Cooking With a Robot - A virtual FloBi cookbook

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Abstract

Nowadays, devices in modern kitchen environments are connected to an operation system providing the tools necessary to support the user during the cooking process. Building upon this foundation we present a novel system composed of three subsystems that aims to support the user during a cooking process by providing him with a virtual cookbook guiding him step by step including a robot for human-robot interaction. By supporting the user we aim to improve the cooking experience of novice as well as experienced cooks. This poster presents the current status of the visualisation of the cookbook, the interaction using intuitive hand gestures and the integration of the FloBi robot.

Introduction

In a modern kitchen, many different devices are connected to an operation system which provides an overview of all accessible functions. Additional, the devices help the user to interact with them and to react precisely if a specific action is to be performed. During a regular cooking process, the user has to coordinate several tasks, e.g., preparing ingredients, timing processes and monitoring temperature. Furthermore, the user has to study the recipe, which can be intimidating for novice cooks. To support the user and make cooking a more enjoyable process, this project provides an interactive virtual cookbook which guides the user through a cooking process step by step in cooperation with the robot FloBi [1]. Its task is to handle the user activities and coordinate those with the kitchen devices, so that the user is able to concentrate on the cooking process. In order to accomplish this, we introduce a novel system composed of three subsystems: One for the recipe itself and the communication with the kitchen devices. One for the visualisation of the cookbook and intuitive control using gestures as well as the integration of the robot FloBi. Finally, one managing dialog-based communication between the system and the user. In this poster we present the current progress regarding the subsystem dealing with the visualisation, gesture control and FloBi integration. So far, we use a simulation for the FloBi robot, which will later be replaced by the physical robot.

Main Objectives

1. Provide an interactive projected cookbook
2. Enable intuitive and easy to use controls via hand gestures
3. Coordinate multimodal ways of user input
4. Integrate the FloBi robot (virtual/physical)

Domain Model

The project is split into several components depicted in figure 1. For communication between the components we use the RSB middleware [2].
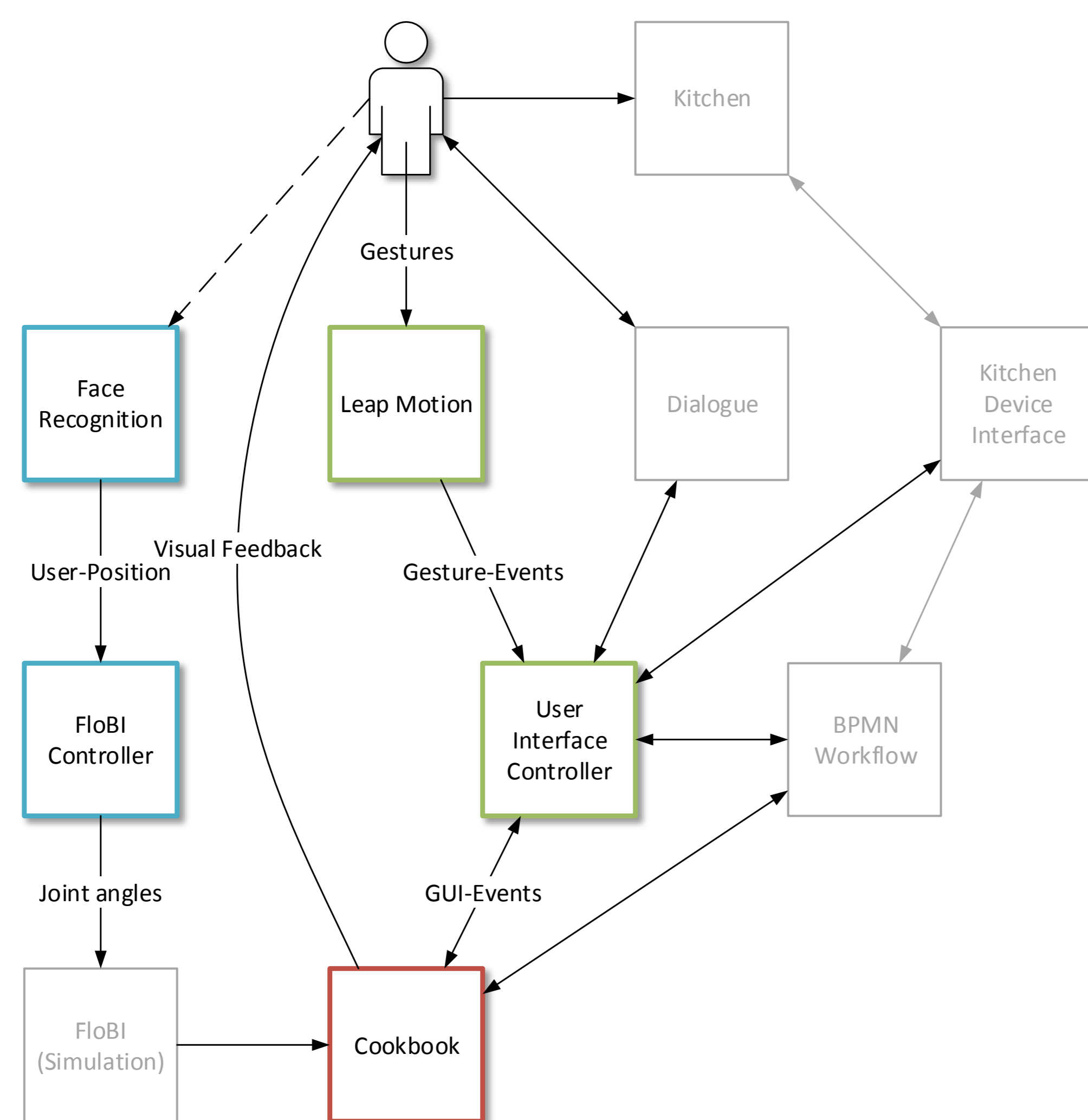

Figure 1: Domain model of the entire project. The components implemented in this group are highlighted.

Components

In the following we introduce our three main components: the cookbook visualisation, the gesture detection and input controller and the face detection and FloBi controller.
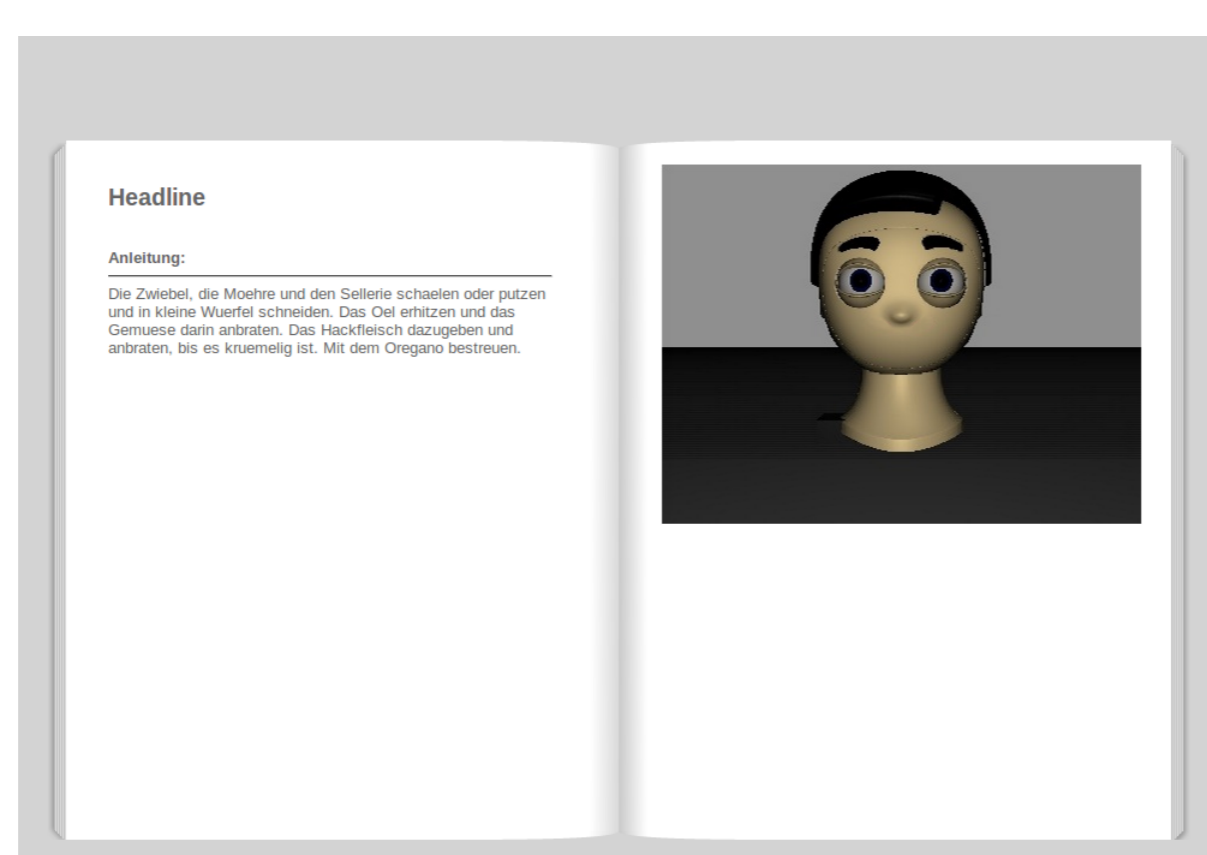

Figure 2: Visualisation of the cookbook. Left side shows the relevant recipe information. Right side shows the virtual robot FloBi. (FloBi's lips are currently not functional.)

Cookbook visualisation

- Technical realisation: HTML5, CSS, JavaScript and the extern library TurnJS [3]
- Caches adjacent pages to allow smooth turning
- Communication using websockets

Controller and gesture detection

- Technical realisation: LeapMotion [4]
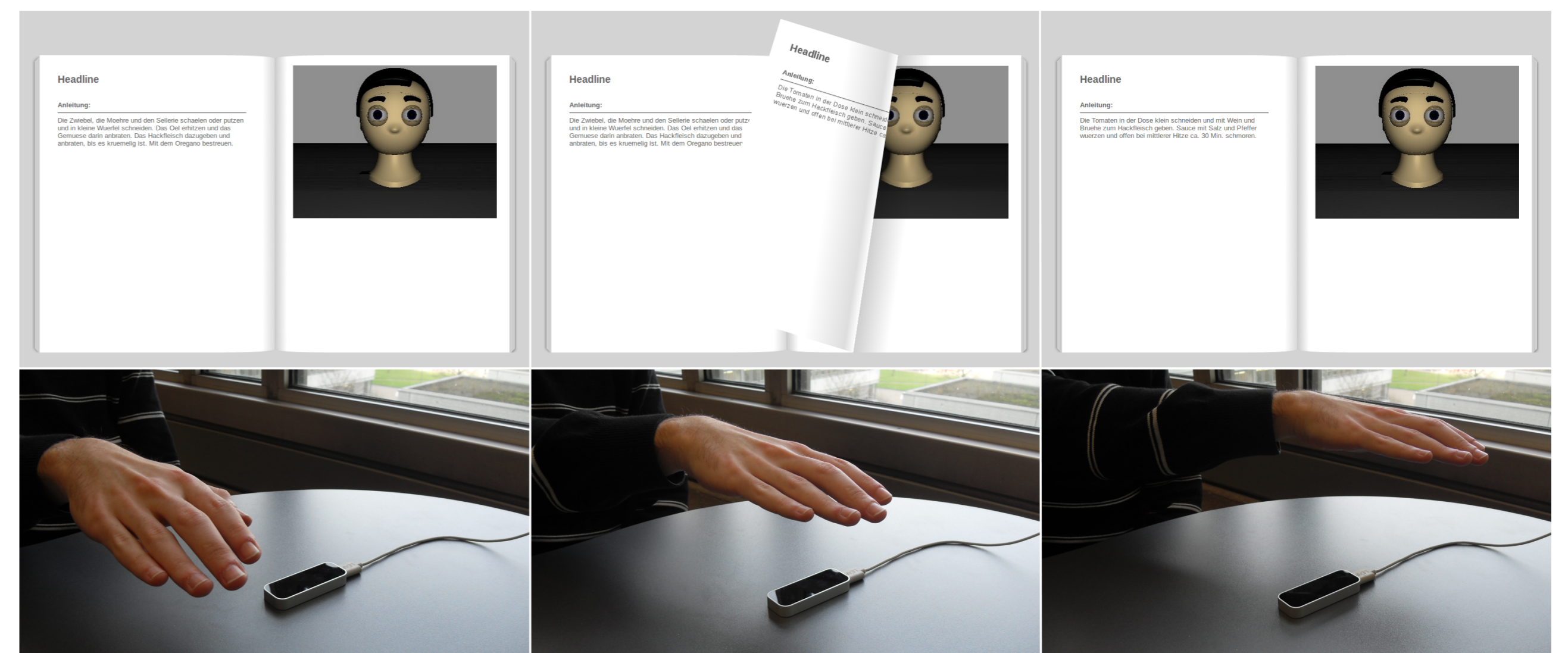- Detects hand gestures
- Coordinates multimodal user input

Figure 3: Swipe gesture turning a page in the cookbook with the LeapMotion. (FloBi's lips are currently not functional.)

Face detection and FloBi controller

- Technical realisation: OpenCV and Haar Cascades for face detection [5]
- Bounding box is used to estimate distance to user's face
- Calculate joint angles for FloBi to look at the face or specific locations (e.g. fridge)
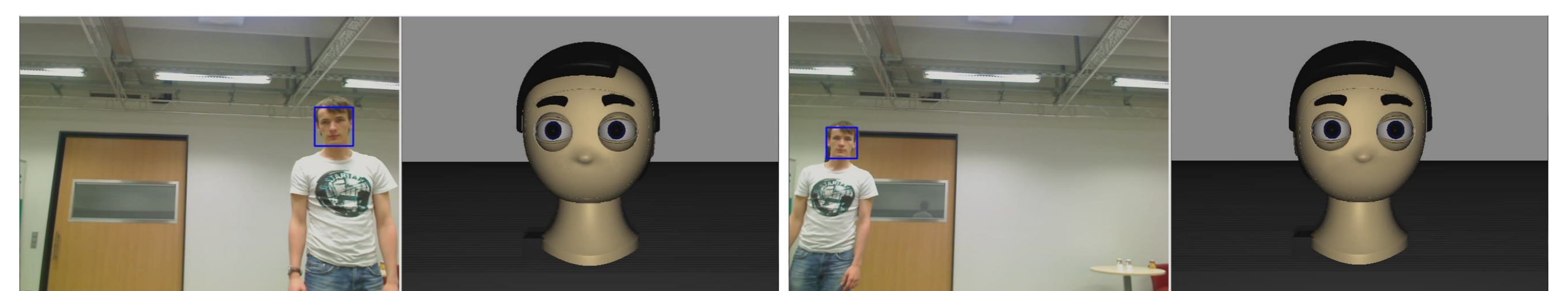- Communication with FloBi via ROS [6]

Figure 4: Face detection in the webcam images and FloBi simulation control. FloBi is looking in the direction of the user. (FloBi's lips are currently not functional.)

Current state

- Cookbook displays simple steps of a recipe
- Recipe information recieved via RSB
- Swipe gestures implemented to turn pages
- FloBi looks in the direction of the closest user
- FloBi's eyes blink to appear more alive

Future work

- Integrate components of other groups
- Implement more gestures if needed
- Display dialog in cookbook
- Improve FloBi behaviour
- Switch to the real robot
- Evaluate usability

References

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