LYRA: Smart Wearable In-flight Service Assistant

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ABSTRACT
We present *LYRA*, a modular in-flight system that enhances service and assists flight attendants during their work. *LYRA* enables passengers to browse and order services from their smartphones. Smart glasses and a smart shoe-clip with RFID reader module provides flight attendants with situated information. We gained first insights into how flight attendants and passengers use of the system during a long distance flight from Frankfurt to Houston.

ACM Classification Keywords
H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

Author Keywords
Wearables; Smart Glasses; Smartphone; RFID.

INTRODUCTION AND BACKGROUND
Ordering a drink on a flight can be a straining process. First, as a passenger you need to call a flight attendant, ask for what is available on the menu, choose without pondering too long on what to drink, tell the flight attendant what to bring and then wait till the flight attendant walks into the kitchen, prepares the drink and then comes back to serve. On the other side, bringing the passengers a drink is only one part of the job of a flight attendant. They are not only waiters, but also baby sitters, therapists, tour guides, and a lot more. All this while smiling and having a positive, energetic attitude, as they are the faces of the airlines. The technology airlines currently use to assist their flight attendants are tablet-computers or paper-based approaches for looking up information about seating and passenger needs. These approaches are hard to use while serving passengers as they are not hands free.

In this work, we present *LYRA*, an easy to deploy, modular in-flight system, that assists flight attendants and passengers to ease the process of requests and enhance offered services through personalized interaction. In contrast to similar projects that use smart watches [2], we use smart glasses as our main output and smart shoes as input for flight attendants (see Figure 2 – left). They allow hands free interaction while providing services and show relevant information in a discrete fashion without the risk of disclosing passenger information. Flight attendants can use this system to address passengers with their names and title in their preferred language and improve service by anticipating usual requests by the passenger (e.g., ordering wine after take off and vegetarian menu). For placing a request, passengers can take a look at the offered menus, drinks and services on their smart device. The devices are connected to the *LYRA* service by simply scanning an QR code provided at each seat. As soon as the request is placed the *LYRA* system selects the most suited flight attendant, based on location and status, and then notifies the flight attendant about the request. To track the attendants location we used Radio Frequency Identification (RFID) tags attached to the floor of the aircraft.

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Figure 1. a) The flight attendant receives a request, b) fulfills the request, and c) checks the request as fulfilled.

LYRA – SYSTEM DESCRIPTION
LYRA consists of four components described in the following sections. We developed *LYRA* based on previews interviews with flight assistant and service managers and an in-depth observation of their working environment.

LYRA Connect is a web-application for passengers to request meals, beverages, or in-plane services. To use the application, passengers open any browser application on his/her smartphone and visit the LYRA-URL (*https://lyra.aero*). When a passenger places a request, it is sent to the server using the in-plane WiFi. The server searches for the closest flight attendant and pushes a notification to his/her *Smart Glass*. The notification contains requested item or services and where the passenger is sitting (seat number). Hence, the flight attendant has all the information he/she needs to fulfill requests.

LYRA Shoe: One challenge in serving the passengers efficiently is locating the attendants' position. By using passive RFID tags *LYRA* can localize attendants when they walk past the aisle (see the Figure 3 – center). We chose this approach due to the challenging and regulated environment of an air-

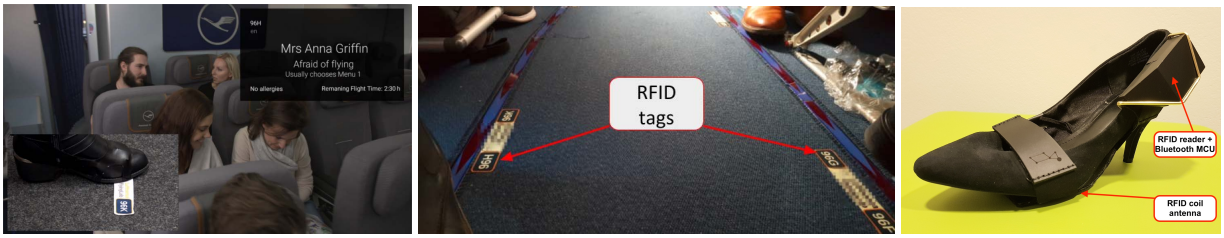

Figure 2. Additional Information about Passenger can be requested by stepping on the RFID-tag with the corresponding seat number (left). Passive RFID tags are placed on aisle, next to each seat (center). The RFID shoe clip is visible with gold colored clipping mechanism (right).

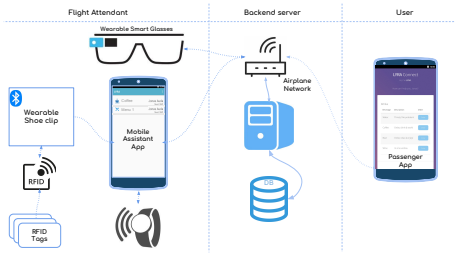

Figure 3. The different components of the *LYRA* system. The attendant kit used by cabin crew members (left), the backend server that is used as a central communication node (center), and the passenger application that allows passengers to send requests to the cabin crew (right).

craft [1]. We designed a custom shoe clip comprised of two parts: RFID reader and coil antenna. RFID reader and battery are build into a box (see Figure 3 – right). The box is clipped on the side of a shoe and is easily detachable. The second part of the system is the coil which is mounted under the shoe with flexible padding and is also detachable. The coil wire is covered with rubber pads and is routed through a side of the shoe to the RFID box. The RFID box also contains a Bluetooth enabled micro-controller which is connected to the attendant's smartphone.

LYRA Attendant: If a request is placed by a passenger the server sends the request to the most suited flight attendant (see Figure 1 – a), based on the attendant's location. The request is then shown in a list on the smart glass (i.e., Google Glass). Additional passenger information (e.g., name or spoken languages) can be accessed by the flight attendant by placing their shoe on the RFID-tag near the passenger's seat (see Figure 2). The navigation through the application is kept simplistic to allow discrete and easy control. If the request is fulfilled, the flight attendant can mark it as completed by simply taping the Google Glass touchpad (see Figure 1 – b and c). To check information about a passenger (e.g., allergies or additional requests) the flight attendant can swipe left and right.

VEGA - Backend Server: The VEGA server acts as a node between the passengers and the flight attendants (see Figure 3). To make it available on-board we registered the URL *http://lyra.aero* inside the on-board network. The server's database contains records about all passengers (name, language, meal preferences), the cabin crew (current position on the plane), and flight information (remaining flight time).

PRELIMINARY EVALUATION

We deployed the *LYRA* system in an Airbus A380 on a flight from Frankfurt to Houston (LH400). The system was intensively used by 35 passengers served by two flight attendants for about one hour. It took 2 minutes of pre-flight instruction and less than 5 minutes of in-flight practice for both attendants to use the system comfortably. In subsequent semi-structured interviews, we elaborated the strength of *LYRA*.

Attendants highlight the simplicity of the interaction concept. Using the shoe to select passenger's information keeps the hands and attention of the attendant free while preserving full control. One of the flight attendants said: *"When we use tablets to check on special needs of our passengers, we have to memorize those needs as we walk to the corresponding seat. Otherwise, we would not have our hands free for service."* showing the overall benefit of using the *LYRA* system for flight attendants. Both flight attendants also mentioned that this increases the overall level of service. One of them stated that: *"It looks really professional, as you just approach the passenger and you exactly know what he or she wants without needing to ask the passenger. With the current system, the passenger needs to call you, you come up and ask, then you only have the the wanted item when coming back."*.

Investigating the flight attendants' impression of the interaction methods, we found that both flight attendants overall liked LYRA's input and output methods. Regarding the input, one attendant mentioned that the shoe input eases up the access to important information during the flight: *"With LYRA selecting information is easier and way faster, as I instantly and directly see the information by simply selecting the passenger with the shoe, and I do not have to manually seek out the information."*. They also mentioned that one benefit of these input methods is the subtle nature and appropriateness: *"The use of the simple swipe gestures and foot interaction to see certain information are subtle and discrete. I prefer that over possible vocal interaction, especially in front of other passengers"*

CONCLUSIONS

We presented our smart in-flight service assistant system - *LYRA* and a first evaluation on a flight from Frankfurt to Houston. The results of the interviews showed the overall feasibility of the *LYRA* approach. Both flight attendants successfully used the system and agreed on the benefit created by the system. *LYRA* has the potential to optimize the work experience of flight attendants and can offer new less cumbersome means of communication for the passengers.

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