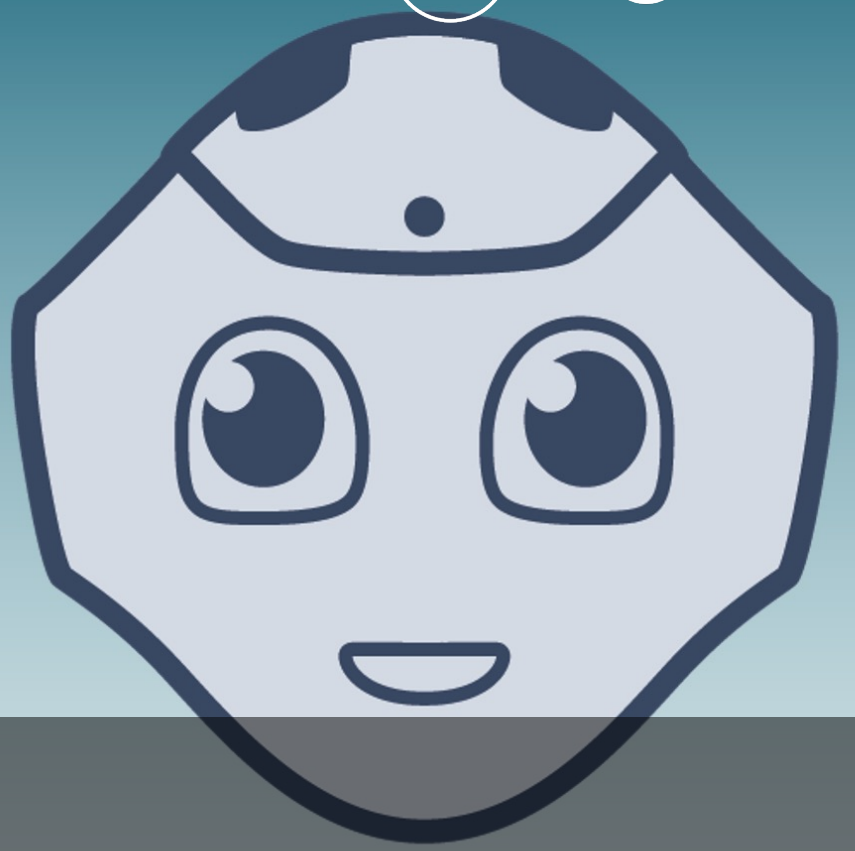
BMW GROUP



WAKA AND I4-X4.

TWO CHATBOT USE CASES AT BMW GROUP.

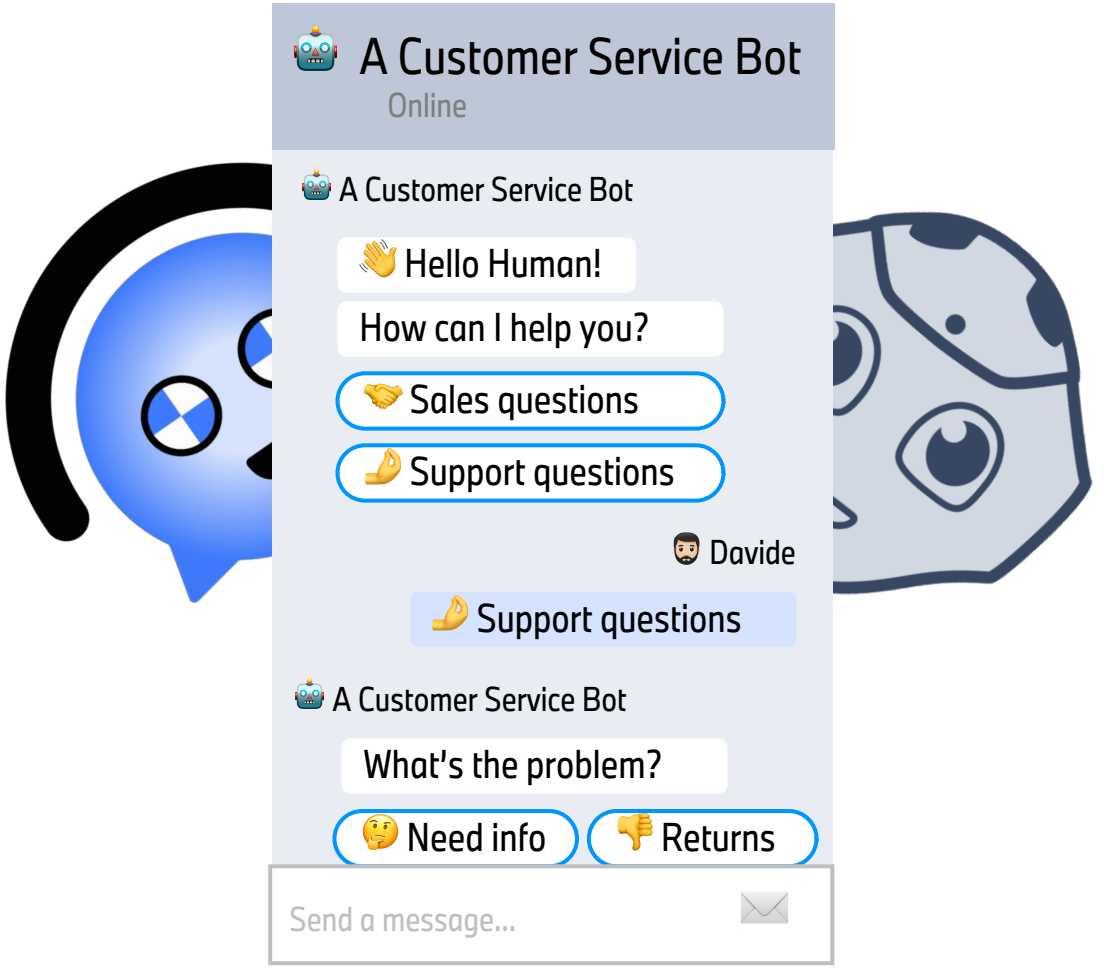
Dr. Davide Cadamuro – BMW Group

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.

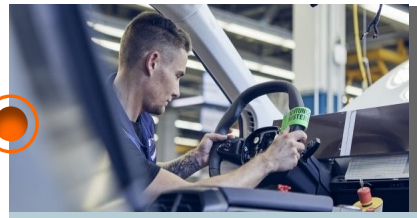
- Research & Development
- Procurement
- Supply Chain Management
- Manufacturing
- Sales and Marketing
- Aftersales & Service
- Driver / Vehicle Features
- Support Functions & Administration

Show 3D Car Parts
Search by Responsible Role
Search within Technical Knowledge Graph

Engineering Assistant

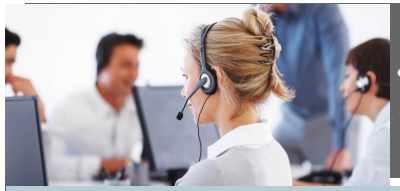
Extending BMW Knowledge Base
EKW Support
Supplier FAQ
Intranet Search

Workplace Assistant - WAKA



Smart Alerting
Intelligent Technical Documentation Search
PDCA Search

Remote Assistance for Smart Maintenance



Product introduction
- Dealer information
- Test drive booking
- Stock Car Search

Customer interaction Chatbot & Virtual Agent

Production KPIs
Plant State Report
Voice Interface
Digital Shopfloor

KPI Reporting T-Cube Voice Assistant

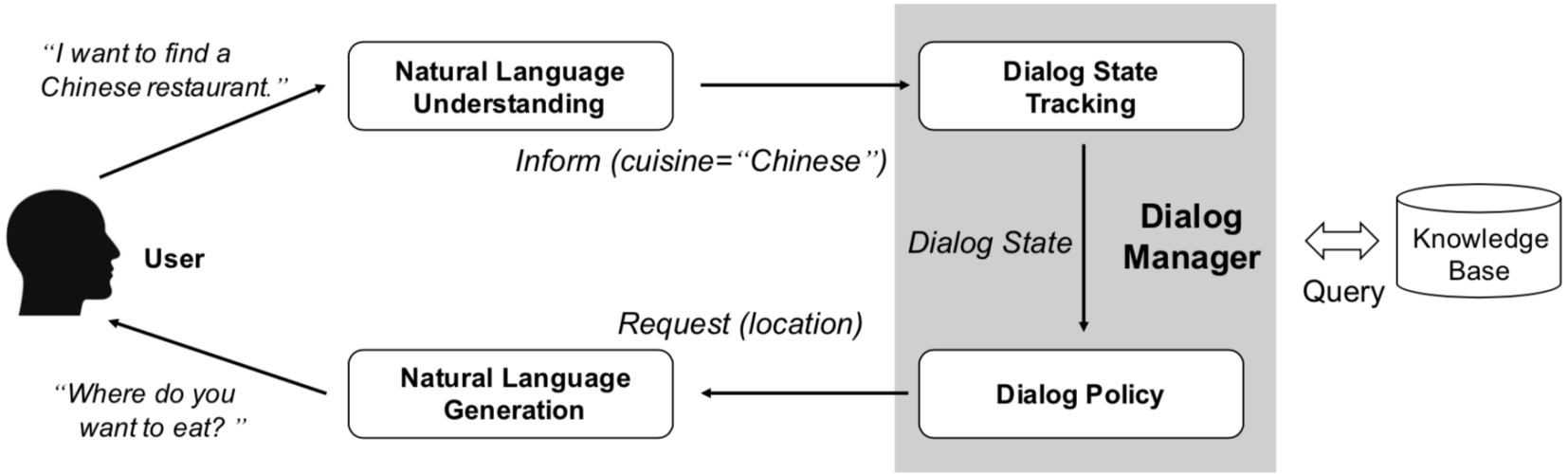
Jira Management
ITSM Ticket Mgmt
Monitoring Skill
Incident Search

IT Service Desk & Operation Assistant

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

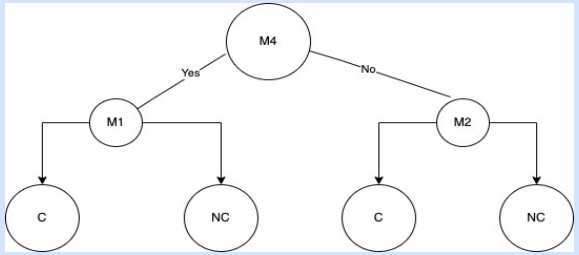
RULE BASED VS CORPUS BASED (AI CHATBOT).

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

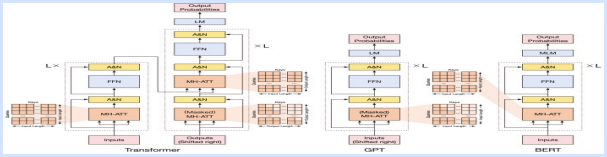


👍 Fast to implement
👍 The decision tree is fully understandable

👎 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 woo'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

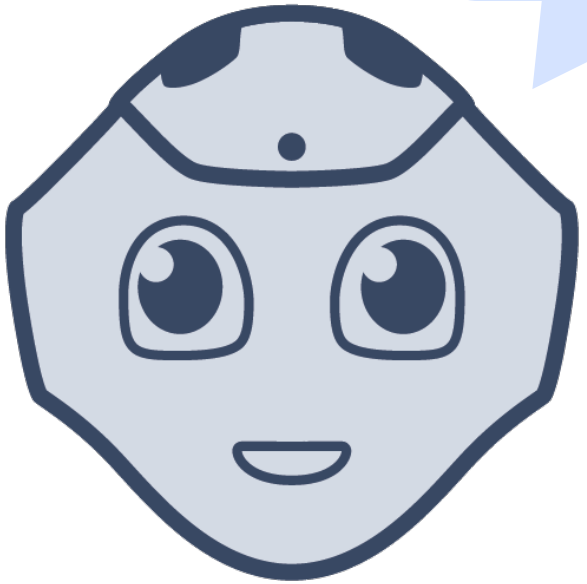
👎 Lots of data, time and skills to be trained
👎 No full control of the interaction

* 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?

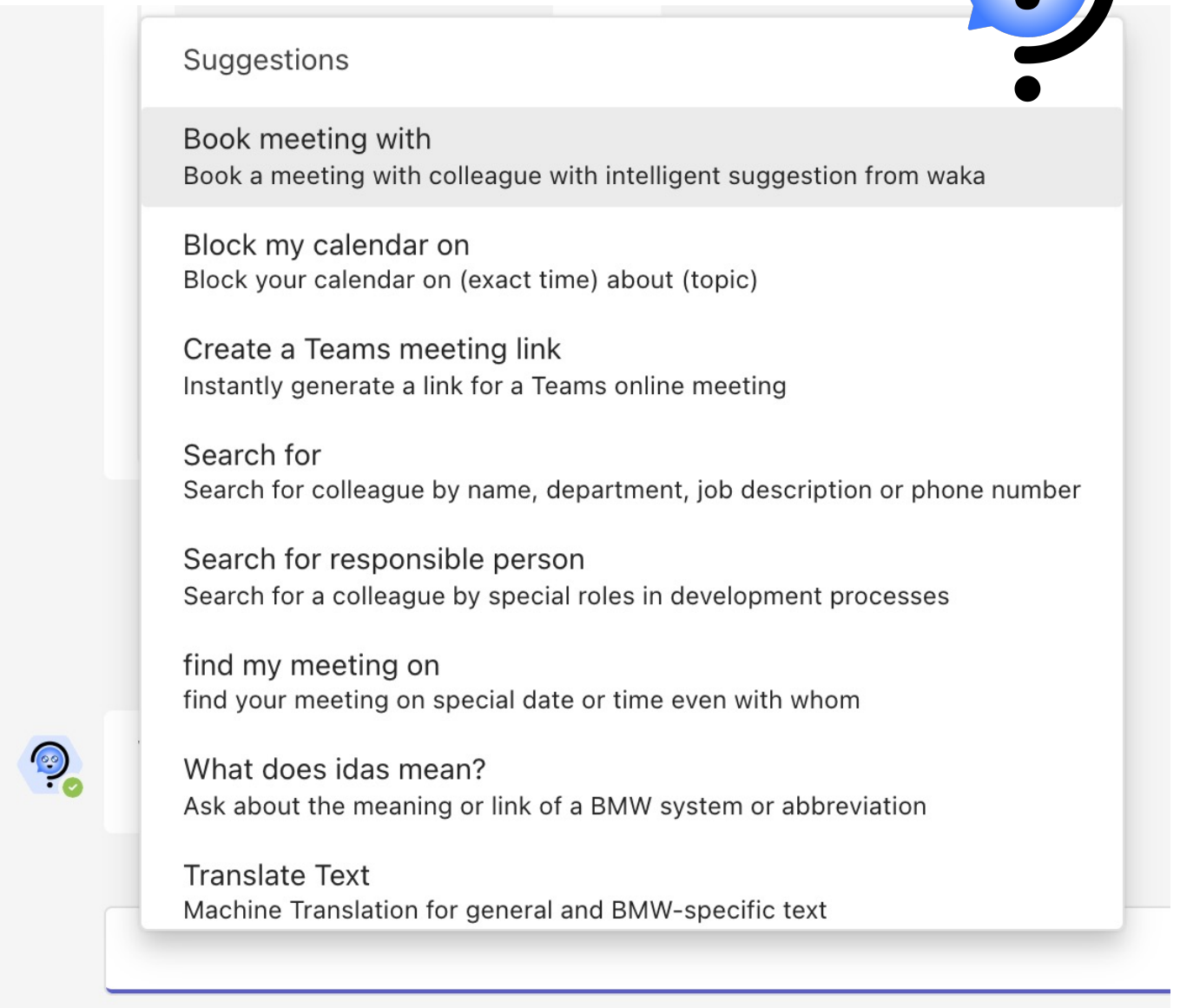


WAKA: THE WORKPLACE ASSISTANT OF BMW GROUP.

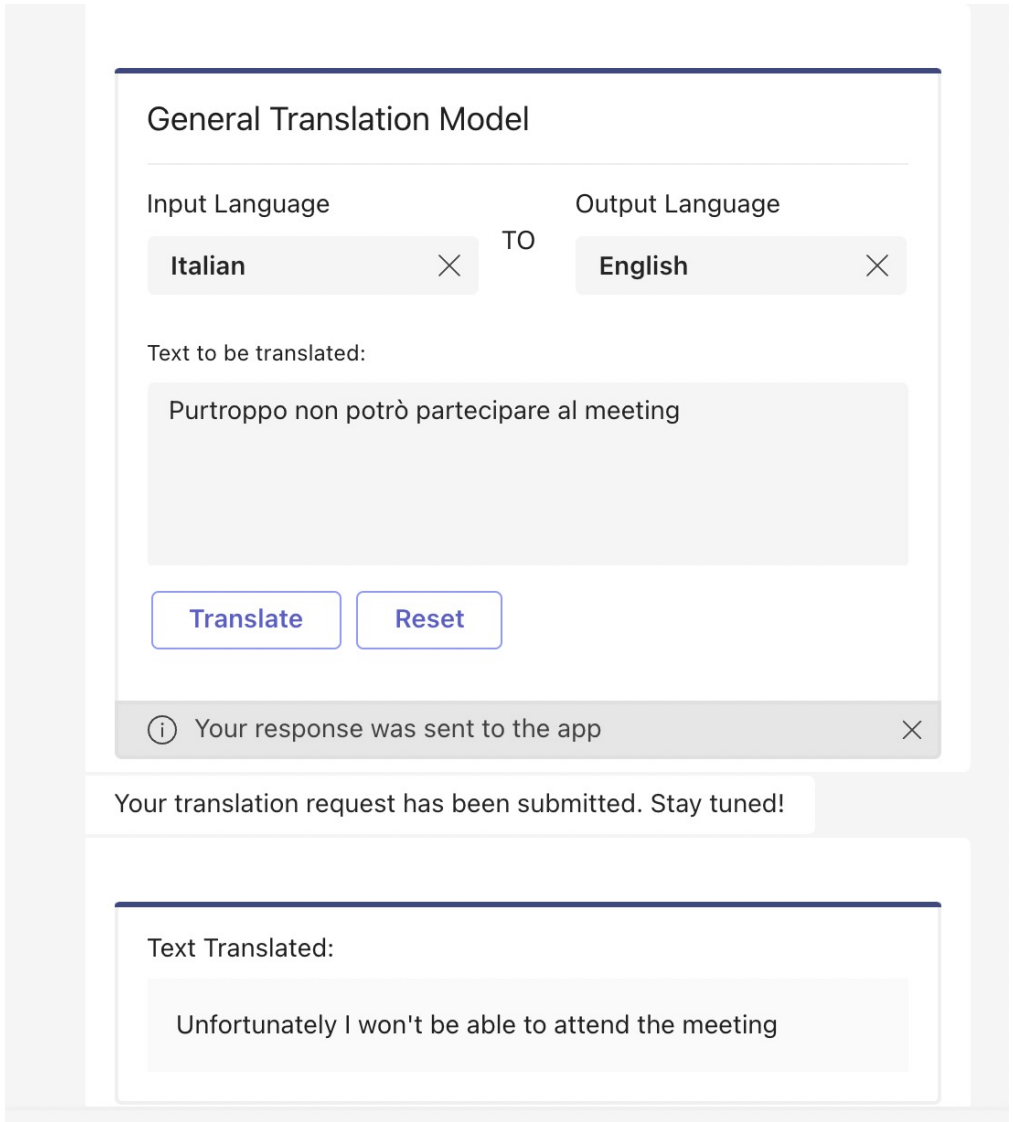
WAKA (Work Assistant Kann Alles) is a chatbot deployed on the instant messaging platform used by BMW Group employees based in Germany.

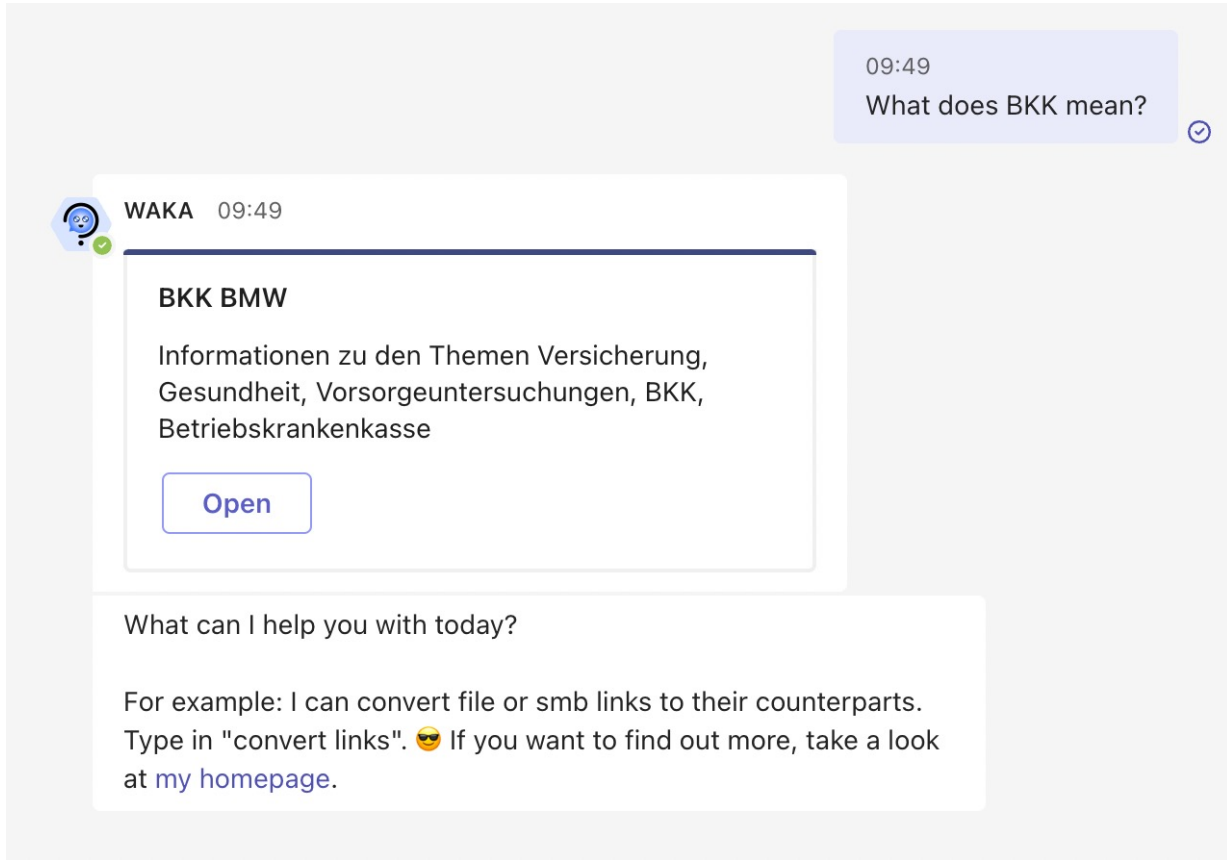
Its initial development dates back to 2019, after several test phases in the past two years it has been rolled out to all the German offices.

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.



WAKA: THE WORKPLACE ASSISTANT OF BMW GROUP.

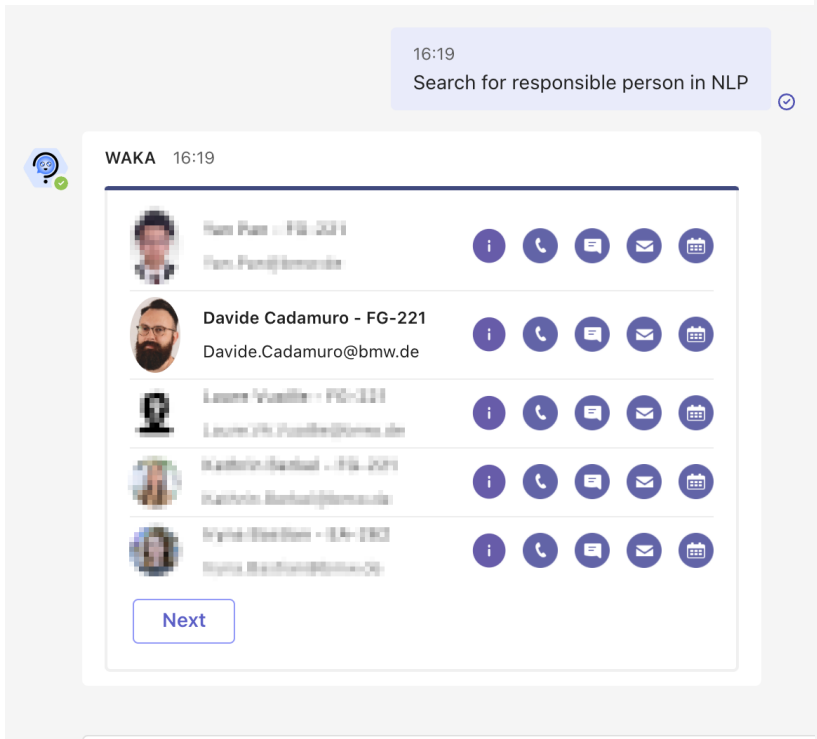


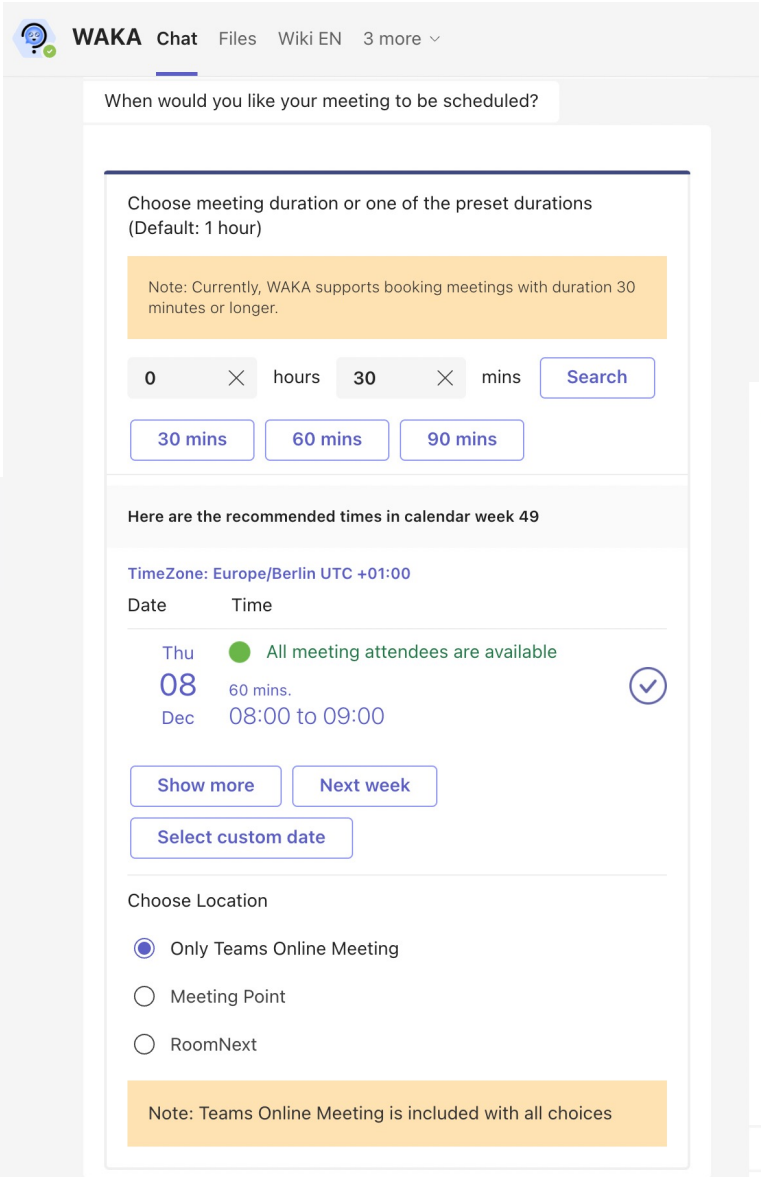


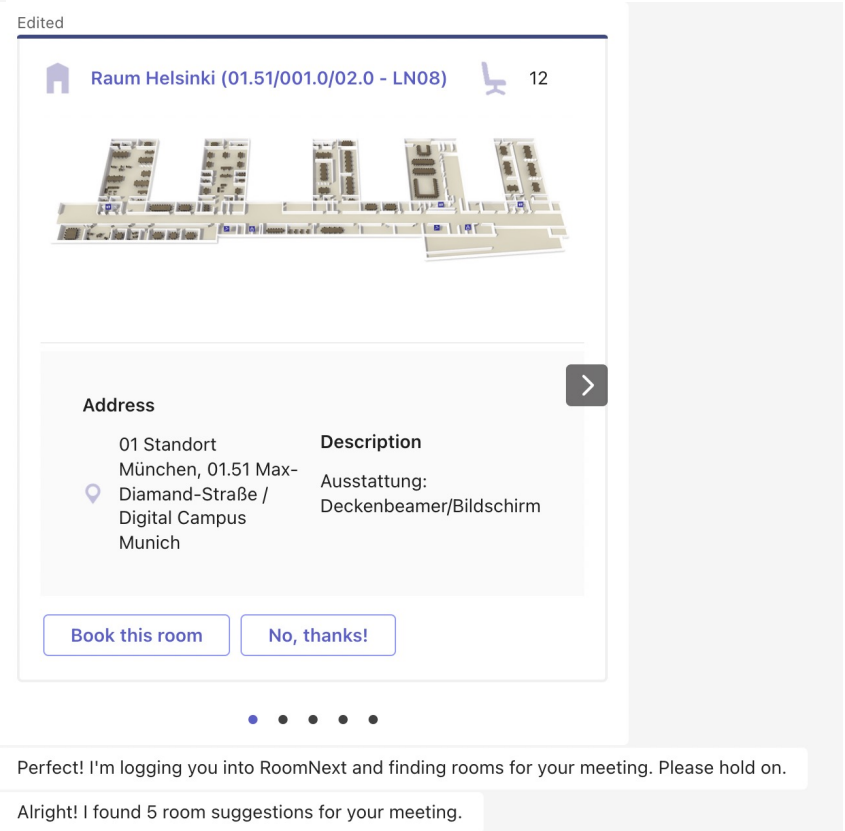
WAKA: THE WORKPLACE ASSISTANT OF BMW GROUP.

WAKA has a workflow for organising meetings:

- expert search
- time slot optimisation
- room search



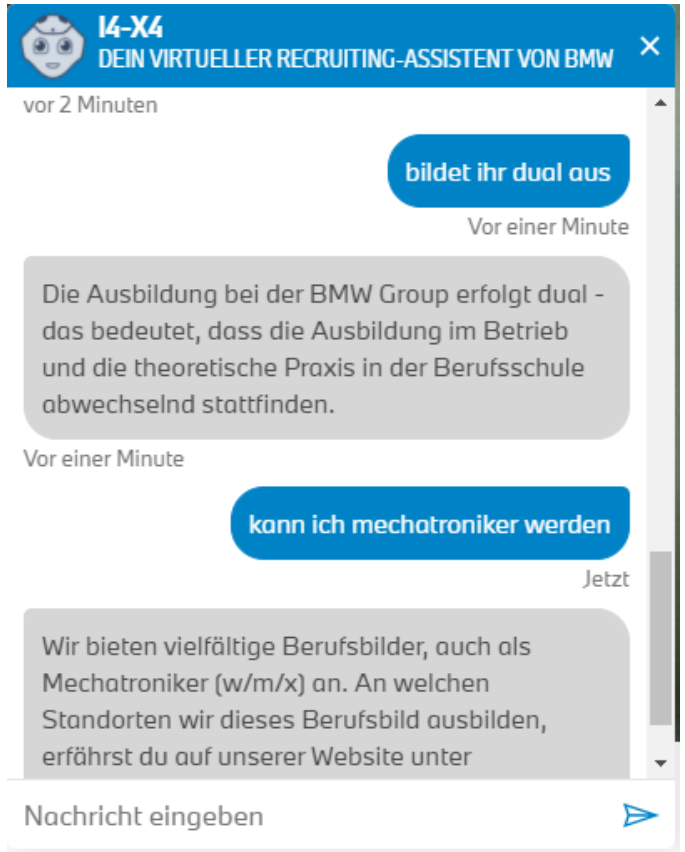




I4-X4: A VIRTUAL INFO POINT FOR STUDENT JOBS.

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.

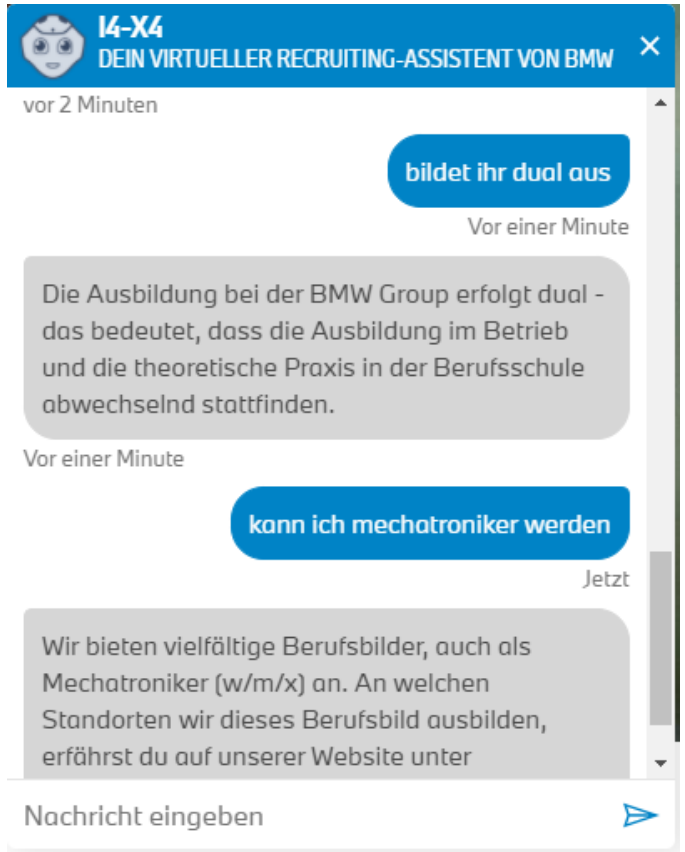


I4-X4: A VIRTUAL INFO POINT FOR STUDENT JOBS.

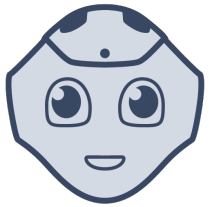
Between March and June 2022:

- 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.



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



Knowledge base

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

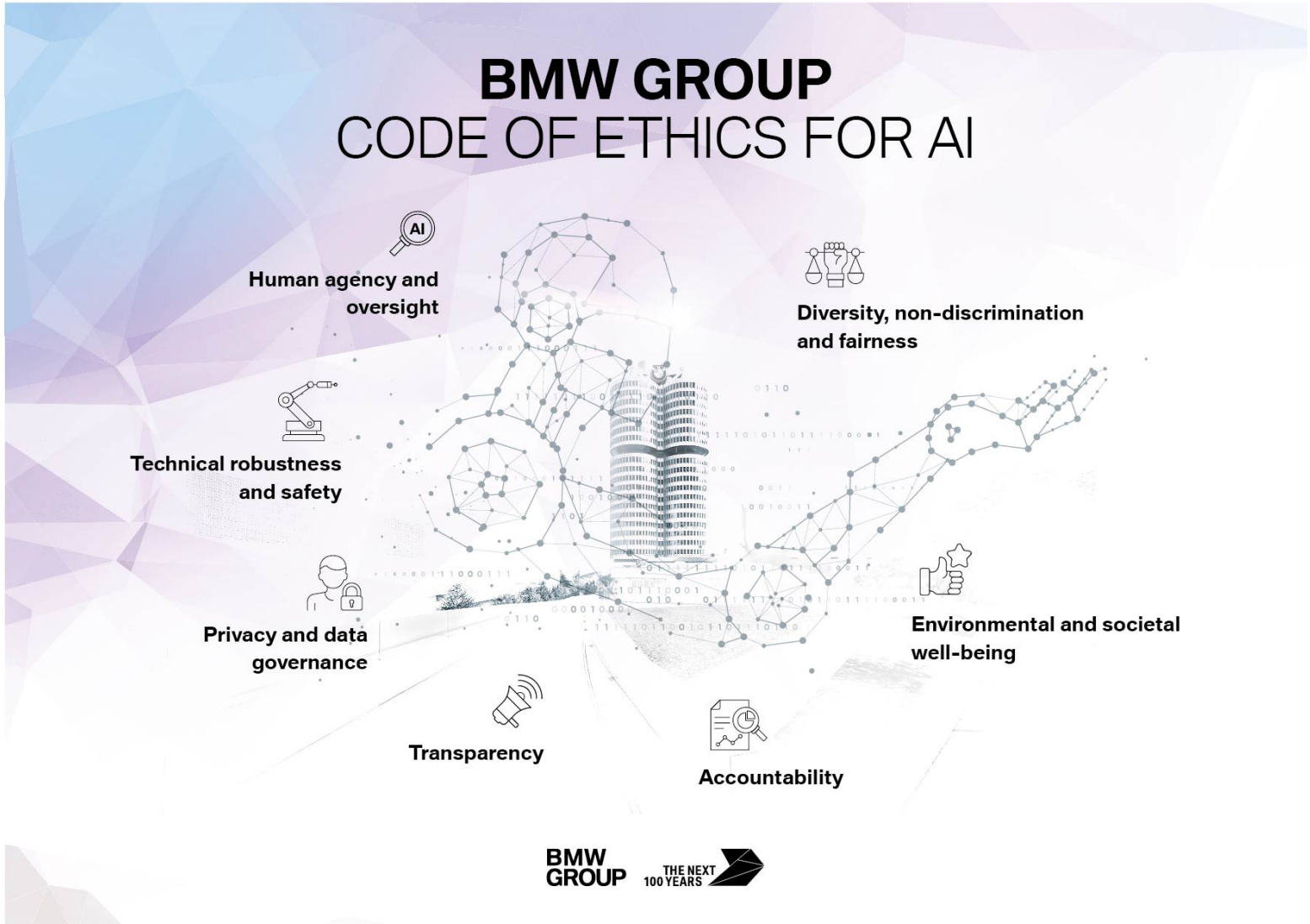
Enable rich editor

1 2 3 4 5 ... 66 Next

Question	Answer
Source: 20211012_Fragenkatalog.xlsx	
Bekomme ich bei BMW in der Ausbildung auch Zuschläge?	Zusätzlich zum Grundentgelt gibt es auch noch Urlaubs- und Weihnachtsgeld sowie ab dem zweiten Ausbildungsjahr anteilige Erfolgsbeteiligung.
Add alternative phrasing	Add follow-up prompt
Kann man verkürzen?	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.
Was muss man machen um verkürzen zu können?	
Kann ich die Ausbildung verkürzen?	
Kann ich die Ausbildung auf ein Jahr verkürzen?	Add follow-up prompt
Add alternative phrasing	

- 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.



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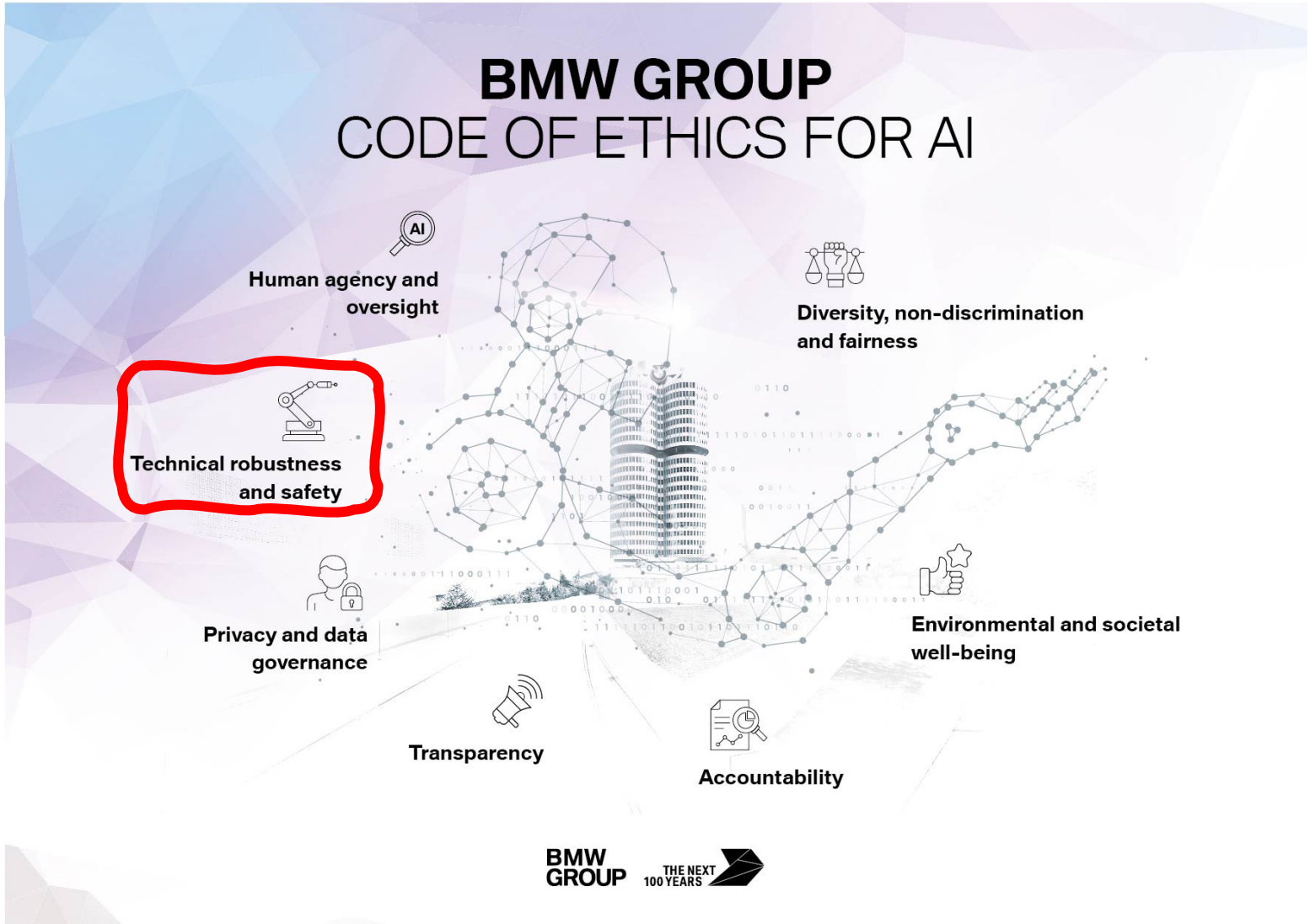

We use a well tested and reliable cloud platform for our use cases.

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/grpw/websites/bmwgroup_com/downloads/ENG_PR_CodeOfEthicsForAI_Short.pdf

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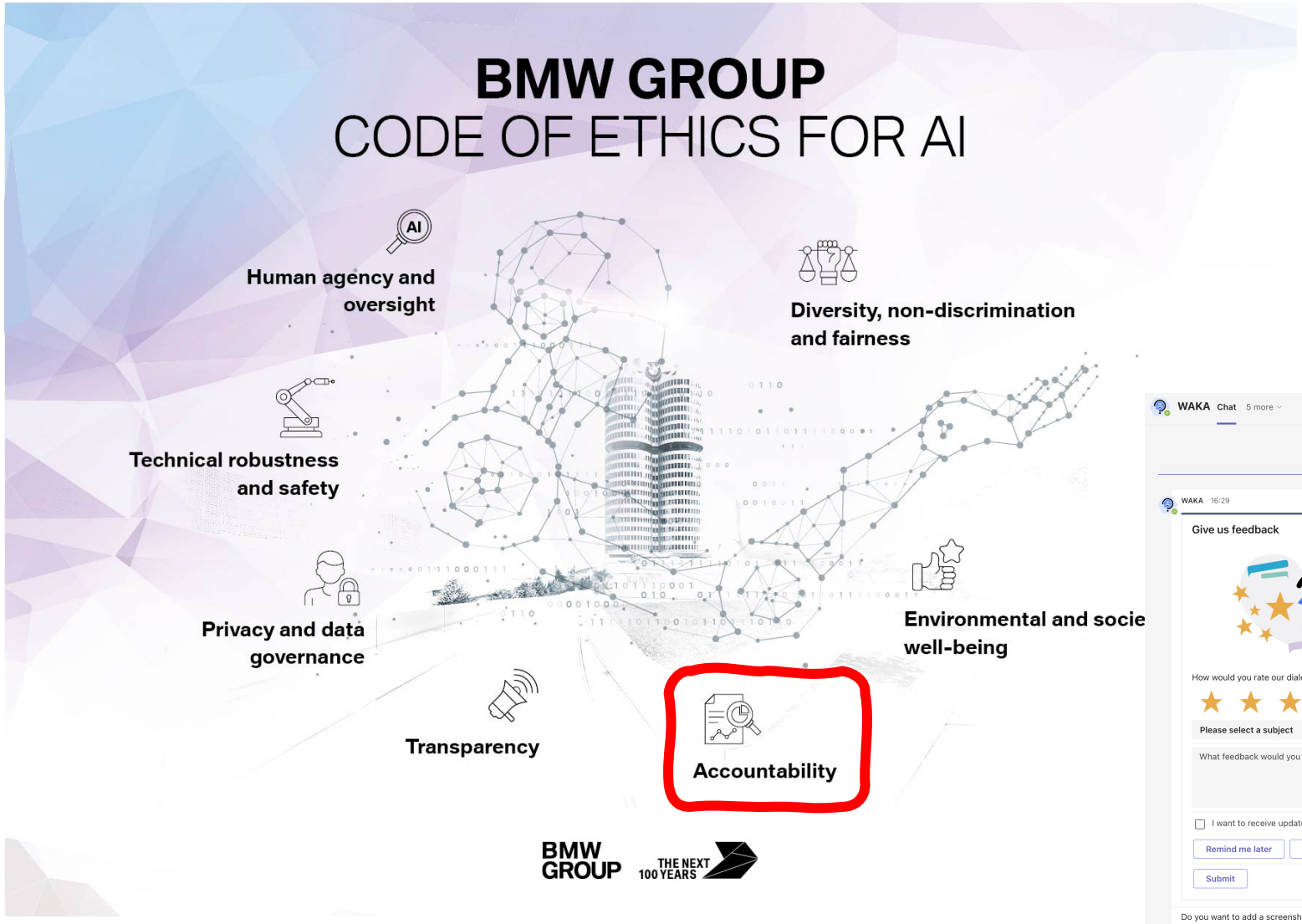
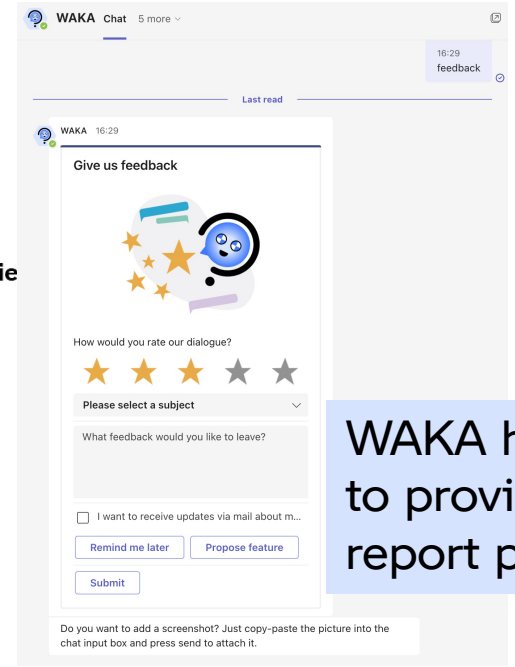


We periodically **check the logs** of the applications **to identify problems** like unanswered questions, wrong answers and possible improvements.

Once identified, the issues are prioritised accordingly and handled by the development team.



WAKA 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

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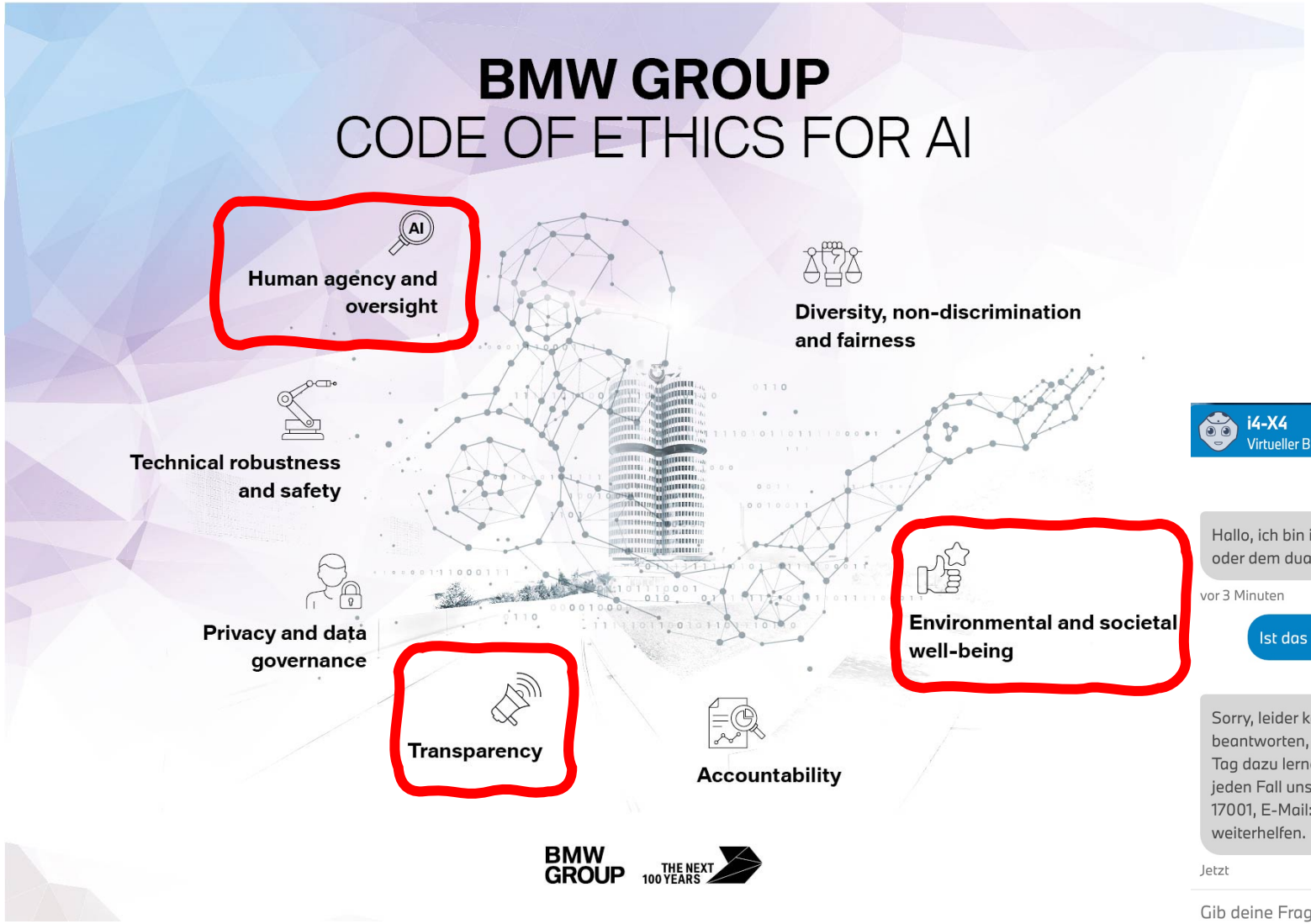
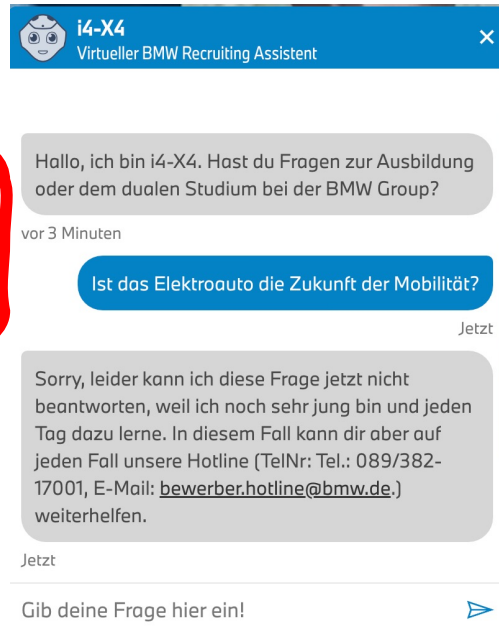
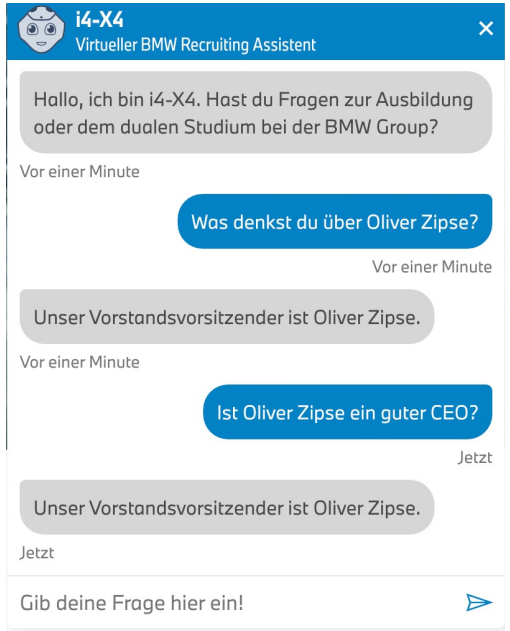


We decided for **rule based chatbots** instead of using AI chatbot engines.

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!





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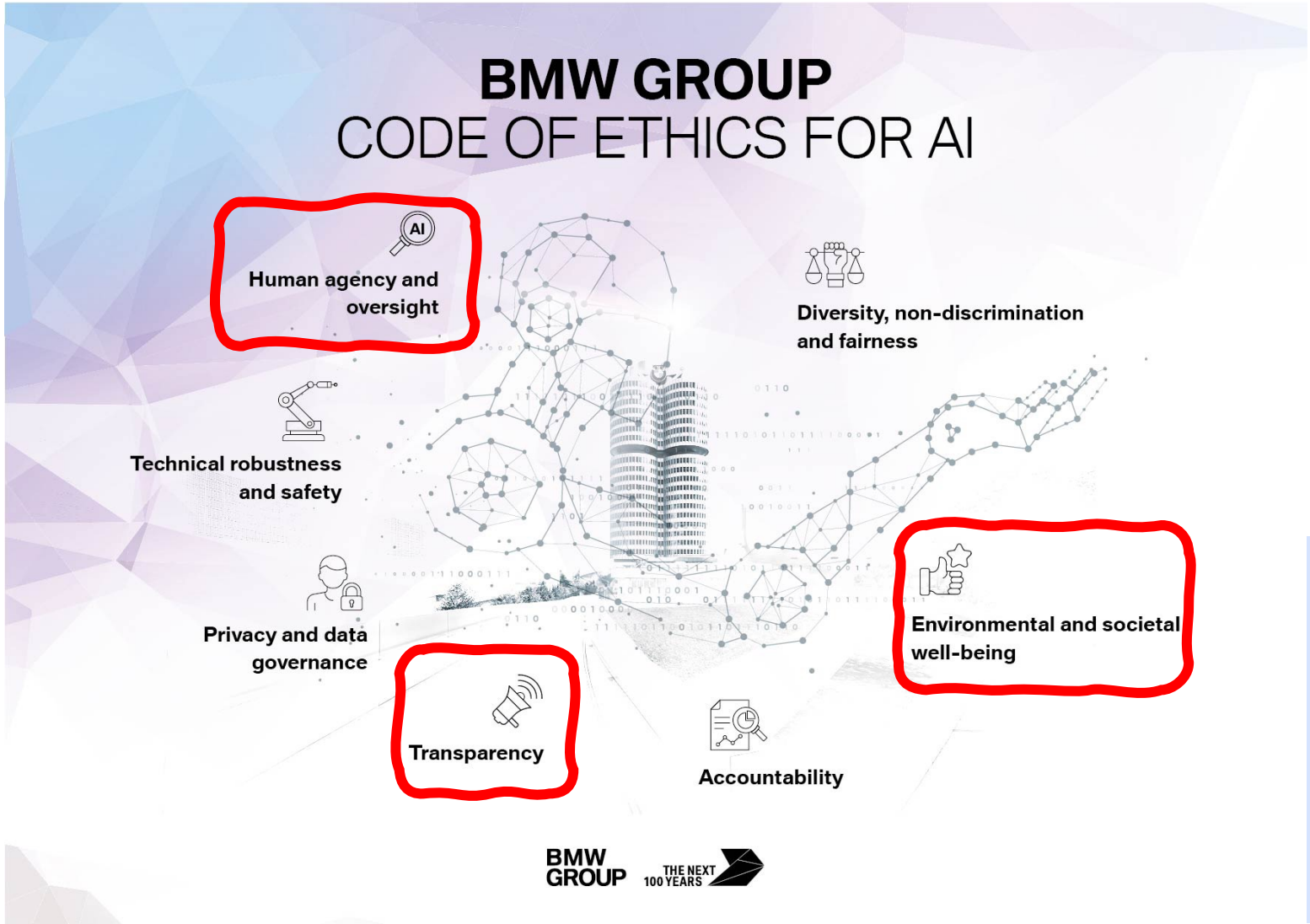

We decided for **rule based chatbots** instead of using AI chatbot engines.

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!

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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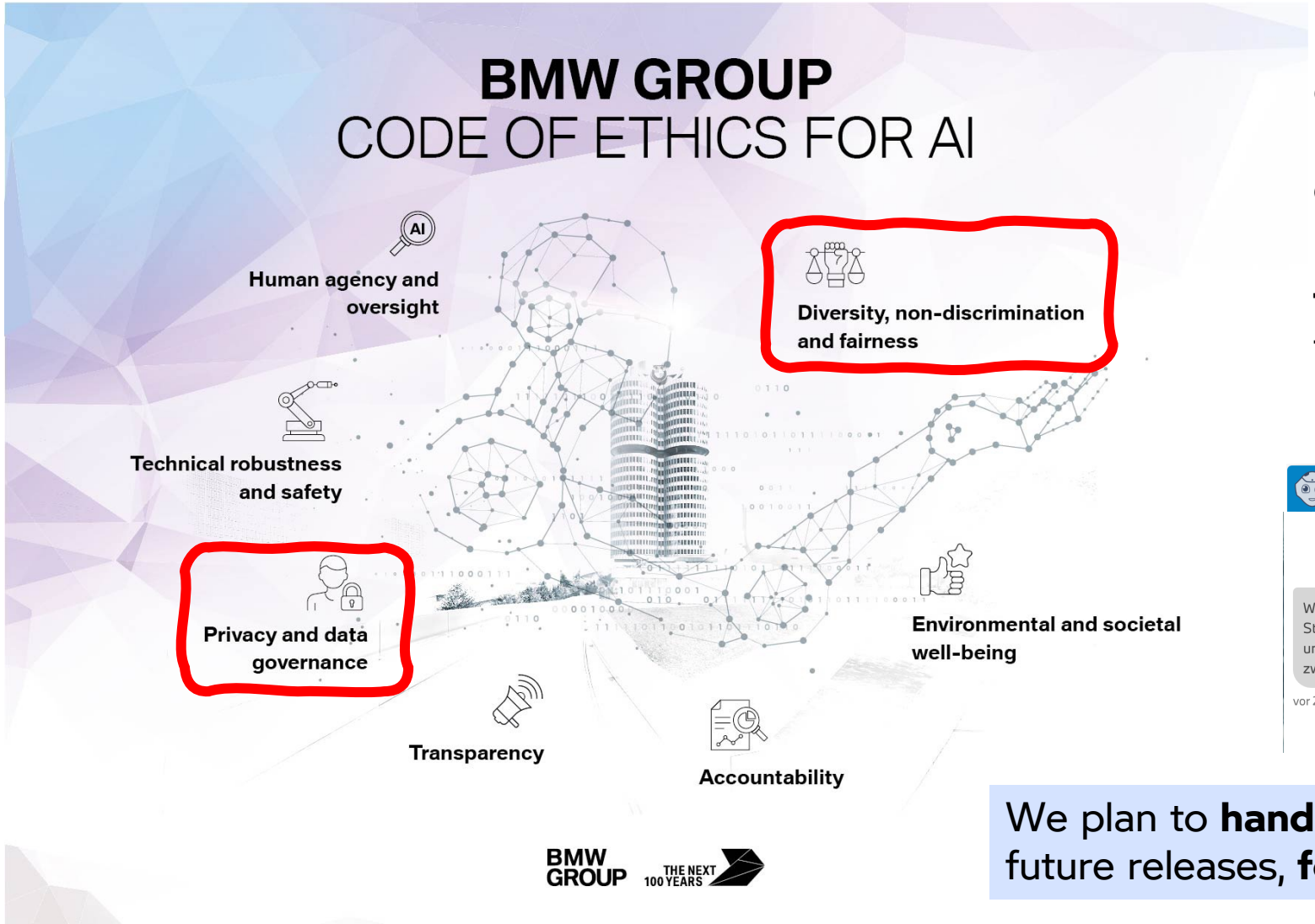
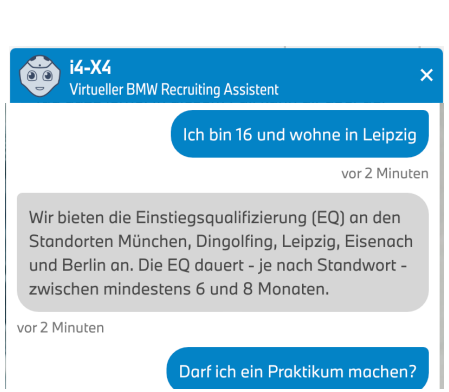
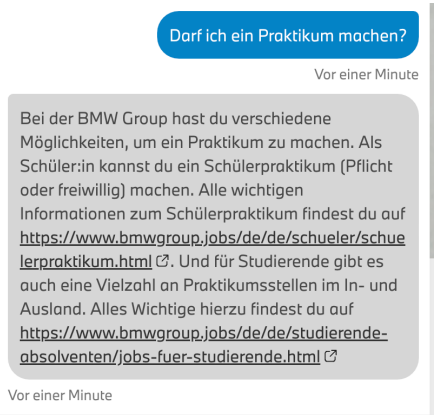


Being i4-X4 a PoC, we decided not to develop a full blown solution to deal with user data, and preferred **to handle no data of the user** interacting with i4-X4.

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





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.