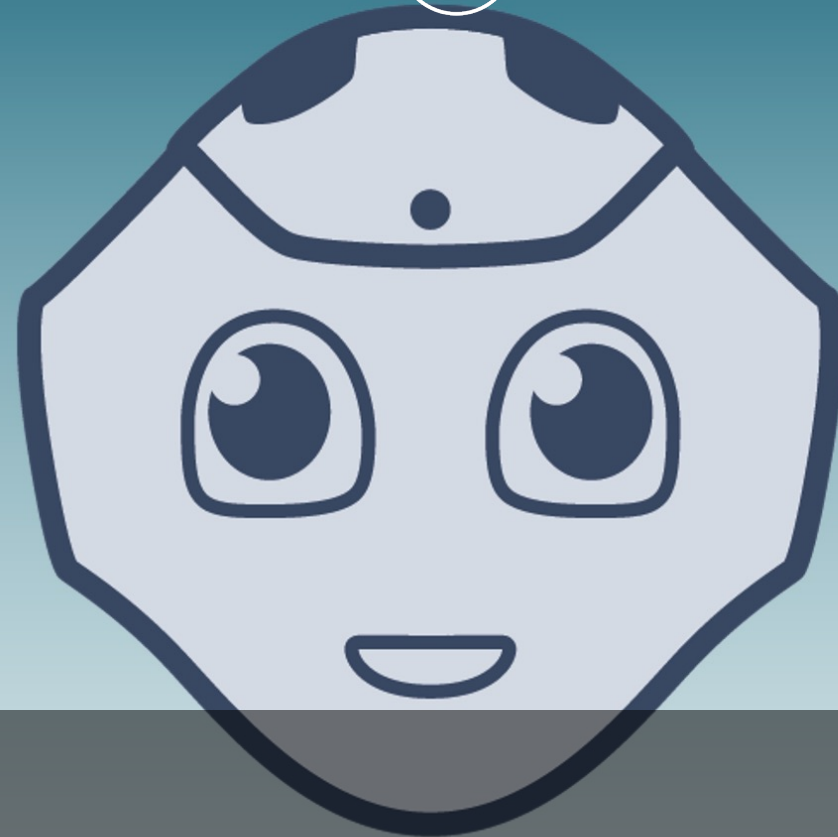


BMW
GROUP



ROLLS-ROYCE
MOTOR CARS LTD



WAKA AND I4-X4.

TWO CHATBOT USE CASES AT BMW GROUP.

Dr. Davide Cadamuro – BMW Group

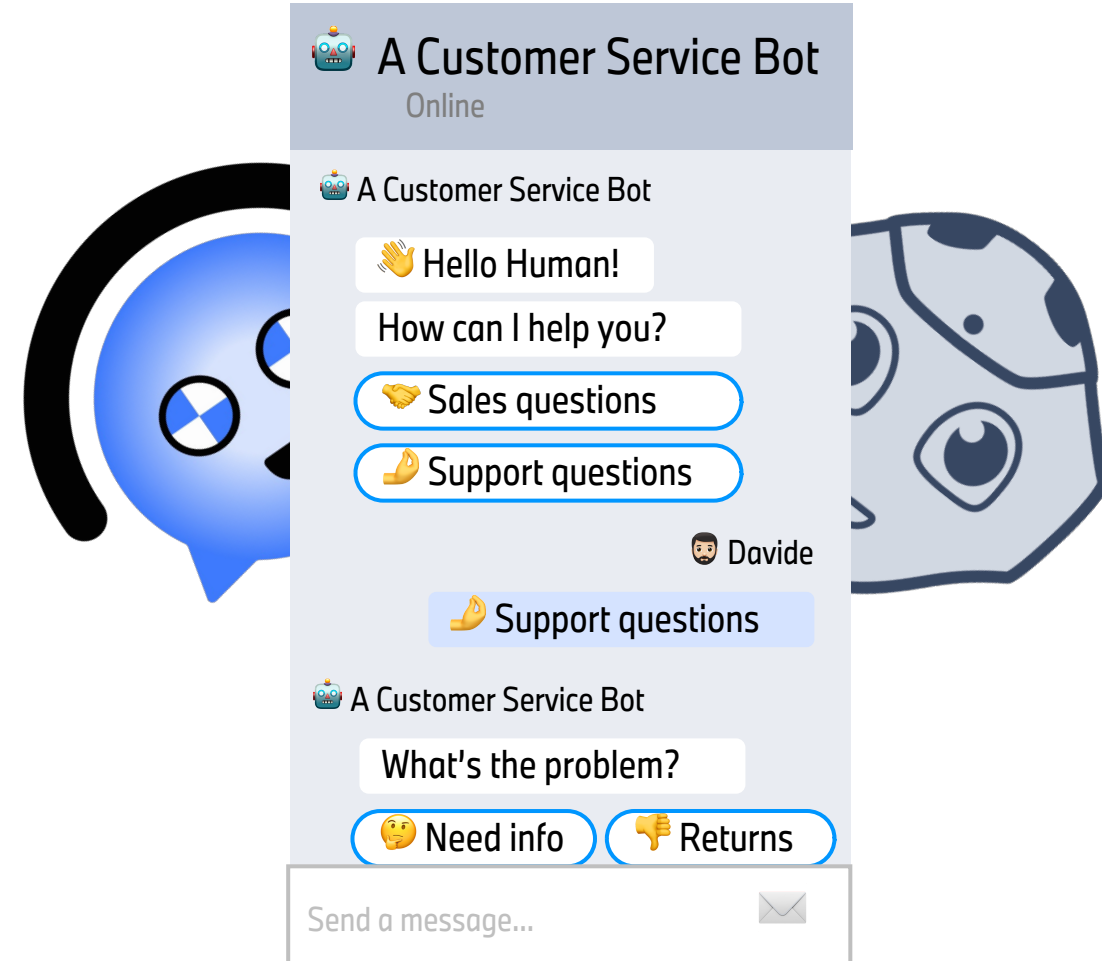
A BOT THAT IS DESIGNED TO CONVERSE WITH HUMAN BEINGS.*

Dialogue is the most human way to communicate:

interacting with chatbots is a natural way to interface with a computer program.

Chatbots and digital assistants are spreading more and more. Being available 24/7 are ideal for interacting with an audience. Typical use cases are:

- customer care,
- online sales,
- virtual assistants,
- interacting with voice controlled devices,
- ...



* <https://www.merriam-webster.com/dictionary/chatbot>

ENTERPRISE CONVERSATION ASSISTANT @ BMW GROUP.

POTENTIAL APPLICATIONS ACROSS THE BMW GROUP VALUE CHAIN.



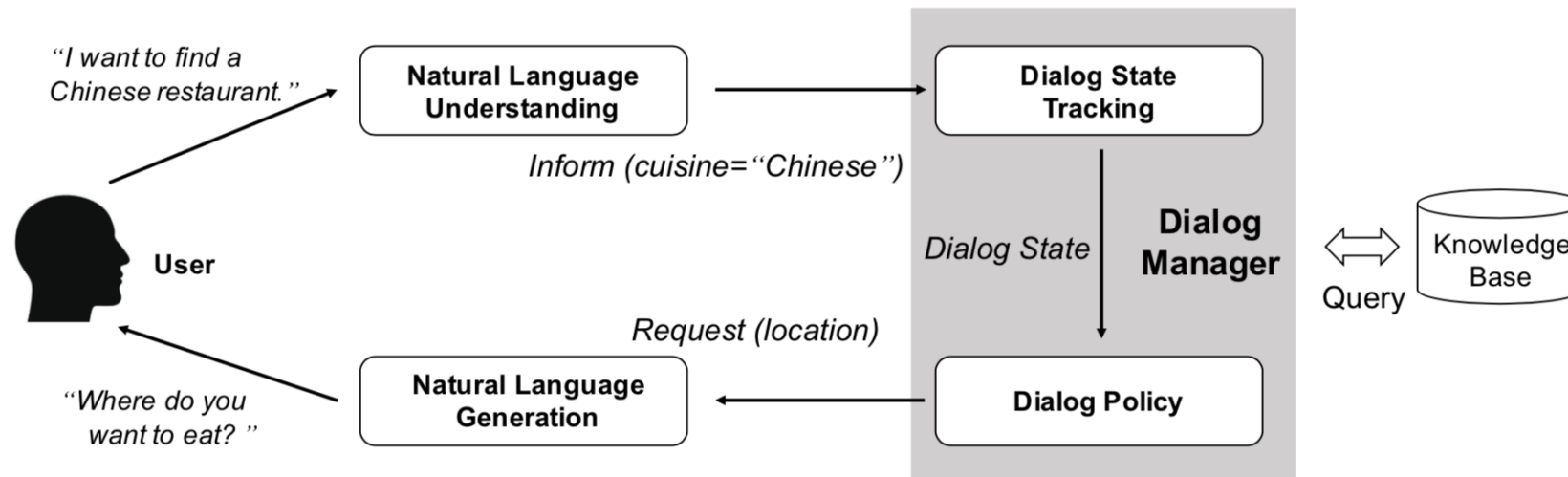
THE CHATBOT ARCHITECTURE.

Natural Language Understanding

- Intent detection (Inform)
- Slot-value extraction (cuisine = "Chinese")

Dialog State Tracking

- Keep track of missing information to complete the task



Zhang, Z., et al. (2020). Recent Advances and Challenges in Task-oriented Dialog System.

Knowledge Base

- Auxiliary system to extract information needed to accomplish the task

Natural Language Generation

- Response generation based on the system action

Dialog Policy

- Next system action selection

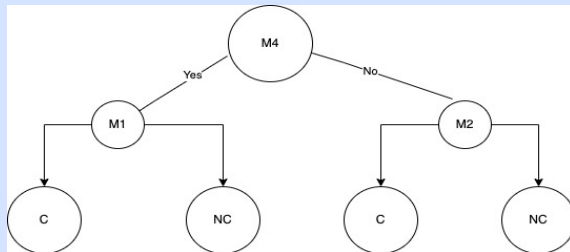
RULE BASED VS CORPUS BASED (AI CHATBOT).

Rule based chatbot:

- Patterns and rules to extract information and select a response

U: BOOK A FLIGHT FROM \$0 TO \$1 =>
B: WHEN DO YOU WANT TO LEAVE?

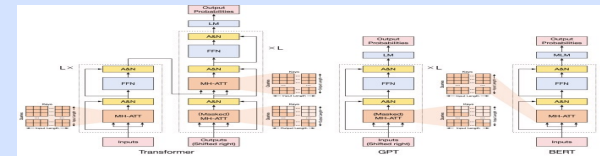
- Rules are linked together in a decision tree



- 👍 Fast to implement
- 👍 The decision tree is fully understandable
- 👎 Conversation is limited, "rigid" and unnatural

Corpus based chatbot:

- Makes use of language models*



- Trained on a big corpus of dialogue to learn conversational patterns

THESEUS Now, fair Hippolyta, our nuptial hour
Draws on apace; four happy days bring in
Another moon: but, O, methinks, how slow
This old moon wanes! she lingers my desires,
Like to a step-dame or a dowager
Long withering out a young man revenue.

HIPPOLYTA Four days will quickly steep themselves in night;
Four nights will quickly dream away the time;
And then the moon, like to a silver bow
New-bent in heaven, shall behold the night
Of our solemnities.

THESEUS Go, Philostrate,
Stir up the Athenian youth to merriments;

Awake the pert and nimble spirit of mirth;
Turn melancholy forth to funerals;
The pale companion is not for our pomp.
Exit PHILOSTRATE

Hippolyta, I wou'd thee with my sword,
And won thy love, doing thee injuries;
But I will wed thee in another key,
With pomp, with triumph and with revelling.
Enter EGEUS, HERMIA, LYSANDER, and DEMETRIUS

EGEUS Happy be Theseus, our renowned duke!
THESEUS Thanks, good Egeus: what's the news with thee?
[...]

- 👍 Conversation is more natural and engaging
- 👎 Lots of data, time and skills to be trained
- 👎 No full control of the interaction

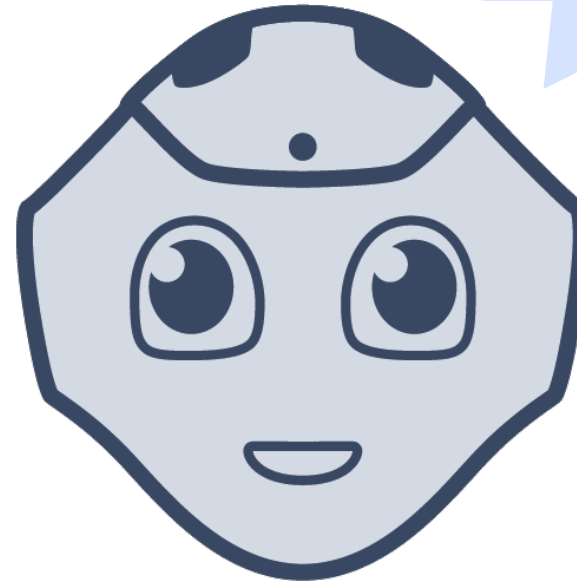
* A language model (LM) is a probability distribution over sequences of words. SOTA LMs have billions of parameters and produce very human-like interactions.

INTRODUCING WAKA AND I4-X4.

Hi! My Name is WAKA - Work Assistant Kann Alles.



Hallo, ich bin i4-X4. Hast du Fragen zur Ausbildung oder dem dualen Studium bei der BMW Group?



WAKA: THE WORKPLACE ASSISTANT OF BMW GROUP.



WAKA (Work Assistant Kann Alles) is a chatbot deployed on the instant messaging platform used by BMW Group employees based in Germany.

Its initial development dates back to 2019, after several test phases in the past two years it has been rolled out to all the German offices.

Available in English and German, its purpose is to increase the productivity by facilitating the access to information and to tools that are otherwise disconnected.



Suggestions

Book meeting with

Book a meeting with colleague with intelligent suggestion from waka

Block my calendar on

Block your calendar on (exact time) about (topic)

Create a Teams meeting link

Instantly generate a link for a Teams online meeting

Search for

Search for colleague by name, department, job description or phone number

Search for responsible person

Search for a colleague by special roles in development processes

find my meeting on

find your meeting on special date or time even with whom

What does idas mean?

Ask about the meaning or link of a BMW system or abbreviation

Translate Text

Machine Translation for general and BMW-specific text

WAKA: THE WORKPLACE ASSISTANT OF BMW GROUP.



General Translation Model

Input Language: Italian TO Output Language: English

Text to be translated:
Purtroppo non potrò partecipare al meeting

[Translate](#) [Reset](#)

ⓘ Your response was sent to the app

Your translation request has been submitted. Stay tuned!

Text Translated:
Unfortunately I won't be able to attend the meeting

09:49
What does BKK mean? ✓

WAKA 09:49

BKK BMW

Informationen zu den Themen Versicherung, Gesundheit, Vorsorgeuntersuchungen, BKK, Betriebskrankenkasse

[Open](#)

What can I help you with today?

For example: I can convert file or smb links to their counterparts. Type in "convert links". 😎 If you want to find out more, take a look at [my homepage](#).

WAKA: THE WORKPLACE ASSISTANT OF BMW GROUP.



WAKA has a workflow for organising meetings:

- expert search
- time slot optimisation
- room search

16:19
Search for responsible person in NLP

WAKA 16:19

- Tom Poni - FG-221
Tom.Poni@bmw.de
- Davide Cadamuro - FG-221
Davide.Cadamuro@bmw.de
- Laura Vuille - FG-221
Laura.Vuille@bmw.de
- Kathrin Barthel - FG-221
Kathrin.Barthel@bmw.de
- Tina Bechtel - EA-180
Tina.Bechtel@bmw.de

Next

WAKA Chat Files Wiki EN 3 more

When would you like your meeting to be scheduled?

Choose meeting duration or one of the preset durations (Default: 1 hour)

Note: Currently, WAKA supports booking meetings with duration 30 minutes or longer.

0 hours 30 mins Search

30 mins 60 mins 90 mins

Here are the recommended times in calendar week 49

TimeZone: Europe/Berlin UTC +01:00

Date	Time
Thu 08 Dec	60 mins. 08:00 to 09:00

Show more Next week Select custom date

Choose Location

- Only Teams Online Meeting
- Meeting Point
- RoomNext

Note: Teams Online Meeting is included with all choices

Edited

Raum Helsinki (01.51/001.0/02.0 - LN08) 12

Address: 01 Standort München, 01.51 Max-Diamond-Straße / Digital Campus Munich

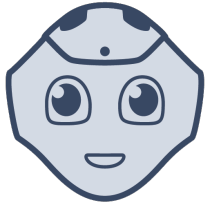
Description: Ausstattung: Deckenbeamer/Bildschirm

Book this room No, thanks!

Perfect! I'm logging you into RoomNext and finding rooms for your meeting. Please hold on.

Alright! I found 5 room suggestions for your meeting.

I4-X4: A VIRTUAL INFO POINT FOR STUDENT JOBS.



Available at <https://www.bmwgroup.jobs/de/de/schueler.html>

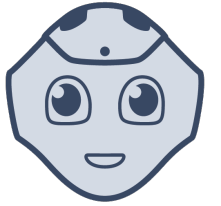
- Task oriented chatbot interfacing a Q&A system about jobs opportunities, working life and career at BMW Group.
- Aiming to replace the telephone and email Q&A services.
- Live since March 2022, pilot phase focusing on students looking for an internship.

The screenshot shows a chat window titled "I4-X4 DEIN VIRTUELLER RECRUITING-ASSISTENT VON BMW". The chat history includes:

- A blue button: "bildet ihr dual aus" (sent "vor 2 Minuten").
- A grey response bubble: "Die Ausbildung bei der BMW Group erfolgt dual - das bedeutet, dass die Ausbildung im Betrieb und die theoretische Praxis in der Berufsschule abwechselnd stattfinden." (sent "Vor einer Minute").
- A blue button: "kann ich mechatroniker werden" (sent "Vor einer Minute").
- A grey response bubble: "Wir bieten vielfältige Berufsbilder, auch als Mechatroniker (w/m/x) an. An welchen Standorten wir dieses Berufsbild ausbilden, erfährst du auf unserer Website unter" (sent "Jetzt").

At the bottom, there is a text input field with "Nachricht eingeben" and a blue send button.

I4-X4: A VIRTUAL INFO POINT FOR STUDENT JOBS.



Between March and June 2022:

- Displayed >165000 times to the users
- Interacted with >8500 users
- Asked >14500 questions
- 40% of questions asked outside office hours
- ~84% of the questions have been answered by i4-X4

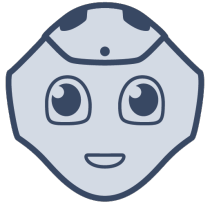
- FAQs are answered by the bot.
- Our personnel deals only with complicated or sporadic questions.

The screenshot shows a chat window for the virtual assistant I4-X4, titled "I4-X4 DEIN VIRTUELLER RECRUITING-ASSISTENT VON BMW". The chat history includes:

- A message from the user: "bildet ihr dual aus" (received "vor 2 Minuten").
- A response from the bot: "Die Ausbildung bei der BMW Group erfolgt dual - das bedeutet, dass die Ausbildung im Betrieb und die theoretische Praxis in der Berufsschule abwechselnd stattfinden." (received "Vor einer Minute").
- A message from the user: "kann ich mechatroniker werden" (received "Vor einer Minute").
- A response from the bot: "Wir bieten vielfältige Berufsbilder, auch als Mechatroniker (w/m/x) an. An welchen Standorten wir dieses Berufsbild ausbilden, erfährst du auf unserer Website unter" (received "Jetzt").

At the bottom, there is a text input field labeled "Nachricht eingeben" and a blue send button.

14-X4: A VIRTUAL INFO POINT FOR STUDENT JOBS.



Knowledge base

Search the KB 656 QnA pairs + Add QnA pair View options

Enable rich editor

1 2 3 4 5 ... 66 Next >

Question	Answer
<p>Source: 20211012_Fragenkatalog.xlsx</p> <p>Bekomme ich bei BMW in der Ausbildung auch Zuschläge? ×</p> <p>+ Add alternative phrasing</p>	<p>Zusätzlich zum Grundentgelt gibt es auch noch Urlaubs- und Weihnachtsgeld sowie ab dem zweiten Ausbildungsjahr anteilige Erfolgsbeteiligung. 🗑️</p> <p>+ Add follow-up prompt</p>
<p>Kann man verkürzen? ×</p> <p>Was muss man machen um verkürzen zu können? ×</p> <p>Kann ich die Ausbildung verkürzen? ×</p> <p>Kann ich die Ausbildung auf ein Jahr verkürzen? ×</p> <p>+ Add alternative phrasing</p>	<p>Du kannst deine Ausbildung um maximal ein Jahr verkürzen. Dir werden für die mittlere Reife oder das Abitur 6 Monate angerechnet und wenn du besonders gute Leistungen in der Berufsschule erbringst, könnte sich deine Ausbildung um weitere 6 Monate verkürzen. Dein:e Ausbilder:in beantragt die Verkürzung in Absprache mit dir. 🗑️</p> <p>+ Add follow-up prompt</p>

- We use the service of a cloud platform from a major USA tech player.
- To train the bot, we have to upload question-answer pairs, better if questions come with many alternative phrasing.

OUR CODE OF ETHICS FOR AI* SETS FEW LIMITS ON THE TECHNOLOGIES WE USE.

BMW GROUP CODE OF ETHICS FOR AI



Human agency and oversight



Diversity, non-discrimination and fairness



Technical robustness and safety



Privacy and data governance



Environmental and societal well-being



Transparency



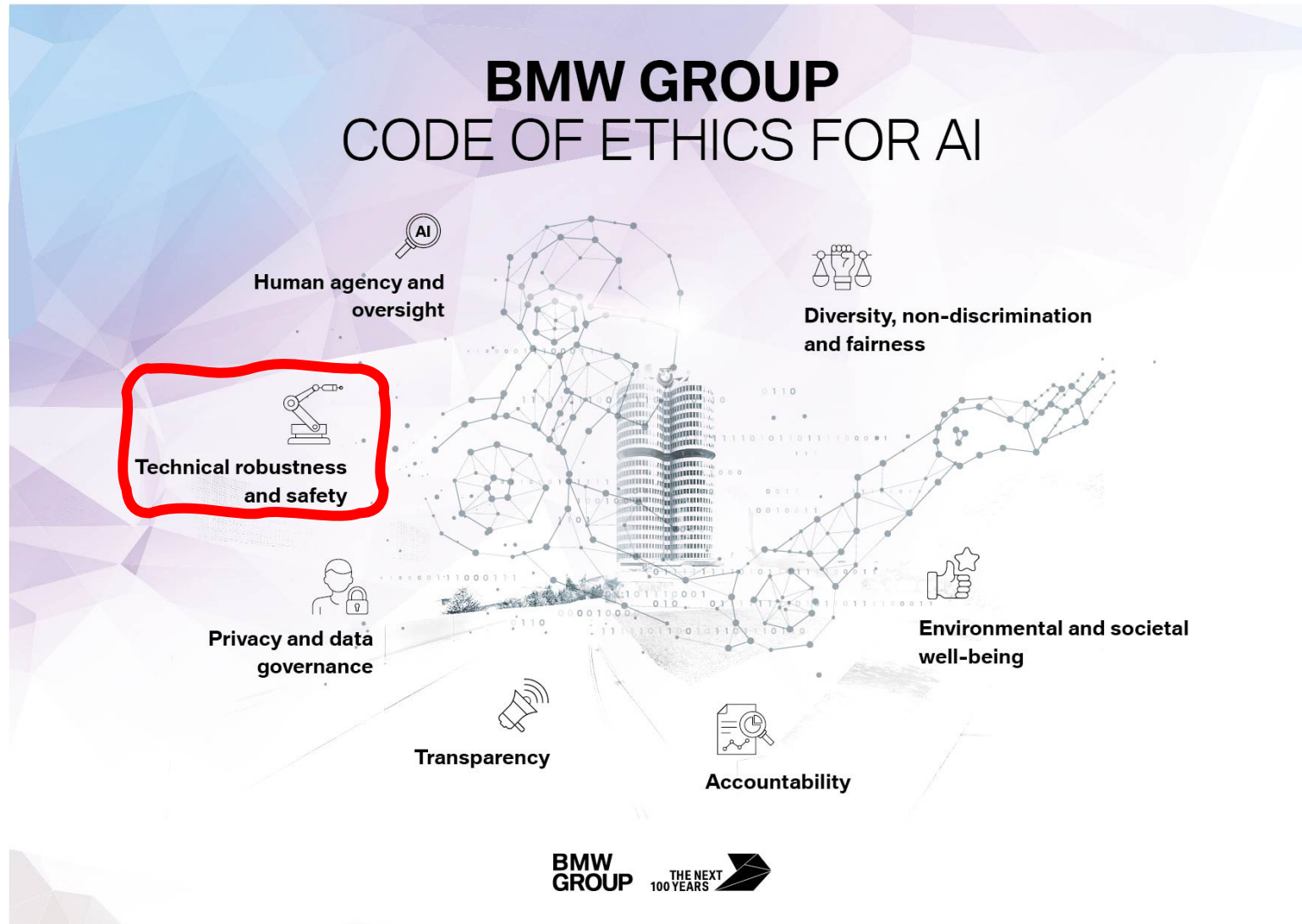
Accountability



THE NEXT
100 YEARS

* https://www.bmwgroup.com/content/dam/grpw/websites/bmwgroup_com/downloads/ENG_PR_CodeOfEthicsForAI_Short.pdf

OUR CODE OF ETHICS FOR AI* SETS FEW LIMITS ON THE TECHNOLOGIES WE USE.



We use a well tested and reliable cloud platform for our use cases.

It allowed us a fast implementation providing reliable out of the box solutions, and reduced the effort to operate the infrastructure.


Cloud specialists of BMW Group IT provided support and guidelines for a safe and resilient cloud infrastructure.

* https://www.bmwgroup.com/content/dam/qrpw/websites/bmwgroup_com/downloads/ENG_PR_CodeOfEthicsForAI_Short.pdf

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 Diversity, non-discrimination and fairness

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 Privacy and data governance

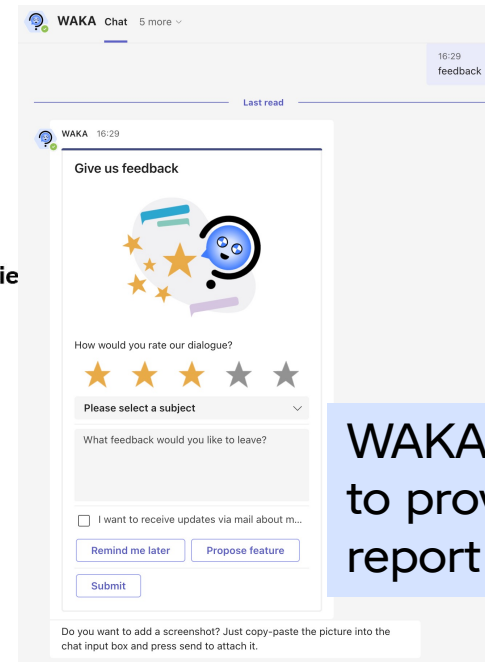
 Environmental and social well-being

 Transparency

 **Accountability**

BMW GROUP THE NEXT 100 YEARS

We periodically **check the logs** of the applications **to identify problems** like unanswered questions, wrong answers and possible improvements. Once identified, the issues are prioritised accordingly and handled by the development team.




WAKA Chat 5 more

16:29 feedback

Last read

WAKA 16:29

Give us feedback



How would you rate our dialogue?

★ ★ ★ ★ ★

Please select a subject

What feedback would you like to leave?

I want to receive updates via mail about m...

Remind me later Propose feature

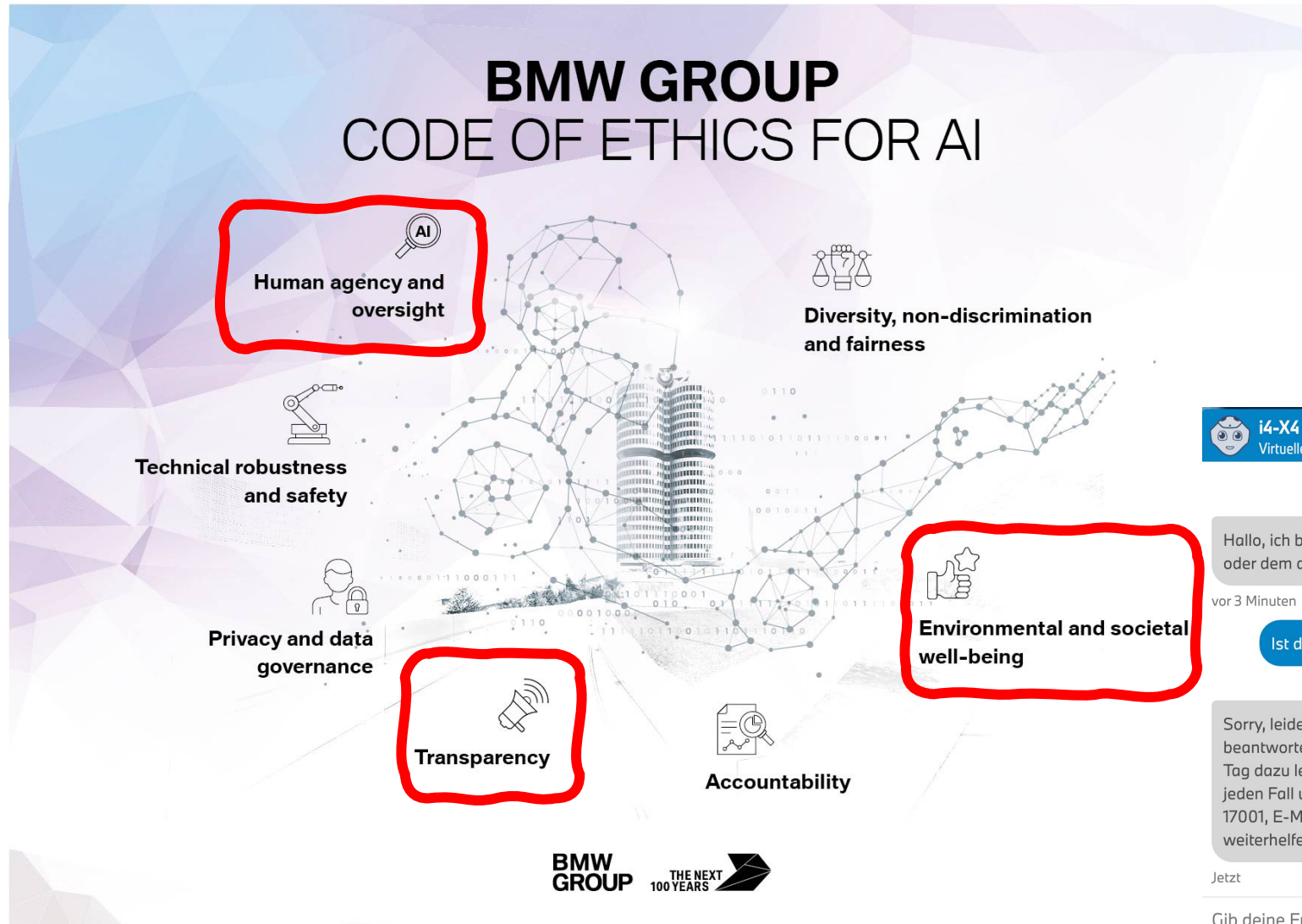
Submit

Do you want to add a screenshot? Just copy-paste the picture into the chat input box and press send to attach it.

WAKA has a feedback command to provide suggestions and report problems.

* https://www.bmwgroup.com/content/dam/grpw/websites/bmwgroup_com/downloads/ENG_PR_CodeOfEthicsForAI_Short.pdf

OUR CODE OF ETHICS FOR AI* SETS FEW LIMITS ON THE TECHNOLOGIES WE USE.



We decided for **rule based chatbots** instead of using AI chatbot engines.

The **conversation feels not natural, but we have full control of the output** and possibilities of misunderstandings, gaffes and blunders are limited.

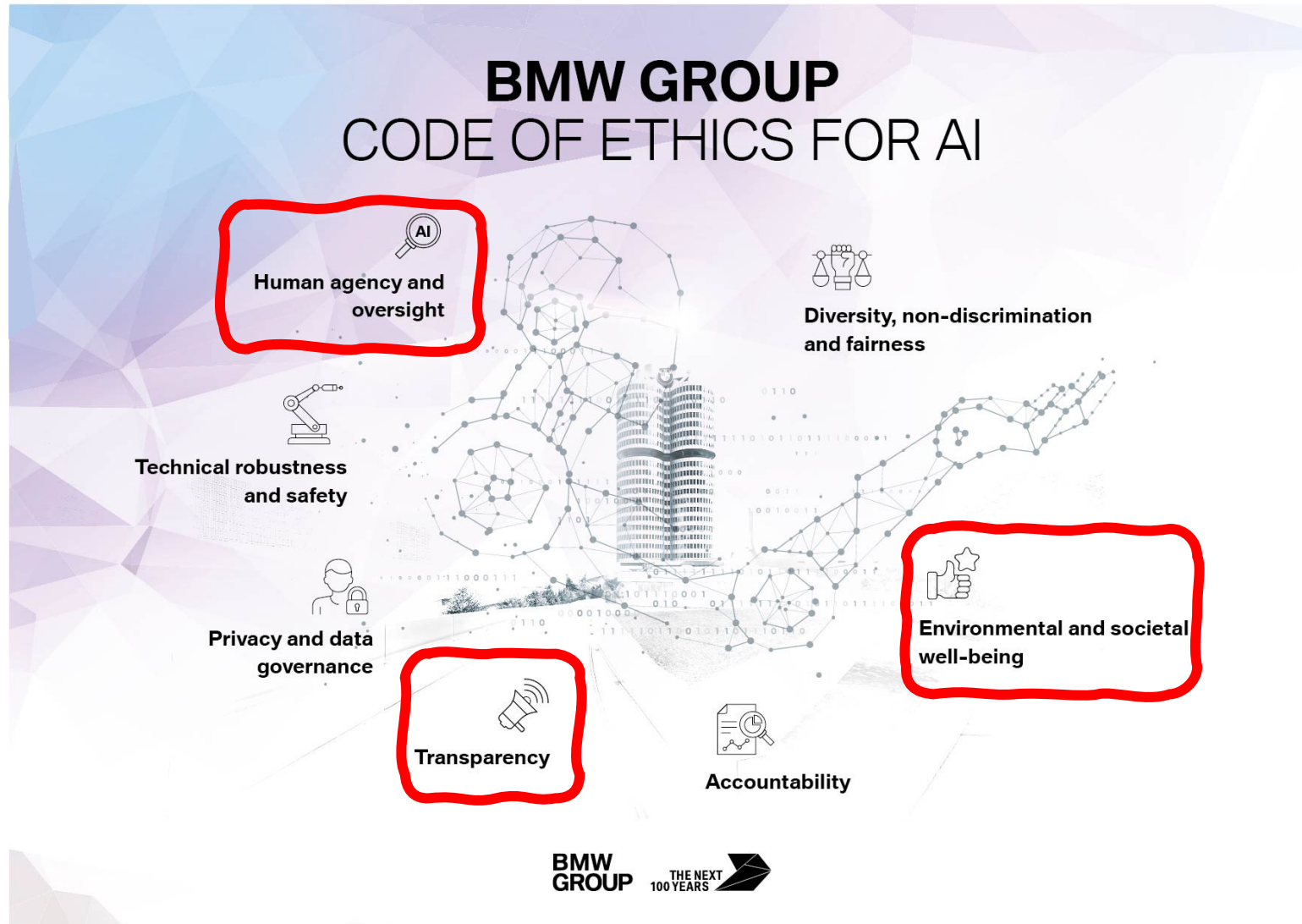
No discrimination or harassment from our chatbots!

A screenshot of a chatbot interface for 'i4-X4 Virtueller BMW Recruiting Assistent'. The chat history shows a user asking 'Hallo, ich bin i4-X4. Hast du Fragen zur Ausbildung oder dem dualen Studium bei der BMW Group?' and the chatbot replying with 'Hallo, ich bin i4-X4. Hast du Fragen zur Ausbildung oder dem dualen Studium bei der BMW Group?'. A follow-up question 'Ist das Elektroauto die Zukunft der Mobilität?' is shown with the chatbot's response: 'Sorry, leider kann ich diese Frage jetzt nicht beantworten, weil ich noch sehr jung bin und jeden Tag dazu lerne. In diesem Fall kann dir aber auf jeden Fall unsere Hotline (TelNr.: 089/382-17001, E-Mail: bewerber.hotline@bmw.de) weiterhelfen.'

A second screenshot of the 'i4-X4 Virtueller BMW Recruiting Assistent' chatbot interface. It shows a conversation where the user asks 'Was denkst du über Oliver Zipse?' and the chatbot replies 'Unser Vorstandsvorsitzender ist Oliver Zipse.'. The user then asks 'Ist Oliver Zipse ein guter CEO?' and the chatbot again replies 'Unser Vorstandsvorsitzender ist Oliver Zipse.'

* https://www.bmwgroup.com/content/dam/grpw/websites/bmwgroup_com/downloads/ENG_PR_CodeOfEthicsForAI_Short.pdf

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The **conversation feels not natural, but we have full control of the output** and possibilities of misunderstandings, gaffes and blunders are limited.

No discrimination or harassment from our chatbots!

We **monitor** the advances in NLP research, and we **test** and **research** ourselves large LM architectures to find a **safe way** to have a more **natural conversation with our chatbots.**



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BMW GROUP CODE OF ETHICS FOR AI

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 Transparency

 Accountability



Diversity, non-discrimination and fairness




Environmental and societal well-being



Being i4-X4 a PoC, we decided not to develop a full blown solution to deal with user data, and preferred **to handle no data of the user** interacting with i4-X4.

Unfortunately, this makes i4-X4 rather **forgetful**, and unable to process information like age or place of residence.

 i4-X4
Virtueller BMW Recruiting Assistant

Ich bin 16 und wohne in Leipzig
vor 2 Minuten

Wir bieten die Einstiegsqualifizierung (EQ) an den Standorten München, Dingolfing, Leipzig, Eisenach und Berlin an. Die EQ dauert - je nach Standort - zwischen mindestens 6 und 8 Monaten.
vor 2 Minuten

Darf ich ein Praktikum machen?

Darf ich ein Praktikum machen?

Vor einer Minute

Bei der BMW Group hast du verschiedene Möglichkeiten, um ein Praktikum zu machen. Als Schüler:in kannst du ein Schülerpraktikum (Pflicht oder freiwillig) machen. Alle wichtigen Informationen zum Schülerpraktikum findest du auf <https://www.bmwgroup.jobs/de/de/schueler/schuelerpraktikum.html> ☞. Und für Studierende gibt es auch eine Vielzahl an Praktikumsstellen im In- und Ausland. Alles Wichtige hierzu findest du auf <https://www.bmwgroup.jobs/de/de/studierende-absolventen/jobs-fuer-studierende.html> ☞

Vor einer Minute

We plan to **handle properly** user information in the future releases, **for a more intelligent conversation flow.**

* https://www.bmwgroup.com/content/dam/grpw/websites/bmwgroup_com/downloads/ENG_PR_CodeOfEthicsForAI_Short.pdf

CHATBOTS @ BMW GROUP: A SUCCESSFUL STORY.

- A virtual assistant is available for all BMW Group employees in Germany.
 - Integrates separates tools simplifying some workflows.
 - Easy access to information like BMW Group-glossary and translation systems.
- A Q&A bot provides information about student jobs in Germany.
 - Available 24/7.
 - BMW Group personnel deals only with complicated or sporadic questions.
- The BMW Group Code of AI Ethics influenced the technical development of our chatbots.
 - We took conservative technical choices to have safer, explainable and accountable chatbots.
 - We monitor, test and research advanced AI solutions to improve our chatbots.