Virtour: Telepresence system for remotely-operated building tours

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ABSTRACT

This is my abstract

Keywords

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1. INTRODUCTION

The University of Texas at Austin has a constant stream of visitors and tours of the beautiful campus. Of special interest to us, are the large number of tours given at our computer science building: the Gates Dell Complex (GDC). The tour guests range in ages and backgrounds, and tend to be prospective students to both undergraduate and gradute programs, or visiting faculty. Unfortunately, there is a large population of prespective students that are unable to physically come to our campus and are thus unable to partake in the conventional tours.

Our lab has a group of autonomous wheeled robots which can localize, navigate, and perform tasks without human intervention for long periods of time. Furthermore, our lab is placed in a central part of our building and is thus a common place for tours. As such it only made sense that we utilize the platform we have built to try to solve the aforementioned problem.

This is why we designed Virtour. Virtour is a public facing system for teleoperated building tours. Virtour builds on the existing Building-Wide Intelligence autonomous robot platform and is designed to keep the robots and any humans involved safe. Through the use of modern web and robot technologies it allows untrained public users to remotely control our robots in what we call a virtual tour. Our system is created to balance external control abilities while maintaining our rigorous standard of safety and security for the robots and people involved. As such it gives the user control of what the robot is doing, while at the same time using existing the autonomous navigation capabilities and obstacle avoidance.

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2. RELATED WORK

3. ROBOT PLATFORM

Virtour is made to be run on the Building Wide Intelligence Project's segbot robot platform CITE. These robots are designed to be fully autonomous and cohabitate the Gates Dell Complex Computer Science building with the humans within. The segbot robot platform has three currently operation versions. Our last generation version 2 robots, a version 2 with an additional Kinova arm, and our latest generation version 3 robots. Although virtour supports all three versions, it is mostly run on the latest generation so that is what is described.

3.1 Hardware Platform

The robot's base is a Segway Robotipcs Mobility Platform (RMP) CITE, which is powered by a lithium-ion battery pack. The frame was designed in-house and supports a wide array of sensors. For navigation, localization, and obstacle avoidance, we use a Velodyne Puck lidar. Point clouds and RGB data is provided by a Microsoft Kinect. Our latest generation robots also have a laser range finder to compensate for the lidar's blind spots. The robot is equipped with a custom-built computer which runs Ubuntu 14.04. The computer is powered by the RMPs battery, thus removing the need for an external car battery (which was present in our version 2 robots). The battery life on a running robot is approximately 6 hours.

3.2 Software Stack

Our robots are powered by the Robot Operating System (ROS) CITE. GET MORE INFO FROM SOME ONE"S PAPER

4. THE WEB CLIENT

Virtour consists of two platforms, the user facing client, and the server and associated software that runs on the robots. The user client is built using web 2.0 technologies to adhere to modern web development trends and simulatniously support as many platforms as possible. We decided to use a web-based client because of the increasing prominence of web browsers in people's lives. Furthermore, a web based approach means that our end-users do not have to install any additional software to connect with or use the robots, thus reducing the friction for trying our service.

4.1 Modern Approach

The website is designed to be simple and functional while still being aesthetically pleasing to end users. It uses a grid system, powered by Bootstrap 2.0, to create a fully responsive web layout. This allows us to support any web-powered platform (eg: mobile devices, tablets, and computers) by making the website scale and re-organize based on the specifications of the device.

When a user first visits our website, he or she is greeted by a list of our currently active and available robots (more on server implementation later). From here our user can select a robot to connect to (by clicking on the robot's name and image) to initate a virtual tour session. Tour sessions can be either led or spectated. Each tour can have at most one leader, but no limit on the number of spectators. If the tour has no existing leader and tours

4.2 Leader UI

4.3 Guest UI

5. THE SERVER

5.1 Tour Manager

5.1.1 Leader Management

5.1.2 Robot Control

5.1.3 Authentication

5.2 IP management

6. SCAVENGER HUNT INTEGRATION

7. CONCLUSIONS

8. ACKNOWLEDGMENTS

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