

Pepper Waiter HRI Project

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1 Introduction

Human Robot Interaction is the study of how one or more humans work with one robots in order to accomplish a goal. The Pepper Waiter project was devised to create such an interaction.

Pepper is a robot created by Softbank Robotics specifically to interact with people. It has tactile, visual, and audio sensors on its head to help a person convey information in a variety of ways. On top of that it is equipped with an android tablet on its "chest" that can be used for further interaction.

In this project we decided to create a program that allowed to use the Pepper in a bar or restaurant to take an order instead of a human. This idea came to us by thinking of the current global situation and how the less human-to-human contact there is, the better. As such we decided to create a way to adhere to the social distancing norms by removing interaction with a human waiter.

2 Inspiration and Research

For this projec
copy papers + parts of presentations ad justify them to the

3 Solution

talk about what we decided to do to solve the proposed problem

4 Implementation

Different tools and API are used in order to create human interactions with a Pepper real robot or simulator, like:

- Softbank SDK;
- Naoqi softwares;

- MODIM - Multi-modalInteraction Manager.

All of the tools are described in the following paragraphs.

4.1 Softbank SDK simulator

The Softbank company, which produces Pepper robots, has made available an SDK which allows to connect to a real robot or to create a simulation of the robot using Android Studio application (Softbank SDK). Because of Covid constraints, it was not possible to use directly the Pepper robot, placed in the laboratories of DIAG-University of La Sapienza: for this reason the simulation mode was used.

This simulator gives the opportunity of visualize the movements, the dialogs and the interactions that the robot has with people.

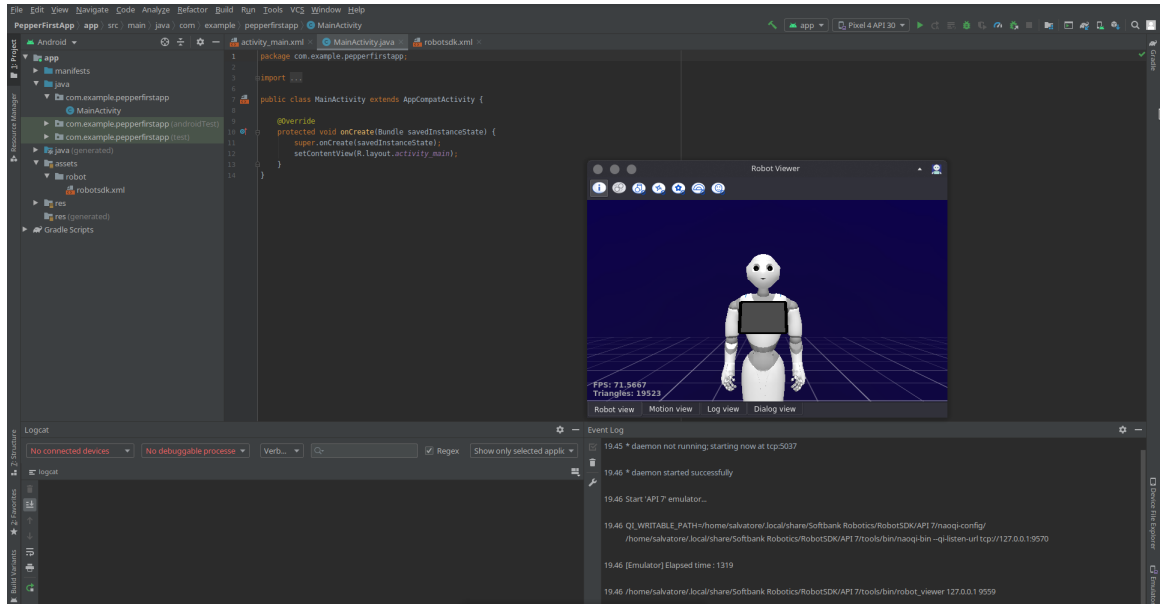


Figure 1: Pepper simulator in Android Studio.

Therefore, to be able to interact and communicate with Pepper, this simulator is used as a client interface, which is connected to a docker image containing the **naoqi** Operative System, containing all the tools and softwares

used to run and operate the robot itself.

In the simulator, as can be seen from the figure 1, there is also a tablet on the chest of the robot. This tablet can be virtualized through another library, modim, later detailed.

4.2 Naoqi - Pepper tools

As said before, the OS of Pepper is virtualized thanks to a docker image that is running on our host systems (For further references see the following Git Repository).

Once inside the docker image the `naoqi` software must be started in order to initialize and register all services of Pepper, like Dialogs, TextToSpeech, SpeechRecognition and more.

```
[1] 1631642702.448689 4540 qimessaging.servicedirectory: Registered Service "ALKnowledgeManager" (#26)
[1] 1631642702.449537 4548 qimessaging.servicedirectory: Registered Service "ALKnowledge" (#27)
[1] 1631642702.462624 4538 qimessaging.servicedirectory: Registered Service "ALAudioPlayer" (#28)
[1] 1631642702.467776 4543 qimessaging.servicedirectory: Registered Service "ALTextToSpeech" (#29)
[1] 1631642702.475992 4542 qimessaging.servicedirectory: Registered Service "ALBattery" (#30)
[1] 1631642702.485827 4547 qimessaging.servicedirectory: Registered Service "ALFrameManager" (#31)
[1] 1631642702.488696 4542 qimessaging.servicedirectory: Registered Service "ALPythonBridge" (#32)
[1] 1631642702.726181 4546 qimessaging.servicedirectory: Registered Service "ALVideoDevice" (#33)
[1] 1631642702.729729 4548 qimessaging.servicedirectory: Registered Service "ALRedBallDetection" (#34)
[1] 1631642702.746545 4544 qimessaging.servicedirectory: Registered Service "ALBehaviorManager" (#35)
[1] 1631642702.756354 4544 qimessaging.servicedirectory: Registered Service "ALAnimationPlayer" (#37)
[1] 1631642702.760873 4542 qimessaging.servicedirectory: Registered Service "ALSpeakingMovement" (#38)
[1] 1631642702.777761 4547 qimessaging.servicedirectory: Registered Service "ALAnimatedSpeech" (#39)
[1] 1631642702.782520 4546 qimessaging.servicedirectory: Registered Service "ALColorBlobDetection" (#40)
[1] 1631642702.785795 4541 qimessaging.servicedirectory: Registered Service "ALVisualSpaceHistory" (#41)
[1] 1631642702.816791 4546 qimessaging.servicedirectory: Registered Service "ALTracker" (#57)
[1] 1631642702.917138 4537 qimessaging.servicedirectory: Registered Service "ALVisualCompass" (#60)
[1] 1631642702.927218 4537 qimessaging.servicedirectory: Registered Service "ALUserInfo" (#61)
[1] 1631642702.944940 4537 qimessaging.servicedirectory: Registered Service "ALThinkingExpression" (#62)
[1] 1631642702.953171 4547 qimessaging.servicedirectory: Registered Service "ALBasicAwareness" (#63)
[1] 1631642702.954558 4543 qimessaging.servicedirectory: Unregistered Service "ALBasicAwareness" (#63)
[1] 1631642702.964603 4540 qimessaging.servicedirectory: Registered Service "ALBackgroundMovement" (#64)
[1] 1631642702.967649 4539 qimessaging.servicedirectory: Registered Service "ALListeningMovement" (#65)
[1] 1631642702.975031 4539 qimessaging.servicedirectory: Registered Service "ALExpressionWatcher" (#67)
[1] 1631642703.049440 4543 qimessaging.servicedirectory: Registered Service "ALAutonomousLife" (#76)
[1] 1631642703.130949 4539 qimessaging.servicedirectory: Registered Service "ALDialog" (#77)
[7] 0:naoqi-bin*
```

Figure 2: Naoqi SDK: overview of service registered on start.

This gives us the possibility of command Pepper, indeed inside the docker image different tools are present, with which one can set some robot parameters like joint angles and the posture, or simulate an input on a sensor like the approach of an human being or a person that talks with Pepper.

Beyond the already presented tools, obviously scripts created from us can be runned inside naoqi, in order to set the behaviour of the robot. These

scripts can be put inside a shared folder between the host system and the docker image (the directory is `/home/pc_name/playground`). Inside this directory the Pepper Waiter softwares are positioned and developed .

4.3 Modim

Like described before, the app running on Pepper’s tablet can be virtualized through antoher library called Modim (For further references see the following Git Repository)

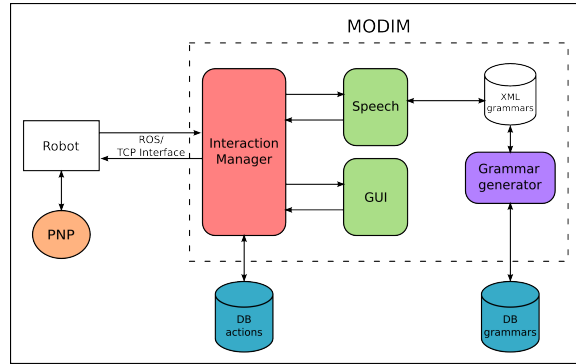


Figure 3: Multi-modal Interaction Manager software architecture.

The Multi-modalInteraction Manager (MODIM), the Graphical User Interface (GUI) and the speech system allow the use of different modalities for the output and input of information from the robot to the user and viceversa. The output modalities considered are the use of texts, images or videos using the GUI or by voice using the speech synthesis. Input modalities are the touch-screen (i.e., with the use of buttons on the GUI) or spoken inputs interpreted by the speech recognizer.

Therefore, after connecting the Interatcion Manager with Pepper, thanks to this library the app on the tablet can be simulated on a web browser; the user can interact with this one with buttons present on the GUI, both clicking on them through the web browser and giving spoken input (e.g. simulating them thanks to the `naoqi` software).

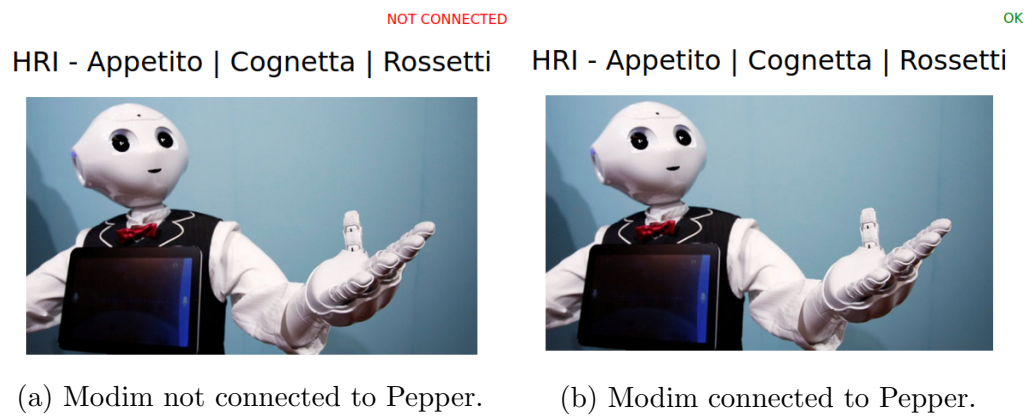


Figure 4: Connection of MODIM to the robot

5 Results

mini description of functionality

6 Conclusion

Conclusion