EV-Consumption Prediction

This is an analysis of the EV-consumption prediction project.
The project is about a machine-learning model that can predict the amount of charge needed in an EV to travel a certain distance. The model analyzes the past data to be able to create a prediction for the amount of charge needed. The data retrieved from the vehicles is used locally to avoid any chance of online leaks.

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Context of use: Education
Level of education: Bachelor

Impact on society

What impact is expected from your technology?

What is exactly the problem? Is it really a problem? Are you sure?

There is a huge rise in Electric vehicles in the Netherlands, the Dutch government also wants to completely ban the intake of petrol and Diesel cars by 2030 as well as, and they want to make passenger vehicles by 2030 emission-free.

Since EV usage in the country will rise, it will also need more charging infrastructure to charge the vehicles, it will also need more energy (in terms of electricity), plus it will also introduce many new EV drivers.

It is known new drivers are comparatively more range anxious about their vehicles. This range anxiety needs to be addressed in order to create an efficient charging infrastructure in the Netherlands which can support all vehicles.

It is known that the range anxious drivers charge their vehicles more often which means they occupy the charging station more compared to other experienced drivers, Studies show that if the charging situation and rise of EVs in the Netherlands are not optimised, a huge increase in charging infrastructure will be inevitable in order to meet the demand.

It is therefore important that charging is done efficiently for the vehicles. The EV consumption prediction tool aims to predict the amount of charge a certain vehicle needs in order to complete its journey. This solution can help the drivers make informed decisions and also help in resource(electricity, charging stations) sharing, hence eventually increasing the efficiency of existing infrastructure.
The application uses the past data of the vehicles to predict the amount of charge needed.

This prediction model project is a step in the direction to help reduce the range anxiety and help in efficient planning.

This app is not a complete solution to the rise of EVs, rage anxiety, infrastructure requirements, and energy requirements. It is a part of the solution.

Are you sure that this technology is solving the RIGHT problem?

This solution does help solve a part of the problem which is range anxiety by helping the drivers to make conscious choices about how much charge they need in the vehicle.
This solution will help in making the drivers aware of the charge they

needing car for a trip, which will promote less wastage of energy in the behaviour of the drivers and also helps them better in planning and sharing the resources.

How is this technology going to solve the problem?

This technology will help drivers to understand how much they need to charge their vehicle before the trip. This will help build the behaviour to use as much as is required and help in resource sharing and reducing anxiety.

However there are some drawbacks as well, for example, drivers charging more than is needed but that can be controlled by making the charges charge the vehicle a certain amount and then stop. But then again, it is human behaviour and will take time to change.

This however at the moment is an assumption that the driver's behaviour will change, it has been noticed that humans can try to find loops in technology to fulfil their agendas, which in this case could be to charge the vehicle more than necessary.

However it is also noted that money is a big motivator and if drivers see that they save money over time by using the solution that we provide, it is pertinent that many will change their behaviour.

To evaluate the outcome in future, is quite hard from this project, however, this makes me think that maybe in the second version in future, this app could show drivers that they are saving money if they follow the advice of the app and money can be a good motivator to help people make better decisions.

What negative effects do you expect from this technology?

It is possible that many drivers who do not want to use the app will face social negative consequences. This project will also be a part of the application in future that drivers would have to install in their phones, hence increasing the dependence on technology and phones even more.

Even after all testing, it is possible that the prediction is incorrect, this could lead to vehicles stopping working on the road, and lead to traffic jams.

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

This could become a transformative technology. In daily life it will enable drivers to plan a trip beforehand, it will help save money and be beneficial for the environment. In the long term, it can shape humans to plan their trips

beforehand and charge their vehicles especially when it is cheaper to charge and hence save money.
This will make our society act a bit more responsible towards climate change.

As per my own personal values, I believe that we should all live like Amish people, but that is not where the world is heading or maybe it is.; but for sure we are not there yet.
I personally think it is nice technology to have, money is a big motivator and has always been, if the user saves money and also helps save the climate a little in return, I think it is a good product that can help in shaping the society.

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.

One thing the project can use is to show how much benefit the user did to society and personally. They should be able to see the money they saved and the trees they planted(based on co2 reduction due to their driving behaviour). This could potentially trigger users to be better at saving resources and also saving money.
Another thing that might need to be regulated is that many people do not like using apps and do not like phones as well, such people of the society shall not be mis treated on the assumption that since they do not use the app it means they are harming the environment.

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?

Individuals might use the technology to plan routes that involve illegal activities, such as avoiding law enforcement checkpoints or facilitating the transportation of contraband. Additionally, the misuse of personal data collected by the technology could lead to identity theft or privacy breaches, potentially resulting in illegal activities like fraud or harassment.

Can fakers, thieves or scammers abuse the technology?

Bad actors might exploit the technology to harass individuals by interfering with their charging schedules or spreading false information, causing distress. Identity theft and scams are also concerns, with scammers posing as legitimate service providers to steal personal information. Manipulating the availability of charging resources could lead to disputes and tensions among users.

Can the technology be used against certain (ethnic) groups or (social) classes?

For instance, bad actors could manipulate the technology to discriminate against users based on their demographic attributes, favouring one racial or social group over others in terms of charging priority or terms. Biased energy allocation could lead to resource imbalances, channelling more energy to individuals from specific ethnicities or social classes while disadvantaging others. Additionally, exclusionary policies could be enacted to limit access to charging infrastructure for particular groups, further deepening social divisions.

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.

The electric vehicle charge prediction technology, while designed to facilitate efficient trip planning, could be exploited by bad actors to increase societal divisions or inequalities. These manipulations could take various forms, such as selectively providing charging information to specific user groups, disseminating false environmental impact claims to target different demographics, or even prioritizing charging based on user profiles to favour certain groups over others. In a political context, bad actors might use the technology to create perceptions of unequal access to charging infrastructure in areas with particular socio-economic or political characteristics, thereby fueling divisions.

How could bad actors use this technology to subvert or attack the truth?

Bad actors could generate false predictions about electric vehicle charging needs, leading to unwarranted concerns and misinformation about charging station availability or energy consumption. Manipulating the data used for predictions might be another tactic, creating false narratives regarding energy usage trends or environmental impacts. Malicious users could even disseminate misleading information to discourage the adoption of electric vehicles, undermining the efforts towards sustainable transportation.

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

To mitigate the risks associated with bad actors impacting the electric vehicle charge prediction technology, several key improvements can be made. Strengthening user verification and access control measures can ensure that only authorized individuals have access to sensitive data. Enhanced data encryption and continuous monitoring bolster the security of the system against unauthorized access and misuse. Clear ethical use guidelines should be established. Regular engagement with user communities and compliance with relevant legal regulations are also essential steps to prevent misuse and promote the ethical and lawful use of the technology.

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?

Yes, it does use personal data :

Vehicle Information: Details about the electric vehicle, such as model, battery capacity, and energy efficiency.

User Preferences: Information on driving habits.

Usage Patterns: Data on how frequently and for what distances the vehicle is used.

Charging History: Records of previous charging sessions, including duration and timings

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

I do not believe the technology invades the privacy of the user since it just makes the predictions. But I also agree that the data regarding the vehicle and driving patterns are recorded. But that is something which could not be avoided. However, it must be noted that all the recorded data is anonymised to reduce the chances of it getting misused.

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

Yes, the users are informed about the data that will be collected. And since the data is anonymised, the chances of it being misused are severely decreased.

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

This approach involves collecting only the necessary data, ensuring the anonymization and encryption of personal data to protect user identity, and maintaining strong user consent and control mechanisms. The technology would also be transparent about its data policies, informing users about data collection, usage, and sharing practices.

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

personal data?

In the future, the collection of personal data through technologies like the electric vehicle charge prediction system can lead to significant impacts. Enhanced personalization is a major aspect, where more sophisticated data collection allows for highly tailored services. For electric vehicles, this could mean predictions of charging needs becoming more accurate and customized to individual driving patterns. Additionally, the aggregated data can be invaluable for infrastructure planning. Understanding travel patterns and charging behaviors on a larger scale can guide the strategic placement of charging stations and the development of energy grids.

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

To enhance privacy and data protection in the electric vehicle charge prediction technology, several key improvements are recommended. First, strengthening data encryption is crucial to secure the transmission and storage of personal data. Implementing rigorous consent protocols will ensure that users are clearly informed and have agreed to the collection and processing of their data. Expanding user control over their data is also important, allowing them easy access to view, edit, or delete their personal information.

Human values

How does the technology affect your human values?

How is the identity of the (intended) users affected by the technology?

The identity of the intended users, primarily drivers of electric vehicles, is affected by the technology in several ways:

Enhanced Responsibility: Users may become more aware and responsible for energy consumption, as the technology encourages planning and efficient use of resources.

Tech-Savvy Image: Users might be perceived as more tech-savvy and environmentally conscious, aligning with innovative and sustainable technology trends.

Data Privacy Concerns: Since the technology uses data about the car and the driving pattern of the user, users might become more concerned about their privacy and data security.

Dependence on Technology: There's a potential increase in reliance on technology for decision-making in everyday tasks like travel.

Community Interaction: Users might engage more with communities focused on sustainable living and electric vehicles, fostering a sense of belonging in these groups.

How does the technology influence the users' autonomy?

The technology enhances users' autonomy by enabling them to make better-informed decisions about travel in electric vehicles. It provides charge predictions, allowing users to plan routes and charging stops more effectively, reducing the need for frequent charging and offering greater flexibility in travel. However, there's a potential downside of over-reliance on technology, which could diminish spontaneous decision-making. Thus, while it augments autonomy in journey planning, it's important to balance technology use with personal judgment.

What is the effect of the technology on the health and/or well-being of users?

The technology for predicting electric vehicle charge requirements primarily impacts user well-being by reducing range anxiety, a common concern among electric vehicle drivers. By providing accurate predictions, it eases the stress of potentially running out of charge during trips. This assurance can lead to a more relaxed driving experience and increased confidence in using electric vehicles. However, there's a need to balance this with the potential for

over-reliance on technology, ensuring users maintain essential journey planning skills.

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.

I could think of a few things :
Improved Accuracy and Reliability: Continuously refine the model to ensure more accurate and dependable predictions.

Inclusivity in Design: Ensure the technology is accessible and usable by a diverse range of users, regardless of their technical expertise.

Feedback Integration: Create a more effective system for users to provide feedback, which can be used for ongoing improvements and user-centric development.

Stakeholders

Have you considered all stakeholders?

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

Name of the stakeholder
Private EV owners

How is this stakeholder affected?
They will be using the application to predict the charge they need for a trip.

Did you consult the stakeholder?
No

Are you going to take this stakeholder into account?
Yes

Name of the stakeholder
Fleet owners

How is this stakeholder affected?
They are the main users of the application, this application can help them to manage their vehicles and change in them.

Did you consult the stakeholder?
No

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?

Name of the stakeholder
Fuel car users

How is this stakeholder affected?
These users will be affected indirectly, It is possible that they may face bad reputation since they are using fuel cars.

Did you consult the stakeholder?
No

Are you going to take this stakeholder into account?
Yes

Now that you have thought hard about all stakeholders, what improvements would you like to make? List them below.
There is no such improvement that I can think of, it is an application that the users can use to predict the charge on the vehicle needed.

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, I am aware of the pitfalls and understand that the data is never concrete and is always biased.
I took that into account by considering carefully only the parameters which I needed and the ones that directly affect the charge in an EV. However, I still need to keep an eye on the model and it's performance during the production to catch any missing pitfalls.

How does the technology organize continuous improvement when it comes to the use of data?

The technology works on the concept of retraining the model.
And if the new model is better and more accurate than the previous one, the previous one is exchanged with the new one.

How will the technology keep the insights that it identifies with data sustainable over time?

There is a possibility which suggests that the data will not be available in future, in case the clients do not agree to install the device in their vehicles which sends the data to us, in such a scenario the need for the application will also be over.

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

The data stored by users is with their permission and they are aware of the data that is being stored. The stored data is treated with respect and is not for sale. However, it is possible that the insights from the data could be for sale. But I do not see it happening at the moment.

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

At the current moment, I cannot think of any substantial improvements, however, it would be a good idea to check the data before it is fed into the system, often broken sensors send bad data which is taken as correct data in the system since we never put a check and like to believe censor data is correct and will stay correct.
However, a broken sensor sending incorrect data could substantially affect the model and prediction system.

one thing I could suggest is to put a check in the system to ensure that the collected data is validated before it enters the system.

Inclusivity

Is your technology fair for everyone?

Will everyone have access to the technology?

No, only the client will have the access to the technology.

Does this technology have a built-in bias?

As far as I know, I took measures to ensure that there is no bias in the model however, I will have to keep an eye on this while the model si in prediction to ensure that no bias seeps in the model with time.

Does this technology make automatic decisions and how do you account for them?

This technology, designed to predict the required charge for electric vehicle trips, does make automatic decisions in the sense that it processes input data (like trip distance, driving patterns, and vehicle specifications) to calculate the necessary battery charge. However, these decisions are more about providing information and suggestions rather than controlling the vehicle or the user's actions directly.

Is everyone benefitting from the technology or only a a small group? Do you see this as a problem? Why/why not?

The technology for predicting electric vehicle charge requirements primarily benefits electric vehicle (EV) owners, which could be seen as a niche group. This isn't inherently problematic as many technologies target specific user bases. However, it does highlight issues of accessibility and inclusivity, particularly in areas with lower EV adoption or among socio-economic groups that may not afford EVs. While it currently serves a smaller demographic, its long-term contributions to environmental sustainability offer indirect benefits to a broader population. As EV adoption increases, the direct benefits of this technology are expected to become more widespread, enhancing its overall societal impact.

Does the team that creates the technology represent the diversity of our society?

the project was created by me alone, so the answer is no.

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

To enhance the inclusivity of the electric vehicle charge prediction technology, several improvements can be made. Firstly, diversifying the data set to include various vehicle types, driving styles, and geographic areas will make the model more applicable to a broader range of users. Improving the user interface for accessibility and adding multilingual support will help accommodate users with different abilities and language preferences. Offering affordable versions of the technology can make it accessible to those with budget constraints. Additionally, providing educational resources and engaging with diverse communities will ensure the technology meets the needs of a wider audience, making it more inclusive and user-friendly.

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?

The complete documentation regarding the process and reasoning behind the choices made were explained along with the future recommendations on how the model could be improved. Yes, i believe that the users/stakeholders will be aware of how the technology works and the reasoning behind it, also the document structure is created in a way that it will be easy for the user to locate documents regarding any queries they may have of the technology.

If the technology makes an (algorithmic) decision, is it explained to the users/stakeholders how the decision was reached?

Yes, I am transparent regarding how the model works. In the documents, I have explained which data is collected and why. Substantiation regarding which algorithm is used and why is also explained. The reasoning regarding which data is dropped is also well documented.

Is it possible to file a complaint or ask questions/get answers about this technology?

Yes, I will be available along with the organization since they are aware of each step I take during the process. So to file a complaint or ask queries users can directly contact Crossyn.

Is the technology (company) clear about possible negative consequences or shortcomings of the technology?

No, the technology is not currently clear about the possible negative consequences or shortcomings of the technology. This aspect requires improvement.

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

Enhance accuracy and adaptability to real-time data.
Expand user guidelines for varying conditions.
Implement a more robust feedback system.
Increase environmental impact awareness in usage.

Sustainability

Is your technology environmentally sustainable?

In what way is the direct and indirect energy use of this technology taken into account?

This project aims at reducing the load on power usage, so in a way, the project aims at reducing energy consumption. However, it must be noted that while making the project, energy usage was not taken into consideration, it is also worth noting that the queries and code were highly optimised so as to do the least possible computations in order to be faster and energy efficient.

Do you think alternative materials could have been considered in the technology?

For this project, I do not believe it was possible to use any alternative technologies or materials.

Do you think the lifespan of the technology is realistic?

The lifespan of the technology is realistic. This technology creates a prediction model that will be trained from time to time to stay efficient.

What is the hidden impact of the technology in the whole chain?

The hidden impact of this technology on the whole chain will be it's use of energy and processing power to load huge amount of data, clean and transform it, and also to make a prediction model out of it.

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

This technology has been refined multiple times while creating to use the least possible resources and be as fast as possible. At the current moment, I do not see a way of making it even better.

Future

Did you consider future impact?

What could possibly happen with this technology in the future?

This technology if used by millions of people could be beneficial for the environment as well as it will be beneficial by saving time as a resource. Since this application aims at reducing range anxiety, it aims to equip the user with the knowledge regarding how much charge they need in their vehicle for a certain trip. having this information will help million of user to be less stress stay informed take informed decisions and charge their vehicle as much as necessary, leading to the sharing of resources and saving time, in essence of the community.

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 perfect world where everyone cares about everyone and everyone is responsible my technology, if it is still used and required, could become a stepping stone in terms of ideas. At the moment the aim of the project is enabling the efficient use of resources in terms of time and energy. But in a perfect world where this logic is utilized in many other scenarios, be it dining, or be it processing raw material for food or cloth etc. If resources are used mindfully, then the world would be a much better place.

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 scenario, people will not use this application as they will have no regard for anything. There are no bad implications of using the app and there is no other way the app can be misused. But there could be another scenario where people might judge each other based on whether they use the app or not. It's something similar to what we see every day, people being judged for throwing garbage on roads and having no regard for others, similarly people not using this application or another application that aims at the same thing could be judged on their choice. Another possible scenario is where people will be pushed to use this application by authorities, and that is something that is not very nice.

Would you like to live in one of this scenario's? Why? Why not?

I would like to live in a utopian scenario where people will have regard for each other and also for the earth, I like the idea of using only as much is needed and not more.

What happens if the technology (which you have thought of as ethically well-considered) is bought or taken over by another party?

The technology can be used by anyone as there is nothing in the code or technology that could be used in a bad way.
The code only has logic so it's fine if someone acquires it.
And the database is anonymised so it can also be not used for bad purposes.
If they have access to the database, then yes they can harm but just with the tool/ application nothing wrong can come out of it as I see it now at the moment.

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.

I can improve the technology by feeding the model more data at the moment the data is limited and hence the capacities of the model. However, I would also like to increase the capacity of the model to be more vigilant during driving rather than giving the new range estimates which could also be not nice, the fluctuating predictions form the app.
| would prefer if the app could suggest ways to reach my destination at the suggested energy usage. For example, it could suggest lowering the temperature in the car by 5 degrees or suggesting an alternate route based on elevation and traffic etc.