Air Quality for events

Prediction dashboard on air quality data for events.

Impact on society
What impact is expected from your technology?

What is exactly the problem? Is it really a problem? Are you sure?
Air quality is a huge factor in today's society take for example the nitrogen crisis. While this is one example, bad air quality can have a significant impact on humans as well. Each year around 7 million people die prematurely due to bad air quality. We can confidently say that bad air quality is a worldwide problem. The focus on preventing bad air quality in The Netherlands is focused on inhabited places, while our project has focused on different types of events. The air quality at an event affects not only the surrounding environment but also the attendees which could come from a large number of places.
The application helps legislators and the government give an insight into the bad air quality for events, which a large number of people attend. The application may even help to set standards for pollution at events.

Are you sure that this technology is solving the RIGHT problem?
The technology won't solve the problem of air pollution, however, it will help to spread awareness of bad air quality to the users (government officials).
The tool predicts the air quality at a certain event, this information could then be used by the government to check whether an event meets the air quality regulations imposed by the EU.

How is this technology going to solve the problem?
The application will be trained on air quality data of several months, the effectiveness will be determined by the amount of data that we can use to train the model.
The trained model can then be used to predict the potential air quality at an event, this information should only be used as an information source and not as a decision maker.

What negative effects do you expect from this technology?
There are several potential negative effects of the technology:

The government could use the application to force (not suggest) event organisers to implement precautionary measures to limit air pollution.

The government may use the application in the decision-making process to allow events.

Event attendees could be affected in different ways (e.g. wearing face masks) to limit bad air exposure.

Technology Impact Cycle Tool

Air Quality for events

In what way is this technology contributing to a world you want to live in?

The technology will help to inform the government of the potential (bad) air quality at events. This information could be used to estimate the exposure of the air quality, at these events. It would also be possible for the government to help events improve the air quality at the event in order to limit exposure to bad air quality.

Now that you have thought hard about the impact of this technology on society (by filling out the questions above), what improvements would you like to make to the technology? List them below.

In the application we need to have disclaimers to specify what the application can and can't be used for, to make sure we are not liable for possible wrong predictions.

We would also want to greatly increase the amount of data that is used in the application, to further improve the model. Furthermore, we would like to add possible measures that could be taken to improve (or not worsen) the air quality at events.

Hateful and criminal actors
What can bad actors do with your technology?

In which way can the technology be used to break the law or avoid the consequences of breaking the law?
The system itself does not break any laws nor invade anyone's privacy since the dataset used is anonymised.
However, the output of the system may be used to predict whether an event could break laws regarding air pollution.
It would also be possible to change the data from the measuring stations to make the air pollution seem lower than it actually is.

Can fakers, thieves or scammers abuse the technology?
It would be possible for bad actors to change the data of the air quality measurement stations. This data will have a direct impact on the technology since the data is used to make a model, if the data is modified in any way the outcome of the application can be changed.

The Zicht op Data data could also be abused, since this data is coming from GPS data from phones, it would be possible to gather a lot of phones to create 'busy' postal code areas while they are not busy at all. This data is used in the application to estimate the number of people in a certain postal code, if this data is manipulated this will also change the outcome of the application.

Can the technology be used against certain (ethnic) groups or (social) classes?
No, the application can't be used against certain groups or classes.

In which way can bad actors use this technology to pit certain groups against each other? These groups can be, but are not constrained to, ethnic, social, political or religious groups.
We do not see a way as to how.

How could bad actors use this technology to subvert or attack the truth?
It would be possible for bad actors to recreate technology to predict air quality and use these predictions for fake news.
It would also be possible to use the actual application and manipulated measurements to paint the application as 'wrong' and spread this information.

Now that you have thought hard about how bad actors can impact this technology, what improvements would you like to make? List them below.

We would like to improve the security of the measuring stations, if these stations can't be manipulated a large amount of 'attacks' can be mitigated. Furthermore, making sure that the system uses 2FA will result in it not being able to be used by others who are not permitted to see the application.

Privacy

Are you considering the privacy & personal data of the users of your technology?

Does the technology register personal data? If yes, what personal data?

The project uses 3 different datasets, one dataset contains meteorological data from different measuring stations, one dataset contains air pollution data from the same measuring stations as the meteorological data and the last dataset uses GPS data. This GPS data is anonymised and per postal code, and not in real-time, meaning that 1. we don't get any personal data and 2. it's impossible to determine who is in a certain postal code at a certain time.

Do you think the technology invades the privacy of the stakeholders? If yes, in what way?

The technology only uses anonymised GPS data, no other personal data is received or used by the application.

Is the technology is compliant with prevailing privacy and data protection law? Can you indicate why?

Considering GDPR compliance, since the data is anonymized and according to GDPR recital 26, it is not applicable.

Does the technology mitigate privacy and data protection risks/ concerns (privacy by design)? Please indicate how.

No, it does not.

In which way can you imagine a future impact of the collection of personal data?

Since the application does not store any personal data, we can't imagine the future impact of personal data on the application.

Now that you have thought hard about privacy and data protection, what improvements would you like to make? List them below.

No improvements regarding privacy and data protection are necessary for the application.

Technology Impact Cycle Tool

Air Quality for events

Human values
How does the technology affect your human values?

How is the identity of the (intended) users affected by the technology?
This technology does not affect the users identity, since the user is the government. However, the user could use the technology to monitor or impose restrictions on certain events. This would then affect the event and the attendees.

How does the technology influence the users' autonomy?
The use case of the application is very clear. It is meant to predict the air quality at a certain event in the future. The application's goal is purely informational, no decisions should be made solely on the predictions made by the application.
The output of the application could, as an additional source, be used to help with the decision-making process.

What is the effect of the technology on the health and/or well-being of users?
The application doesn't have an effect on the overall health and well-being of the users, since the users of the application are government officials and not event attendees.
However, decisions made by government officials for events by using the application as an additional source could have a positive impact on the overall health of event attendees.

Now that you have thought hard about the impact of your technology on human values, what improvements would you like to make to the technology? List them below.
For the foreseeable future, no improvements can be made in order to improve the application of human values. However, it should be noted that the application is a supporting application and the users should not be completely reliant on the output of the application to make decisions about events.

Stakeholders
Have you considered all stakeholders?

This category is only partial filled.

Who are the main users/targetgroups/stakeholders for this technology? Think about the intended context by answering these questions.

Name of the stakeholder
Government

How is this stakeholder affected?
The government has a legal obligation to improve the air quality for all its citizens. Currently, most of the improvements are made for full-time inhabited places, however, events or other places where a lot of people gather are often overlooked. The application will give the government more insight into the air quality at these places.

Did you consult the stakeholder?
Yes

Are you going to take this stakeholder into account?
Yes

Name of the stakeholder
Fontys

How is this stakeholder affected?
The institution wants the application to succeed because it affects their student's accomplishments. While the success of the application will also help with the relationship between the institution and TNO/Zicht op Data.

Did you consult the stakeholder?
Yes

Are you going to take this stakeholder into account?
Yes

Name of the stakeholder
TNO

How is this stakeholder affected?
TNO wants the application to succeed because it affects its ideas and vision.

TNO also spent a great deal of time on the project and provided datasets which are used in the application. TNO doesn't want this data to be used randomly, but for a purpose.

Did you consult the stakeholder?
Yes

Are you going to take this stakeholder into account?
Yes

Name of the stakeholder
Zicht op Data

How is this stakeholder affected?
Zicht op Data wants the application to succeed they provided one of the datasets for the application. They want to make sure that their dataset is used in the correct way and that certain conclusions can be made with their dataset. Just like TNO, Zicht op Data has spent a considerable amount of time on this project which is also a reason why Zicht op Data wants the application to succeed.

Did you consult the stakeholder?
Yes

Are you going to take this stakeholder into account?
Yes

Did you consider all stakeholders, even the ones that might not be a user or target group, but still might be of interest?
-

Now that you have thought hard about all stakeholders, what improvements would you like to make? List them below.
The stakeholder analysis shows that there are more stakeholders than previously thought about.

Data
Is data in your technology properly used?

Are you familiar with the fundamental shortcomings and pitfalls of data and do you take this sufficiently into account in the technology?
Yes, the data we have only has 3 months of complete data, meaning that all the predictions will be based on those 3 months.

Therefore, our application won't be as accurate on the other months of the year, since there is no data for these months.

Furthermore, there is a correlation between air pollution and meteorology, we know that we can't predict meteorological data meaning that our predictions could be changing quite severely depending on the weather.

How does the technology organize continuous improvement when it comes to the use of data?
Currently, there is no feedback in the data loop. For the moment this is positive because there is no self-fulfilling prophecy, however, the dataset is small and there is no consistent incoming data, there is the possibility that the application might not be able to reliably predict air quality data for the months that are not in the current dataset.

Furthermore, if the output of the model has significant deviations (really high or really low) in the air quality data a human is needed to check whether this could be possible or not.

How will the technology keep the insights that it identifies with data sustainable over time?
The current dataset consists of over 40.000 rows of data which contain data about Particulate Matter, meteorology, and postal codes, this data is coming from a private source (TNO and Zicht op Data) and is not publically accessible.

New data can be added if this is received from TNO and Zicht op Data, it is necessary to reliably get new data from these partners in order to keep the algorithm current.

While at the moment we have no indications one of the data providers might discontinue gathering and delivering the required data, there is a possibility that Zicht op Data may not provide the anonymised GPS data. This would be a blow to the application since then no estimates can be made about how many people will be affected. We assume that the TNO data will not disappear in the future, but if this data stream does stop, it won't be possible to keep the application current.

In what way do you consider the fact that data is collected from the users?

No data is collected from the users whatsoever.

Now that you have thought hard about the impact of data on this technology, what improvements would you like to make? List them below.

It would be useful to communicate that the accuracy of the predictions made by the application could deteriorate over time as no new data is added. In the future we also need to discuss the stream of continuous data from both TNO and Zich op Data.

Inclusivity
Is your technology fair for everyone?

Will everyone have access to the technology?
Yes, everyone else will have the opportunity to use/ work with the technology even if they arent part of the main target.

Does this technology have a built-in bias?
No, it does not.

Does this technology make automatic decisions and how do you account for them?
The application makes automated decisions when input is given to the system. The outcome of the decision (prediction) is explained as to what the application thinks the value of that input will be.
The application itself cannot be explained because the decisions all take place in a 'black box'.

Is everyone benefitting from the technology or only a a small group? Do you see this as a problem? Why/why not?
The technology is mainly used as an information source, it predicts the air quality on a certain date for a certain event. This means that there is a group that benefits from the technology while a large group will not. The government will get the predicted information and can use this information (not standalone) to help improve air quality, together with event organisers, at events. Basically, there are 2 groups that benefit from the technology, the government because they get the information about the air quality at an event and the event attendees because they can profit from the improvements made to ensure good air quality at an event.

Does the team that creates the technology represent the diversity of our society?
Yes, the development team consists of different cultural and educational backgrounds.

Now that you have thought hard about the inclusivity of the technology, what improvements would you like to make? List them below.
None at this point.

Transparency
Are you transparent about how your technology works?

Is it explained to the users/stakeholders how the technology works and how the business model works?
Yes, it is explained how the technology works for each step that was taken. The data source is also known.

If the technology makes an (algorithmic) decision, is it explained to the users/stakeholders how the decision was reached?
The application uses machine learning to determine the output. This is communicated with the users and stakeholders. By using machine learning a 'black box' is created which means that we don't know what happens.

Is it possible to file a complaint or ask questions/get answers about this technology?
There is currently no system in place, however, it is possible to contact the group developing the project.

Is the technology (company) clear about possible negative consequences or shortcomings of the technology?
The accuracy of the technology for predictions in the far future may not be as accurate as we would like, this is due to the limited size of the dataset.

Now that you have thought hard about the transparency of this technology, what improvements would you like to make? List them below.
It should be communicated clearly that the application is using machine learning which creates a 'black box' of whom no one knows what happens in it.

Sustainability
Is your technology environmentally sustainable?

In what way is the direct and indirect energy use of this technology taken into account?
The service would be run in the Cloud which means that the Cloud Service Provider would use energy to keep the cloud system up and running.
The measuring stations are powered by solar panels, which do not have an impact on the energy footprint of the project. However, these still have to be made which does cost energy.

Do you think alternative materials could have been considered in the technology?
No, as we do not have any impact on the measuring stations or other data-gathering devices. We only have control over the application, and for this, we do not see a way how alternative materials could be considered.

Do you think the lifespan of the technology is realistic?
Yes, it lasts as long as it can be run in the Cloud, while the accuracy may deteriorate in the future if no new data is acquired.

What is the hidden impact of the technology in the whole chain?
The energy the Cloud server uses in order to host the application, the energy and materials that are used to keep the measuring stations operational, and the energy and tooling used to gather the anonymised GPS data.

Now that you have thought hard about the sustainability of this technology, what improvements would you like to make? List them below.
So far no improvements can be made.

Technology Impact Cycle Tool

Air Quality for events

Future
Did you consider future impact?

What could possibly happen with this technology in the future?
The technology could be used as a guideline in the future for the government to create a baseline for air pollution at events. It would also be possible to expand the user base to include event organisers, which could help them give insight into the air quality at their event,

Sketch a or some future scenario (s) (20-50 years up front) regarding the technology with the help of storytelling. Start with at least one utopian scenario.
In a utopian society, the policymakers would know about the air quality and whether it is good or bad at a certain event. Based on that information the policymakers can make decisions or provide steps which the event organizers have to follow to improve the air quality at their event.

Sketch a or some future scenario (s) (20-50 years up front) regarding the technology with the help of storytelling. Start with at least one dystopian scenario.
In a dystopian society, the event organizers will not have information and the policymakers do not inform them about the air quality at their event. If the air quality at the event is bad, this can result in seriously bad health effects for the event attendees.

Would you like to live in one of this scenario's? Why? Why not?
We feel that it would be better to live in the utopian society scenario since in this scenario the risk of bad health effects due to going to an event is significantly lower, because of the precautionary measures which can be taken to improve the air quality.

What happens if the technology (which you have thought of as ethically well-considered) is bought or taken over by another party?
At this point, this is not applicable.

Impact Improvement: Now that you have thought hard about the future impact of the technology, what improvements would you like to make? List them below.
None at this point.