

Evaluation of Gesture-Based Controls for Robotic Systems

Lauren Frazier

April 24, 2012

Todo list

- 1, elaborate on data analysis
- 3, Think of a better name

Contents

Acknowledgements	v
Abstract	vi
1 Introduction	1
2 Related Work	2
3 Smartphone Control Systems	3
3.1 Cellbots	3
3.2 Gesture-Based Control App	3
4 Human Factors Experiment Design	4
4.1 Platform	4
4.2 Track Design	4
4.3 Questionnaire Design	4
4.4 Experiment Procedure	4
5 Results	5
5.1 Raw Data	5
5.2 Questionnaire Data	5
5.3 Analysis	5
6 Conclusion	6

List of Tables

List of Figures

Acknowledgements

These are acknowledgements.

Abstract

This thesis aims to test the effectiveness/ease of use of smartphone gesture-based robotic control systems vs. traditional control systems. Robotic control systems are becoming more common, especially in the military. Arm and hand gestures are typical human forms of communication, so applying that to a robotic control system can yield a more intuitive system. With military applications, there are lives at stake, so having the most efficient, intuitive control system can make a large difference in the success of a mission and the safety of the soldiers involved. "Interactions and Training with Unmanned Systems and the Nintendo Wiimote" (Varcholik, Barber, and Nicholson) describes a gesture based control system that uses the Nintendo Wiimote to determine arm/hand gestures and control a robot. I propose to create a gesture based system using a smartphone and conduct an experiment similar to Varcholik, Barber, and Nicholson, collecting survey data from the participants on the the effectiveness and ease of use of each system.

Chapter 1

Introduction

This thesis aims to test both the perceived and actual effectiveness and ease of use of smartphone gesture-based robotic control systems vs. traditional control systems.

The need for human-robot interfaces is increasing rapidly. The military has already begun using unmanned vehicles in several different arenas (air, ground, water). In order to develop the most efficient human-robot interface, we turned to a traditional form of human-human communication, arm and hand gestures. Arm and hand gestures are typical human forms of communication, so applying that to a robotic control system can yield a more intuitive system. With military applications, there are lives at stake, so having the most efficient, intuitive control system can make a large difference in critical moments and improve the safety of those involved. A more intuitive system will also reduce the training time and expenses for the operators of the vehicle.

“Interactions and Training with Unmanned Systems and the Nintendo Wiimote” [1] describes a gesture based control system that uses the Nintendo Wiimote to determine arm/hand gestures and control a robot. They then conducted a study where subjects used Wiimote gesture system and a more standard system and filled out a survey to indicate how effective the Wiimote system was as compared to the standard control system for the robot.

In this thesis, I propose a gesture based system using a smartphone and conduct a usability study similar to Varcholik, Barber, and Nicholson. The system will use a Samsung Galaxy S II phone for the gesture-based input, a tilt-based controller, and a D-Pad controller, and a Microsoft XBOX 360 controller for the more traditional input. Subjects used each of the controls to guide a iRobot Roomba vacuum through a short course. After the experiment is complete, subjects also filled out a survey, and both sets of data will be used to determine which control scheme is more effective and intuitive.

elaborate
on
data
analysis

Chapter 2

Related Work

Chapter 3

Smartphone Control Systems

3.1 Cellbots

3.2 Gesture-Based Control App

Think
of a
better
name

Chapter 4

Human Factors Experiment Design

General description.

4.1 Platform

4.2 Track Design

4.3 Questionnaire Design

4.4 Experiment Procedure

Chapter 5

Results

5.1 Raw Data

5.2 Questionnaire Data

5.3 Analysis

Chapter 6

Conclusion

Bibliography

- [1] Paul Varcholik, Daniel Barber, and Denise Nicholson. *Interactions and Training with Unmanned Systems and the Nintendo Wiimote*, volume 2008, pages 1–9. NTSA.