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Version history

Version	Date	Person	Note
V0.1	03-04-18	Gerard Zeeman	Created document
V0.2	03-04-18	Gerard Zeeman	Added chapters

1. Preface

One of Willy's goals is to make people aware of the problems and harmfulness that waste entails. Interaction will be the primary method to fulfill this goal. Interaction between humans and robots can be realized with different technologies and with different strategies.

Means of communication from Willy (Willy to Person)

Text

Willy can give information by showing text on his display. This text can be static, depending on the user input. Or the text can be generated by an algorithm

Text to speech

Willy can generate speech by converting text to speech. Nowadays, browsers can fulfill this conversion. If a Chatbot is used, this functionality is mostly included. There are third party variants available. Thirt party text to speech variate from compatibility possibilities, functionality and internet connection requirements.

Visuals

Because Willy has an onboard screen available, he is able to display visuals such as images and videos. The use of visuals can help by making people aware of garbage.

Content of communication

Starting a conversation can be done by using different communication-techniques.

Questioning

Willy can ask questions to start a conversation. If the question is answered, Willy can react based on an algorithm. Because the answer depends on the reaction, this method is harder to achieve. However the attention of the person will be drawn more quickly because of the subject of the answer based on the input.

Another option is to give the end-user different options by asking multiple choice questions. The algortim behind the response will be much simpler. Willy can search for certain words witin the answer to select a certain answer.

Informing

Willy can inform an end-user about the negative influence of garbage to our environment. However the user will not feel he is in a conversation.

Initiation of communication

Before Willy is able to communicate with humans. Willy is required to recognize humans. This can be achieved with different techniques.

Object detection

If a person starts to communicate with Willy, Willy should be able to detect there is a person in front of the robot. One of the possibilities is Willy using its sonar sensors to detect a person.
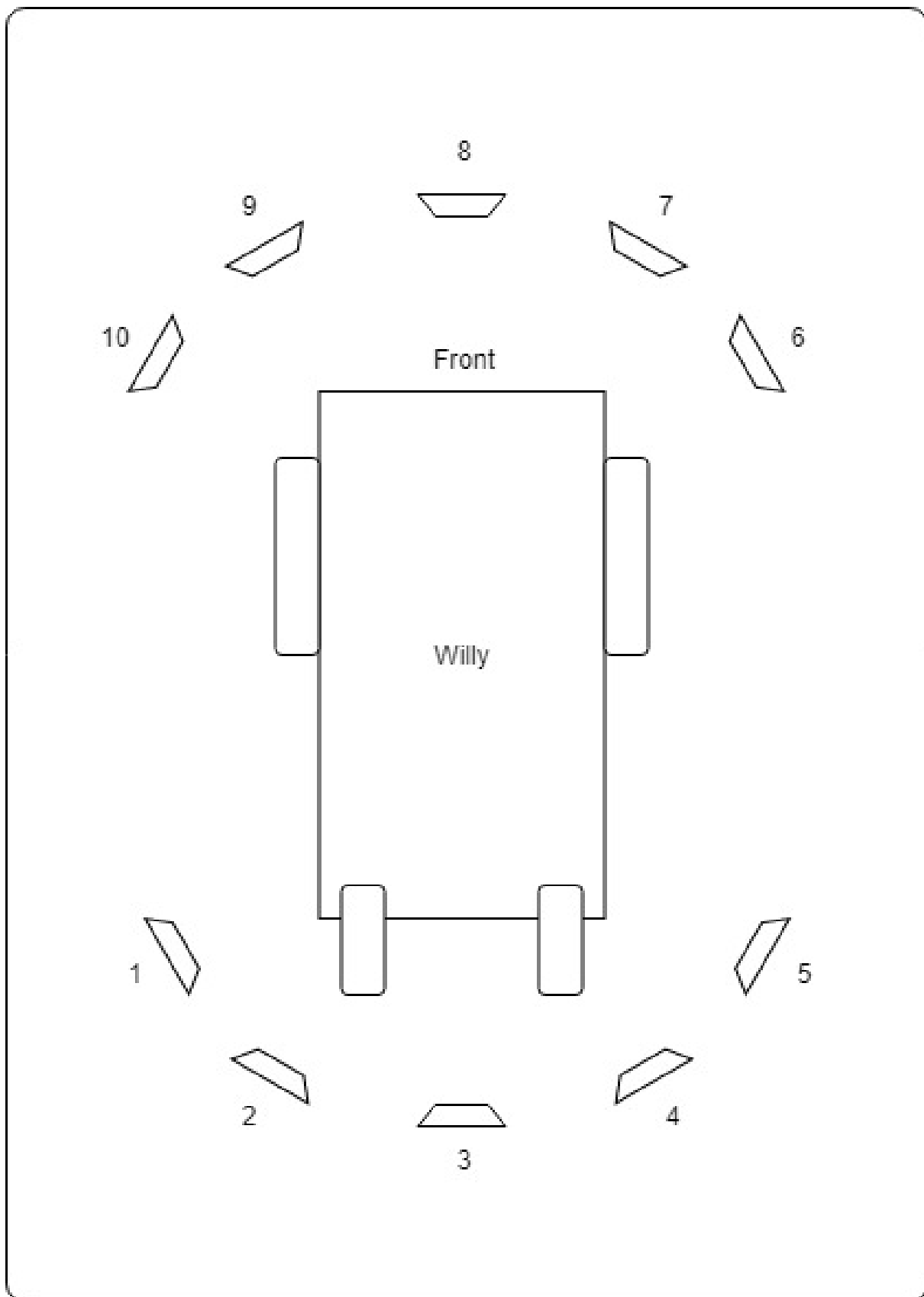
Unfortunately the use of sonar sensors gives a lot of blind spots. Another option is using the LIDAR for object recognition. This option gives way more resolution and accuracy. The placement of the LIDAR sensor is very important for the efficiency. Boththe sonars and the Kinect are not able to detect if the object is actually a person.

The second option uses ROS, ROS contains several packages for detecting and identifying faces, and detecting and tracking humans with RGB-D sensors or laser scanners. Detects persons through head

and face detection and identifies the detected faces. The results are tracked over time to increase confidence. The system is optimized to be used with a Microsoft Kinect or Asus Xtion Pro Live sensor but could also handle different sensors as long as depth and color images are provided.

- Advantage: Cob_people_detection can detect and identifying faces. To start a conversation, Willy can for example require to detect a face for a minimum amount of time. No user input is required.
- Disadvantage: The use of this method requires an extra kinect, because the current kinect will be used for navigation and will be located incorrect for people detection.

Another option is using the Kinect to detect a person. By using the Kinect it is possible to determine wether the object in front of Willy is a person or an other object. A disadvantage is the enormous amount of data that has to be processed. The positioning of the Kinect is also important.

Last but not least, Willy can draw attention by using his screen. Before he starting a conversation, Willy waits for physical user input from an end user. User input can be a accomplished by using the Lead motion or one of the alternative interaction methods.

- Advantage: Don't require any extra hardware. There is no extra algorithm required that defines when the attention of a passerby is drawn or not.Last but not least, this method is less error prone
- Disadvantage: This method required the user to (physical) interact with Willy before an conversation is started.
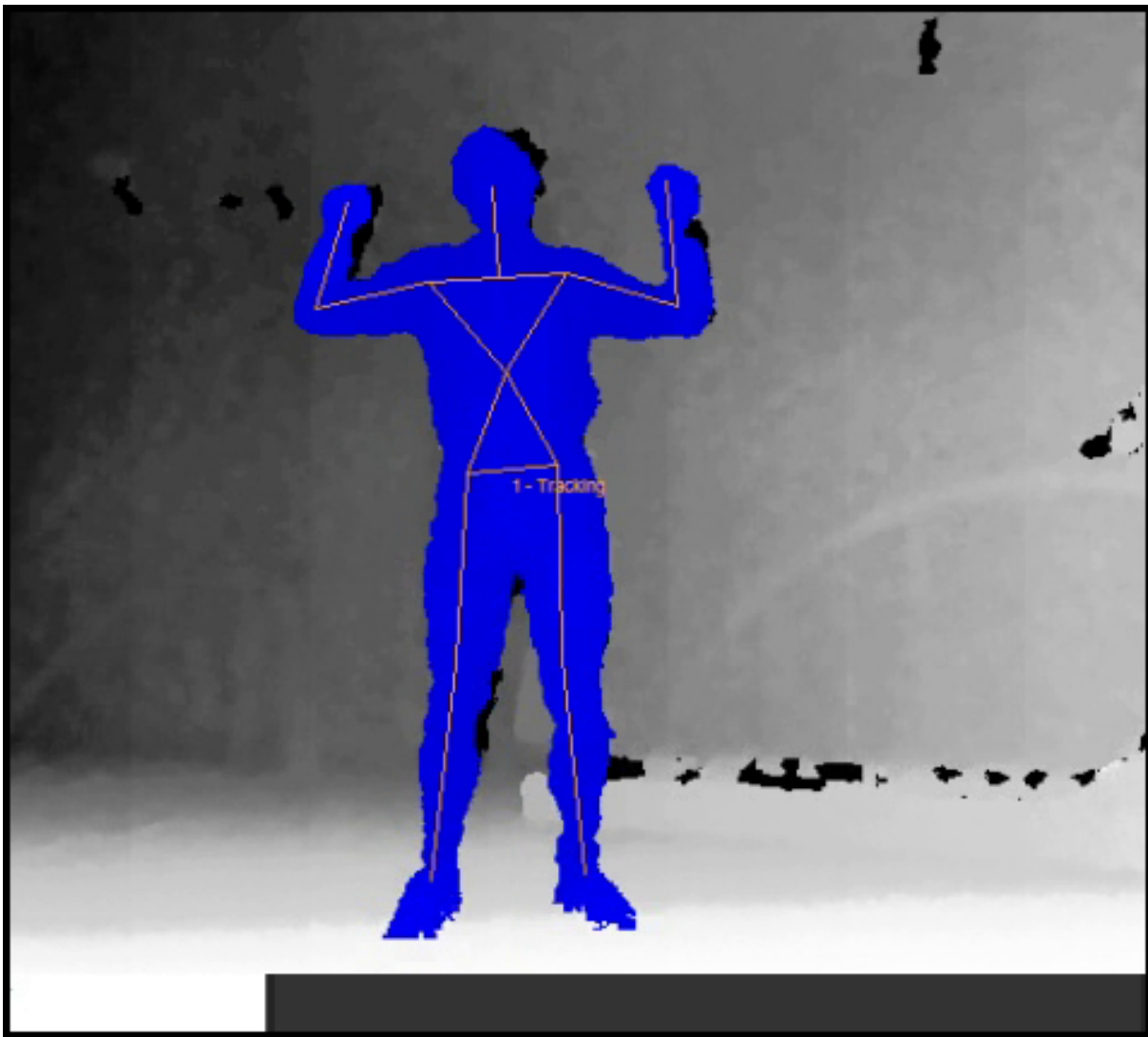
This can be summarized in the following table:

Method	Advantages	Disadvantages
Sonar	Already implemented	Dead spots, slow, no person detection
LIDAR	Fast, high resolution	Position dependent, no person detection
Kinect	Fast, high resolution, person detection	A lot of data to process, position dependent

Means of communication to Willy (Person to Willy)

Voice recognition

To make a person be able to communicate with Willy, the robot should be able to listen to the person by recognizing his or her speech. A good microphone is neccesary for listening to sounds and filtering out background noise. An API can be used to convert speech to text. Voice recognition is a great way to create user interaction, but can be risky if there is a lot of background noise.

Touchscreen

Another way to get user input is a touchscreen. This makes it possible to have buttons and clickable areas. A touchscreen is a good way to create clear user interaction. A touchscreen is however heavy and expensive. Another difficulty is the fact that it is hard to make a touchscreen waterproof and have good responsiveness at the same time. An alternative for a trouchscreen is a normal screen with al LEAP-sensor in front of it. This is cheaper, lighter and gives more possibilities.

Gesture recognition

By using a LEAP-sensor (see previous paragraph) it is also possible to recognize gestures. The different gestures can be showed or explained on the touchscreen. This is also possible with the Kinect, but with somewhat less possibilities.

2. Content of communication

Speech bot

A speech bot is designed to process an incoming speech and create answers for the input. The challenge with a speech bot is creating relevant answers to user input, and some relation with garbage disposal. A problem of many existing speech bots is that these bots have an hard time to prevent giving rude answers. Especially bots created by existing user input reflect this human input.

There are many different existing solutions for speech bots. An import feature these bots must have is support for the Dutch language. Here follows a list of options with Dutch support:

Name	Platform/language	License	Languages	Project link
Live Agent	https://www.ladesk.com/integrations-and-plugins/	14 day trial	39 languages	https://www.ladesk.com/
Semantic Machines	?	?	Language independent	http://www.semanticmachines.com/
Wit.ai	Node.js, Python, Ruby, and HTTP API	Free	A lot (including Dutch)	https://wit.ai/
Api.ai	Android, iOS, Cordova, HTML, JavaScript, Node.js, .NET, Unity, Xamarin, C++, Python, Ruby, PHP, Epson, Botkit, Java	Free	A lot (including Dutch)	https://api.ai/
Microsoft Bot Framework	.NET and Node.js SDK	Open source	A lot (including Dutch)	https://docs.botframework.com/en-us/

Name	Platform/language	License	Languages	Project link
Chatfuel	JSON API, RSS, Subscribe plugin, Digest, IFTTT, Zapier, User input, Live Chat	Free	A lot (including Dutch)	https://chatfuel.com/
Chatterbot	Python, Django	Open source BSD-3	Langue independent	http://chatterbot.readthedocs.io/en/stable/
MyCroft	Linux, Android	Open source	Dutch not standard implemented but possible to create	https://mycroft.ai/

From these solutions, the free ones should be prioritized. An other important necessity is the support of a platform already used in the project. All solutions except Live Agent and Semantic Machines are free to use.

Self created solutions

Another option is the creation of a custom self built system. The advantage of this is the fact that it can be runned offline. A disadvantage is that it is more work to creative and might not give the feeling of social interaction that given by a existing chat bots. However, the main goal is to create awareness about the impact of garbage. A Self created solution may fulfill this task better than a speech bot.

3. Recommendations

This chapter contains recommendations for the best appliances in communication with Willy.

Self created solution

A self created solution can contain, questions, vizuals, video's, information speeches or choices.

Text to Speech

Speech to Text

The recommended solution to speech to text is dependent on wether there is internet available on Willy. In the case of:

- **Willy having internet**: options like wit.ai or api.ai are great when there is internet available. These options don't only have a option to generate text from speech, but also have a chat bot function.

- **Willy not having internet:**: A local option like MyCroft works offline, so in that case this is the best option.

Speech Bot

The speech bot will be the most interactive solution. A speech bot will also be the most smart and innovative solution, however the use of a speech bot has several disadvantages.

- A speech bot will mostly give general answers and sometimes give wrong answers.
- To make the speech bot more smart, internet connection is required.
- Because the above disadvantages, a speech bot may not be fulfill the main goal of social interaction very efficiently.
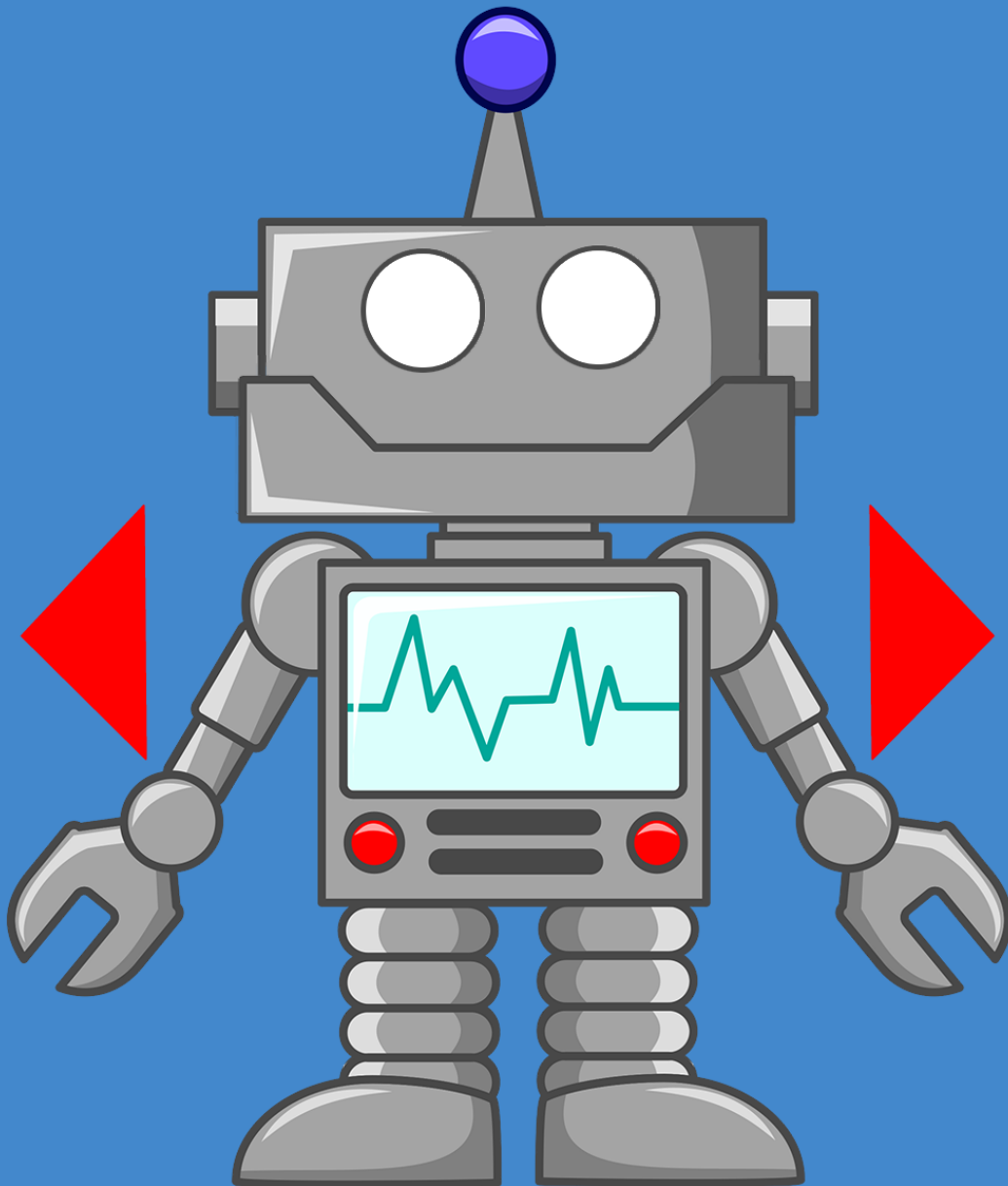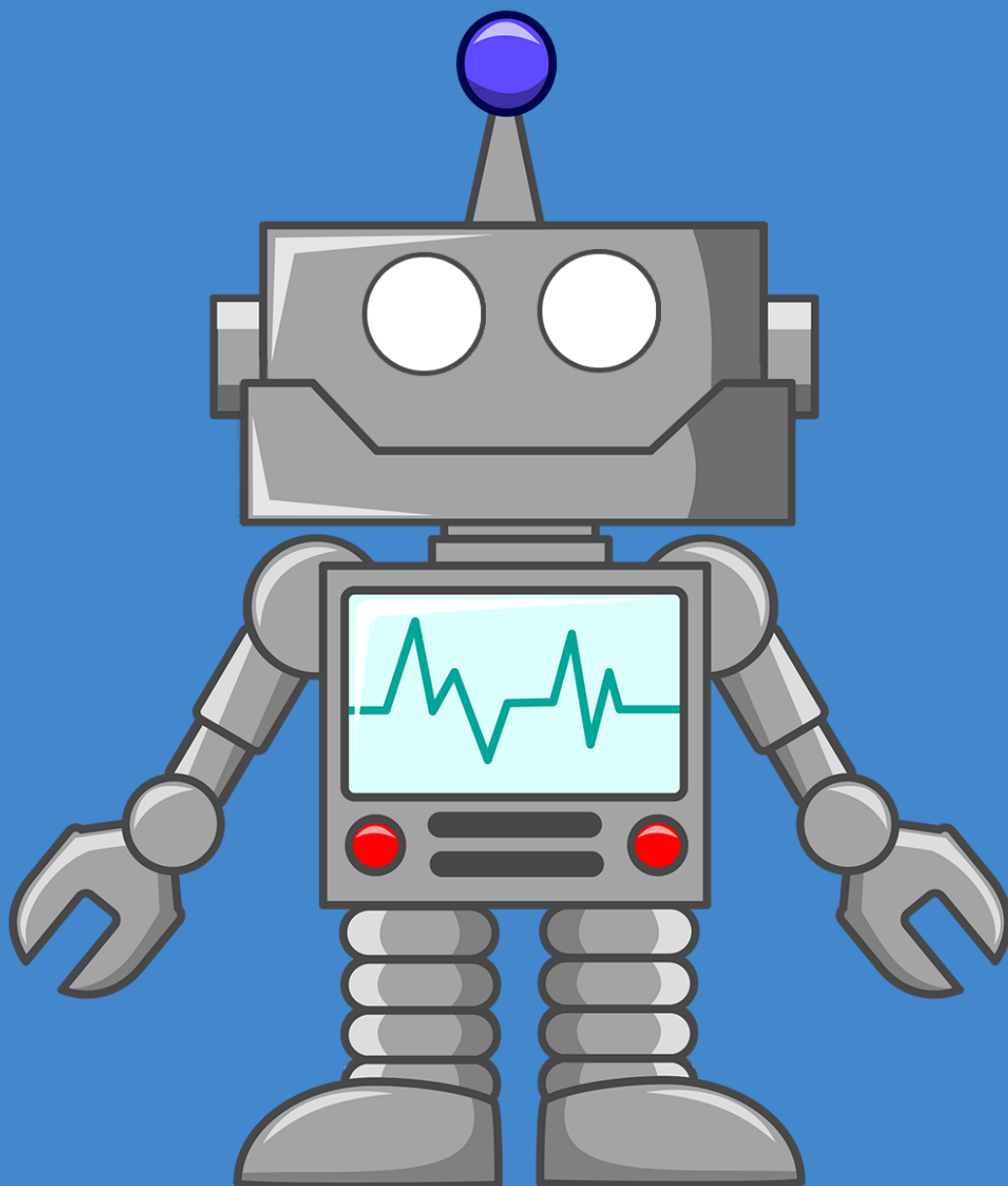
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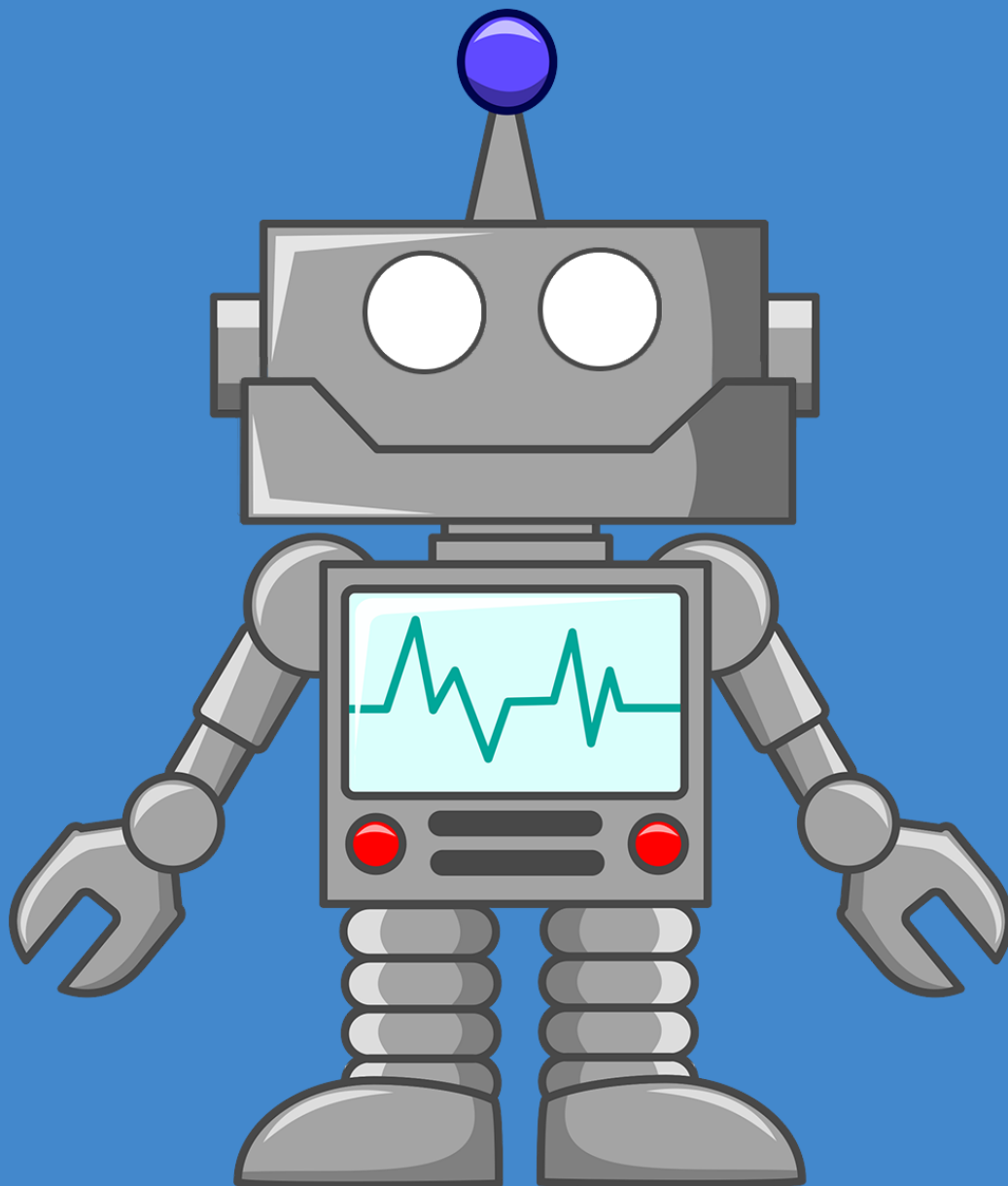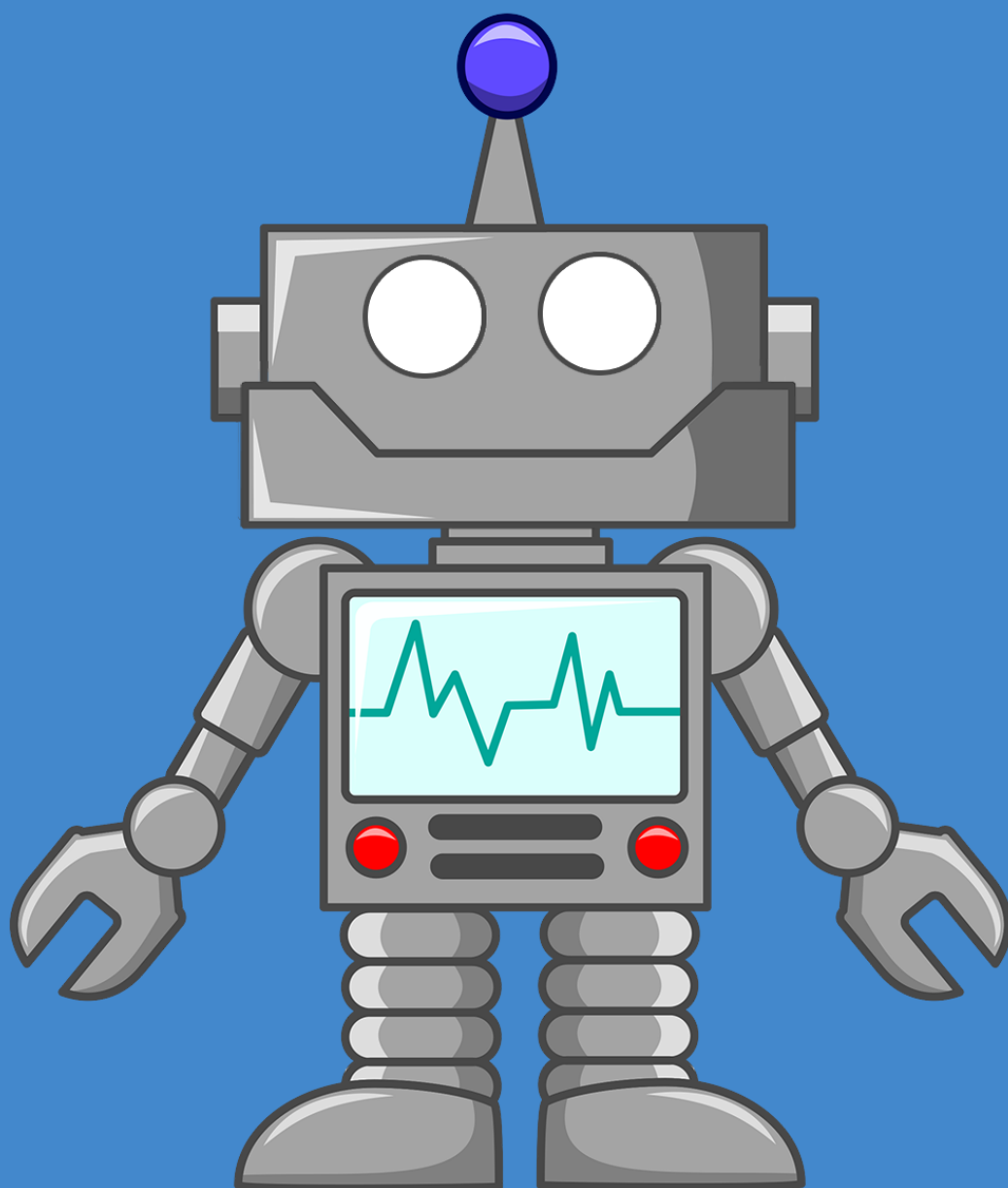
Ik heb trouwens een vraag voor je.

[Vraag]
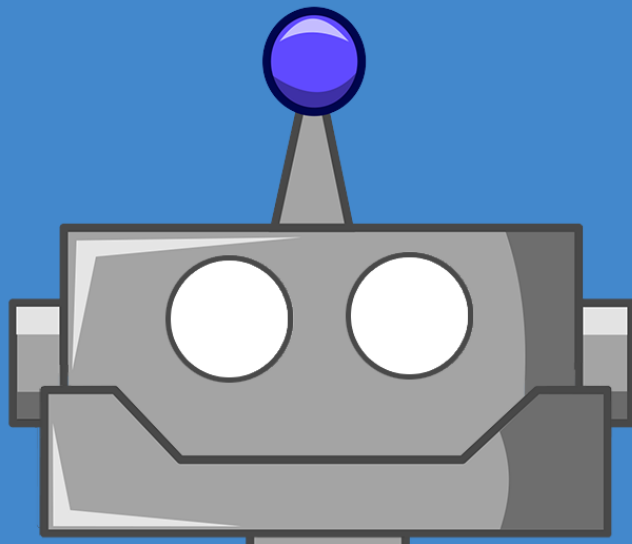
Roep A, B, C of D om antwoord te geven!

A

[Antwoord A]

B

[Antwoord B]

C

[Antwoord C]

D

[Antwoord D]

5. References

Websites

- Chatbotsjournal.com. '25 Chatbot Platforms, A Comparative Table'. https://chatbotsjournal.com/25-chatbot-platforms-a-comparative-table-aeefc932eaff.