Robust Door Detection

for

Dr. Bernd Girod

EE 368

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Project Description

The inspiration for the design project comes from the desire to help blind people. After seeing the slide about Stanley in the the class introduction, the group thought why can't automated navigation be applied to the handicapped. In the complete system, the Android phone would provide a video camera and the video processing to detect doors, stairs, walkable areas in front of the person, walk signs at intersections, cars, and identify friends approaching. This was the inspiration for the project; however, this is too complicated to complete in five weeks. Therefore, one piece was chosen for this project, door detection.

Project Specification

Door detection was selected because of the large continuum of problems to be solved and it is one part of the total navigation application. First, the problem of detecting simple doors in different scenes shall be solved. Then, the detection of multiple doors, open doors, and doors in walls beside the person will be implemented. In addition to these problems, and time allowing, detection of french doors, glass doors, doors that are extremely close, etc. may be implemented.

The project will be written in MATLAB as all members of this design group are remote distance learners, so sharing a single Android phone would be difficult. The group did evaluate the Android phone emulation software and it was determined that, depending on the user's system configuration, the lag of real-time video capture would present significant challenges to the development of the application that are not related to the project goal. The group has decided to indicate detection by tinting the successfully detected door area. The reason for this output, is that the area of the door in pixels may be important for the larger navigation application.

The program shall only be required to detect doors in still images. However, the performance of the software shall be a major concern and, time allowing, the project may be implemented for real-time video. In the absence of video, the primary focus of the project will be on maximizing detection rate in still images.

Figure 1: Example Output

The group has prioritized the goals in the following table:

Goal	Who	Date
1) Door Detection Main Function Determined	Entire Group	05/15/10
2) Still Picture Simple Rectangular Door Detection	Entire Group	05/21/10
3) Still Picture Sidewall Rectangular Door Detection	Group Member 1	06/07/10
4) Still Picture Open Rectangular Door Detection	Group Member 2	06/07/10
5) Still Picture Rectangular Door Detection in Different Scenes	Group Member 3	06/07/10
6) Real-Time Operation	Group Member 1	?
7) French Door Detection	Group Member 2	?
8) Close (< 3 feet) Door Detection	Group Member 3	?

Only goals one to five are required to be completed by the end of the quarter. The other goals may be completed as time allows.

References

1) Shi, et. al. "Investigating the Performance of Corridor and Door Detection Algorithms in Different Environments," International Conference on Information and Automation, p. 206-211, 2006.

2) Cokal, et. al. "Development of an Image Processing System for a Special Purpose Mobile Robot Navigation," Middle East Technical University, Turkey. http://mechatronics.atilim.edu.tr/aerden/publications/m2vip97.pdf

3) Hensler, et. al. "Real-time Door Detection based on AdaBoost learning algorithm," University of Applied Sciences Konstanz, Germany. Laboratory for Mobile Robots. http://www-home.fh-konstanz.de/~bittel/Publikationen/DoorDetection_Eurobot2009.pdf