Are You Being Served?

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Service Robots with Style

There has been a lot of talk about service robots over the past decade, and indeed some service robots are starting to make their way into the real world; delivering food in hospitals, turning book pages for people with physical diabilities, and the like. Unfortunately, while functional, these robots perform their jobs with all the panache of machines. When people want service robots they really want "servant robots" but without the social guilt that now often accompanies the hiring of actual human servants. To do servants correctly, it is necessary to have a hierarchy in the 'help'. Only the *Dark Knight* has been able to maintain style and social standing with a single servant[1]

The AAAI-97 Conference Reception is the AI community's social event of the season. Here, as with almost all AI activities, style and social standing are everything. AI researchers work hard, and when they party, they want to be pampered. Procuring one's own food is gauche; the AI community wants to be served.

Towards this end, KIPR is creating a pair of servant robots (Capt. Peacock and Mr. Humphries) to serve and cater to their charges every gastromical need, while maintaining that old-world flavor that lets you know that while your servants may be smarter, stronger and more expensive than you, they are definitely your social inferiors.

Captain Peacock

The Captain Peacock droid is a sophisticated robot that is the top rung on the serv-oid social ladder. This robot roams the floor looking for a human to serve. When it comes upon a person in need of refreshment, it serves them to the best of its abilities; that is, it calls in Mr. Humphries.

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[1]While Batman has the secret identity, Alfred must have super powers – able to clean an enormous mansion and the Batcave all by himself. These abilities are well beyond the current state of AI.

Mr. Humphries

The Mr. Humphries robot initially follows Captain Peacock about on the floor. When Captain Peacock determines that service is needed, Mr Humphries produces the required food, offers the person a seat, and can even take the person about the floor so that they may stay with their social circle, while eating in comfort. During this phase, Captain Peacock follows Mr. Humphries about to make sure that the person is being adequately served.

Nuts and Bolts

Captain Peacock is implemented on top of a RWI B-21 robot.[2] Additional sensing is provided by a Cognachrome vision system[3] which provides tracking data to allow the robot to follow Mr. Humphries. Interaction with potential customers is accomplished through a set of paddle buttons, a onboard voice synthesizer and a simple voice recognition system implemented on a powerbook. The two robots are connected by radio modems.

Mr. Humphries is a modified TinMan robotic wheelchair.[4] The robot has a motorized tray system which allows the user to get in and out easily without spilling their food. Mr. Humphries also has a Cognachrome system so that it may track the position of Captain Peacock.

Both robots have distinctive color targets for tracking purposes. Each robot is also equipped with an array of sonars rangefinders, IR proximity sensors and bump sensors.

Bits and Bytes

The software of the robots takes advantage of the physical layout of the reception room and of the individual robots.

Both robots have a color marker and a camera. The camera is mounted above the marker and aimed slightly downward. The robots have their

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[2]See www.rwii.com.
[3]See www.newtonlabs.com.
[4]See www.kipr.org.

marker/camera assembly mounted at identical heights. The bearing of the one robot with respect to the other can easily be determined by the X position in the image frame of the color marker. The approximate range to the other robot may be determined by the Y position in the image frame. When the range determined from the image matches the range returned from the sonar system, the robots can be reasonably sure that there are no obstacles (or people) between them.

The robots provide obstacle (and crowd) avoidance using their standard collision avoidance behavior; however, since they are supposed to interact, they periodically stop when next to people. If someone moves up to them they will stop (rather than evade), and query the person as to whether they require service.

The room boundries are observed by a combination of using color tracking and a specialized downward looking sensor which can detect the border. Captain Peacock is also capable of reasonable dead reckoning. His/it's position relative to the border is updated every time the border's position is confirmed, and since the reception area is basically a large rectangle, no complex navigation strategy is needed. A random angle away from border is selected. This bearing is maintained until either another border is detected or people are encountered. This ensures reasonable coverage of the reception area.

Mr Humphries has sensors that enable him/it to detect when a person (he/she) is seated, or is entering/leaving the seat. When someone is seated, they can either have the robot continue wandering, or they may share control with the robot through the use of a joystick. The robot factors the desired heading (as indicated through the joystick) into its obstacle avoidance routines to create a safe trajectory in the desired direction.

Conclusions

Distributing food on a reception floor is easy; serving food with style is a more difficult task. Captain Peacock and Mr. Humphries will pamper their customers far beyond their robotic peers or even their human counterparts.[5] At a classy reception, the question is not whether you got enough food – the buffet table allows that goal to be easily achieved. The question should be: 'were you properly served?' With Captain Peacock and Mr Humphries, we believe the answer is a resounding yes.

Acknowledgements

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[5]Even Alfred draws the line at offering a lap to sit upon while enjoying the evening meal.