Iterative Design of a System for Programming Socially Interactive Service Robots

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savioke

Introduction

Service robots in human environments must be both functional and interactive. For example, A delivery robot should not only excel in delivering items, but also should be aware of people present around it and interact with them appropriately.

We introduce *iCustomPrograms*, a system for programming socially interactive behaviors for service robots, and present its design and evaluation.

Formative Study

Our first goal is to discover potential applications that are desirable for existing Savioke customers and inform the design of our system. We analyzed meeting notes taken during a brainstorming meeting with each customer (A) and customer satisfaction meetings (B—E).

Name	Type	Used Relay since	Point of contact
A	Airport (SE Asia)	2/2016	Corporate executives, Customer satisfaction manager
B	Hotel (SF Bay)	1/2015	Hotel manager, Business consultant, Front desk supervisor
C	Hotel (SF Bay)	6/2015	Guest service manager, Sales & marketing director
D	Hotel (SF Bay)	7/2015	Hotel manager, Guest experience manager
E	Hotel (SF Bay)	8/2015	IT manager, Area general manager

Name	Requested applications	Target areas
A	People delight, Service recovery	Indoor garden, Baggage claim, Immigration hall
B	People delight, Mobile kiosk, Demo	Lobby, Bar
C	People delight, Service recovery, Mobile kiosk	Lobby
D	Service recovery, Demo	Lobby, Breakfast area
E	Mobile kiosk	Lobby

Findings

- Requested applications were realistic potentially due to their first hand experience with Relay.
- Requested applications could be broadly categorized to *people delight*, *service recovery*, *mobile kiosk*, and *demo*.
- Most requested applications involved interactions with humans.

iCustomPrograms

iCustomPrograms is based on *CustomPrograms* (Huang et al. HRI2016, **Fig.1**) with the **findPeople** primitive added (see **Fig.2**).

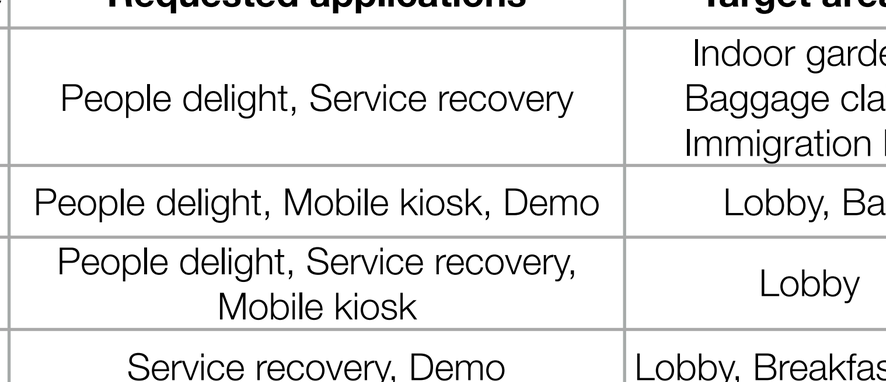
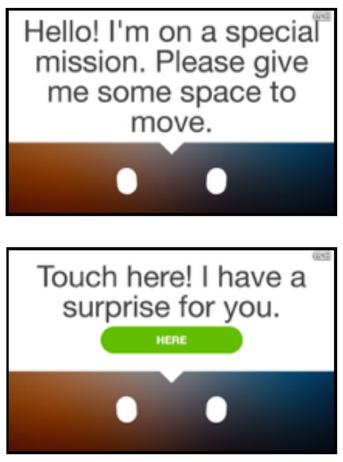


Fig.1

Field Study 1

We implemented *people delight* and *service recovery* using *iCustomPrograms* and deployed them in A



Findings

- Naturally approaching people is difficult.
- Initiating interaction via movements and sounds is effective.
- Service workers want richer control over interactive elements.

Enhancements & Field Study 2

We enhanced *iCustomPrograms* to support *touch-to-interact*, HTML formatting, and asynchronous sound playing (see **Fig.2**)

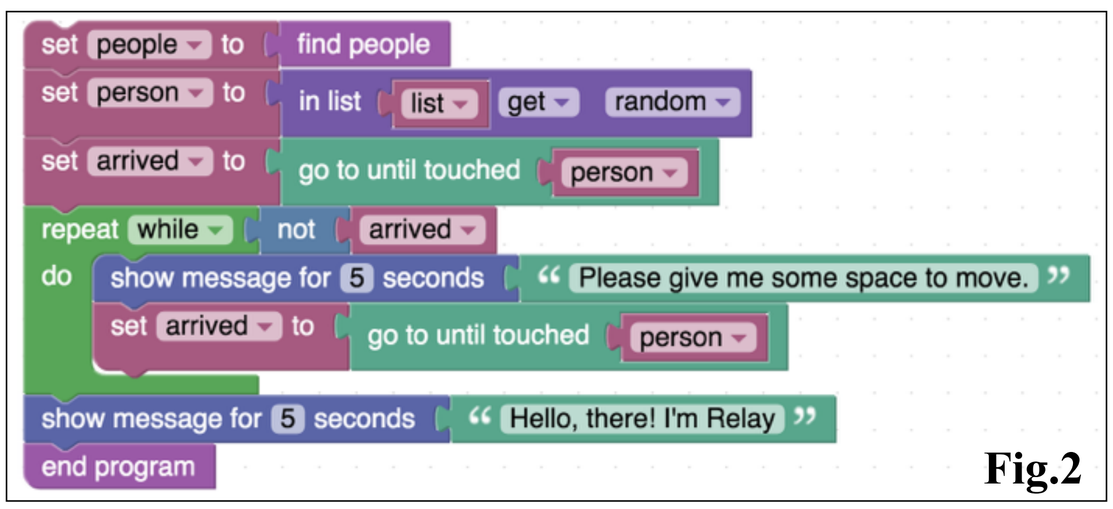


Fig.2

and deployed the improved *people delight* in A and a new application *mingle in place* in B, C, D, and E for at least 2 weeks.

Pictures from field study over easter (a,b) and another local holiday (c, d) in A are shown below:

Post-deployment interviews

We conducted interviews with the application users and report:

- All mentioned that Relay was successful at interacting with their visitors.
- Over the holiday weekends in A, ~500 passengers interacted.
- In B—E, they noticed different interaction patterns between weekdays & weekends, and across age groups.

Conclusion

We present *iCustomPrograms*, a tool that allows rapid development of interactive applications for service robots. We evaluate programs created with *iCustomPrograms* through field deployments. This evaluation informs future improvements of *iCustomPrograms* and could ultimately lead to more socially interactive robots customized to the particular domain and user.