains, forest fires, etc. Pollution causes a huge loss to life and property and is increasing day by day at a frightening rate.
It can be avoided by adapting a healthy way of living, i.e., by eating healthy and by getting involved in some sort of physical activities in a pollution-free surrounding. We are now so preoccupied with work that we don't have time to think about our health; instead, we just keep moving and follow our instincts based on the cognition we have at our disposal.

A healthy lifestyle refers to the way of living that aims to maintain and improve physical, mental, and emotional health. It encloses a range of habits that encourages a healthy mind and body, such as regular exercise, healthy eating habits, ample sleep, and stress management techniques.

- **Reduces the risk of chronic diseases:** Adopting a healthy lifestyle can significantly reduce the risk of chronic diseases such as heart disease, diabetes, and cancer. Studies show that lifestyle choices such as regular exercise, healthy diet, and avoiding smoking and excessive alcohol consumption can lower the risk of developing chronic diseases by up to 80%. A healthy lifestyle also helps manage chronic conditions such as high blood pressure, high cholesterol, and diabetes.

- **Increases life expectancy:** Living a healthy lifestyle can increase life expectancy by several years. Research suggests that adopting a healthy lifestyle can add up to 10 years to a person's life expectancy. By eating a healthy diet, exercising regularly, getting enough sleep, and managing stress, people can improve their overall health and increase their chances of living a longer, healthier life.

- **Boosts energy levels:** A healthy lifestyle can boost energy levels and improve overall well-being. Regular exercise, healthy eating habits, and sufficient sleep help maintain a healthy body weight, improve circulation, and increase oxygen supply to the body, all of which contribute to increased energy levels. A healthy lifestyle also helps reduce stress levels, which can leave people feeling more refreshed and energized.

- **Enhances mental health:** A healthy lifestyle can also enhance mental health by reducing the risk of depression and anxiety. Exercise, healthy eating habits, and getting enough sleep can all help improve mood and reduce the risk of mental health disorders. Engaging in activities that promote relaxation and stress reduction, such as yoga or meditation, can also help reduce stress levels and improve mental well-being.
- **Improves cognitive function:**Living a healthy lifestyle can improve cognitive function by promoting healthy brain function. Exercise, in particular, has been shown to improve memory, attention, and learning. A healthy diet, rich in nutrients such as omega-3 fatty acids, can also promote brain health and cognitive function.
- **Improves sleep quality:** A healthy lifestyle can improve sleep quality by promoting relaxation and reducing stress levels. Exercise, in particular, has been shown to improve sleep quality by promoting relaxation and reducing stress levels. Healthy eating habits, such as avoiding caffeine and heavy meals before bedtime, can also improve sleep quality.

- **Boosts immune system:** A healthy lifestyle can boost the immune system, reducing the risk of infections and illness. Regular exercise, healthy eating habits, and sufficient sleep can all help boost the immune system. Eating a diet rich in fruits and vegetables, which are high in antioxidants, can also help boost the immune system.

- **Increases productivity:** Living a healthy lifestyle can increase productivity by improving energy levels, cognitive function, and overall well-being. By reducing stress levels and promoting relaxation, a healthy lifestyle can also help people feel more focused and productive.

- **Saves money:** Living a healthy lifestyle can save money by reducing healthcare costs associated with chronic diseases such as heart disease and diabetes. By adopting healthy habits such as regular exercise and healthy eating, people can reduce their risk of developing chronic diseases and save money on healthcare costs in the long run.

- **Promotes social well-being:** A healthy lifestyle can promote social well-being by providing opportunities for social interaction and engagement. Exercise classes, sports teams, and healthy eating clubs are all examples of social activities that promote a healthy lifestyle and provide opportunities for social interaction and support.

There must be a tool that can conduct the research for us and make the finest recommendations if we are to receive the greatest results. One such device is our prototype.

Objectives pertaining to minimise the problem

- **Awareness**: Our project mainly deals in creating awareness about the toxic effects of exercising in a polluted atmosphere. As mentioned above, in our survey output we found that a huge proportion of the population is ignorant and they must be informed about all of it.
- **Health hazards:** Heart diseases, lung cancer, cholera, hepatitis, etc are all caused due to pollution contributing to the number of deaths. Efficient physical activities can improve this data. It will even improve the immunity and stamina of an individual. Hence leading to a better lifestyle with less chances of health hazards**.**
- **Increasing productivity:** Many people are involved in physical activities but oftenly can't get the desired output. People go to the gym in order to upgrade their physique or weight loss, they go on long walks to avoid blood pressure-related problems and being active increases their physical strength. However, not getting enough output is quite common. The leading reason for this is lack of skills and professionalism, with our prototype we will resolve this issue.
- **Increase the lifespan:** They say health is wealth, it is something you can't buy. You can't add years to your life by earning money. You have to cherish it, maintain it and take care of yourself. According to a study the average lifespan of an Indian is 69.66 years, this number used to be greater. Earlier people lived in a relatively cleaner environment which boosted their lifespan, we can bring those days back. Our prototype will contribute in doing so.

Tools & Technologies

In order to resolve the issue to check the air quality without having internet connection on mobile phones, as well as on smartwatch, we are going to introduce the following tools and technologies:-

Sensor and the App:-

We are introducing a sensor, that will help us to monitor the air quality index around us, in a radius of 10 meters. This chip can be placed at the back of our phones as well as our smartwatches. The application that will collect the data through the sensor and provide us, is Airly- The AQI Tester.

Detailed Work plan

In order to implement the above mentioned chip and the application, the following steps would be taken:-

- **Product Development-** First in order to develop the sensor, we will be conducting different experiments on the sensors required to monitor different gases of air, like Oxygen , Nitrogen, etc. Then, with the help of these sensors, we would try to implement the same for our product. As soon as we get ready with the sensor, we would start developing the software application, that would provide us the numeric readings of the data collected through the sensor. After the app gets ready, our technology would be ready to be used by all. Also, this technology will not only be present for usage on our phones, but it will also be compatible with our smart watches.

- **Product Usage**- As soon as the user receives the sensor, he/she has to first install our application, which would be availing on all platforms as well as on our website. After the installation of the app, the sensor needs to be fitted at the back of the mobile phone/ smart watch. After fixing the sensor, the app needs to be started. Please note that the sensor would be active only when the app is running in the background. Without the app, the sensor would be of no use. When we are in a location, when we switch the app on, the sensor takes samples and calculates the AQI.
  If the AQI is not suitable for our health, the device(on which the sensor is attached) would start buzzing. This buzzing would not stop, until and unless the AQI being recorded doesn't meet the

conditions approved by WHO. Closing the app would also not stop the buzzing of the device. So, the only option available to the user would be to change his/her location to a new safer location.

- **Collaboration and Integration-** After finalizing our product, we will collaborate with different companies in this sector, and try to reach out to maximum users. Hence, we will approach certain fitness tracking companies and body checkup companies for collaboration and could charge them some commission later for each customer generated for them. We plan to keep these other services as an option to our customers and not a compulsory subscription to buy along with our core services. It's essential now to integrate all these services in a customer-friendly way to provide an extra edge for the customers to subscribe all the services from our app only, rather than buying them independently from different platforms.

Novelty

There are many applications and technologies available, which do help us to measure the AQI around us, but one of their major drawback is that they provide all of these data's over internet connection only. Our project aims to provide this data just with the use of a sensor. There are sensors too available in the market, but they are very large, due to which they are not portable, specially when we are going outside to do exercise or jog. So, in order to exercise in proper environment, this tool and the technology associated would be of a great use, as exercising in polluted environment is really bad for our health, and exercising in a polluted environment has adverse effect on our health.

Possible Constraints

There are different constraints possible in case of our project:-

- **Market Capturing:** The first big challenge that we will face in this aspect is we don't have enough money to spend on publicity like other big companies do. Secondly, the big companies which are currently working on similar fitness tech products can create a similar model quite fast and at a cheaper rate.

- **Testing the Product at Starting:** Once we are done with the making of our product, we have to give the first 2-3 months or more months to test, whether we are able to achieve the results which we aim at. First comes the accurate pollution detection and secondly whether it's suggesting the accurate results as suggested by our experts with minimum error.

Expertise Available

Shashank knows UI/UX designing, product designing and has marketing skills and will contribute to the interface development, programming and managing economic factors for the product.

Shubhendu knows AI/ML and has learned Java language programming from school days and will contribute to sensor designing and programming for the basic developments of the chip and the software of the application.

Expected Outcome

- **Spreading Awareness:** With our product, we expect that after using it for some time, people will become more aware of the common problems they are facing, unaware of the physical activities they are performing in a polluted environment. Even from our survey, we know that more than 50% of people don't acknowledge that exercising in a humid environment can feel tiring and exhausting.
- **Better Planned Workout:** Our product will help people in planning their workouts better and prepare accordingly. For example: switching a planned running hour to a simple walk if the pollution level rises on that day and wearing light clothes, drinking more water & reducing the duration of high-intensity workouts on a hot and humid day.
- **Location Selection For Physical Activities:** Suppose someone wants to play cricket/train for a marathon/ wants to bicycle for leisure in all these cases our product can help them in choosing the location. Our product will show them the pollution and humidity levels of different locations and accordingly will suggest the type of physical activities they can perform respectively.

  ● **Reduction in No. of Patients Suffering from Pollution Related Conditions:** Often people suffering from diseases like asthma are prescribed to do physical exercises like walking, swimming, hiking, etc.(all at low intensity). Choosing the wrong location will have an adverse effect and with our product, we can fill this gap and help in the recovery of such patients. Hence reducing the overall number of patients.

Suggested plan of action

- **Healthy Feedback and Grievance Management System:** Once people start buying it, we can improve its performance by making it a self-learning model. We will make an active grievance addressing system for a smooth user experience. We will listen to the users' opinions critically. If they don't like any of our services, we will listen to them and improve accordingly.
- **Joining hands with apps booking appointments with Doctors:** By using our app, users will become more aware of their health status and be willing to consult a doctor for their diagnosis. We can leverage this thing by tying up with other apps that do the task of scheduling appointments with doctors. Once it gets successful, we can talk to doctors to provide free medical check-ups monthly to our active users.
- **Expanding our team size according to the Demand:** As the demand for our product increases with time, we have to hire more people to meet this demand. We will have to hire people to set up offline stores to ensure that the device detecting the pollution is working accurately. Further, we will require the team to track user data and give valuable insights. Additionally, later will need people working explicitly for marketing, bug fixing, software developers, etc.
- **Helping Government and Growing:** Collected data from users regarding their medical conditions can be helpful for the government to analyse how a particular disease is affecting the regional population and make strategies accordingly to overcome it. Secondly, for many government projects like construction work in highly polluted areas, the government can recommend our app to workers/engineers, which will benefit them and help us expand.

Conclusion

With increasing pollution, humidity, and temperature which are coming out to be the greatest and direct threat to the health of the living beings, it's very crucial to think about the welfare of the human beings and executable action on the same. Now along with the growing awareness among people about the importance of exercising, it's also important to make them aware of the situations where these physical activities can cause more harm than the benefits.
The innovation which we have planned could be implemented and can be discussed with various state and central government and foreign pollution control experts who could help modify and develop this sensor so that it could be used in almost all living conditions where exercise is possible.The private sectors would be of great support for investing in our product which we will pitch them for the same so that it could be improved more with money and professional help.
Also, to make it a more profitable plan, we could talk and have some guidance from the alumni of IIMs who could provide significant help in building this sensor to be more cost effective to the buyers and profitable to the makers at the same time.

Contribution of each student

Shubhendu Kumar- Abstract, Methodology and Data Analysis, Problem statement and its identification, Detailed description of the project, Current developments, Significance of resolving the problem, Objectives pertaining to minimise the problem.

Shashank Kumar- Tools and Technologies, Detailed work plan, Novelty, Possible constraints, Expertise available, Expertise available, Expected Outcome, Suggested plan of action, Conclusion