An Intuitive Approach for the Design and Implementation of Omnidirectional Telepresence Robot

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Declaration

We, Zain Ul Abideen and Muhammad Husnain Javed, certify that this work is our own and has not been, in whole or in part, presented for assessment elsewhere. Where material has been used from other sources it has been acknowledged and referenced properly.

Signed: _____

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Dedications

We would like to share my heartfelt feelings to produce the fruit of our hard work with blessings, which lead towards the successful demo. First, we would like to thanks to Almighty ALLAH for His endless blessings without which our hard work was no more than some pieces of paper. Furthermore, We would love to dedicate this to our beloved parents for their endless sacrifices, encouragement, love, support and their ability to always believe in us throughout the whole journey. We also acknowledge that the prayers and guidance have given us wings to fly in the sky.

Contents

List of Figures

List of Tables

Abbreviations

TP	**T**ele **P**resence
Qos	**Q**uality **o**f **S**ervice
GUI	**G**raphical **U**ser **I**nterface
IP	**I**nternet **P**rotocol
DNS	**D**omain **N**ame **S**ystem
HTML	**H**yper **T**ext **M**arkup **L**anguage
SSL	**S**ecure **S**ocket **L**ayer
PHP	**H**ypertext **P**reprocessor **L**ayer
SQL	**S**tructured **Q**uery **L**anguage
TCP	**T**ransfer **C**control **P**rotocol
CGI	**C**ommon **G**ateway **I**nterface
ISP	**I**nternet **S**ervice **P**rovider
OS	**O**perating **S**ystem
SSH	**S**ecure **S**hell

Abstract

The telepresence robot is designed to set forth an economic solution to facilitate day to day normal activities in almost every field. The applications of this robot include the conference meeting, conducting interviews, distance learning, teaching, office meeting etc. There are a number of proposed solutions to design telepresence robots e.g Skype and team viewer, but it is pretty silly to use Skype and extra hardware. Video transmission is achieved by using the WebRTC technology between client and user to interface the control commands. The user can log in to the website and the robot could be controlled using a GUI interface along with a separate window for video display. The hosted WebRTC and java scripts translated the commands to the microcontroller to translate the instruction. To achieve the efficient and reliable video transmission the influence quality factors like quality of service (QoS) and bandwidth are resolved using the WebRTC along with the integration of the communication protocols. To protect the data transmission we have implemented the SSL protocol and installed on the server125. To prevent the public access from the control panel we have designed a login page and linked with the Microsoft SQL server to enhance the authentication process. The biggest challenge was to make moving internet connection anywhere without any dependency. The problem of the movement is resolved by Omni wheels as it does not require steering angle. The telepresence robot could be controlled anywhere through the internet and smooth motion of the robot is obtained by omnidirectional control. The robot is modelled as a holonomic omnidirectional and equations of the modelling are implemented in the microcontroller to obtain the omnidirectional movement. The whole process of the robot is accomplished by three phases; two phases of the programming and one phase of the hardware implementation. One phase is WebRTC integration with JavaScript programming, second for microcontroller programming to control motion and third for hardware implementation and software integration of the robot.

Chapter 1

Introduction

Tele-Presence is a phenomenon that allows the operators of having the ability to experience being at the real location of the robot from a remote control station. Through a Tele-Presence Robot we can acquire basic physical sensations like Vision, Motion and Audio from the robot's environment which is transferred by means of a communication channel. Basically what a Tele-Presence robot does is that the operator can control the robot from anywhere he or she likes and can get output in the form of a live video and audio stream. Thus the main channel of communication between the operator and the robot is the Live video stream. The operator feels that as if he is physically present at the location of robot.

Face to face real time interaction has been an effective means of communication but financial cost, time etc. have become more and more tolerable. With the latest advancement in multimedia and networking technologies video conferencing has become very popular and cost friendly. Many applications have been developed to make this interaction more effective and easy. These applications include Skype, WebEx, IMO, Face time and many more. However these applications provide very limited and unsatisfactory functionalities and could not maintain proper level of Face to Face real time meeting between two persons. For Example separate displays of participants on both ends fails to provide the sensation of co-location as in real face to face meetings.

1.1 History of Tele-Presence

In a spearheading paper, the U.S. subjective researcher Marvin Minsky ascribed the advancement of the possibility of Tele-Presence to sci-fi creator Robert A. Heinlein: "My first vision of a remote-controlled economy originated from Robert A. Heinlein's prophetic 1948 [sic] novel, Waldo," composed Minsky. In his sci-fi short story "Waldo" (1942), Heinlein initially proposed a crude Tele-Presence ace slave controller framework.

The Brother Assassin, composed by Fred Saberhagen in 1969, presented the entire idea for a Tele-Presence ace slave humanoid framework. In the novel, the idea is depicted as takes after: "And after a minute it appeared to every one of his detects that he had