International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 4 Issue: 3 331 - 334

ARDROID: Arduino and Android based Internet Controlled Telepresence Robot

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Abstract— The ARDROID Telepresence Robot is a mobile platform on which you can plug in your own Android cell phone or tablet. The ARDROID is plugged into its own Telepresence Android Application or can also use the third party API's or any other audio / video conferencing application such as Google Hangouts, Skype etc. It allows a user to remotely interact with other users and associates and their environment. The Telepresence robot provides a level of interactivity which is not present with traditional "call-in" video conference. The user can move around the room and observe participants through the tablet's camera, allowing more effective communication. The user will be able to view live activities, meetings or hold one-on-one meetings. Provided they have Android device with an Internet connection, any user can access the ARDROID Telepresence Robot. Also the BOT can be traversed in any of the environmental conditions like climbing slopes, terrains, rugged paths, etc.

Keywords— *ARDROID,Arduino, Telepresence robot, staircases, Android App.*

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I. OBJECTIVE

The main objective of our robot is to develop a fully robotic platform that pairs with your Android phone or tablet (running our free App) to become a complete telepresence solution. It allows a user to remotely interact with other users and associates and their environment and also has a full control of the robotic platform.

Also our objective is to deploy our project on Android device, as this opens the door to unlimited applications and future enhancements from users and the community.

II. INTRODUCTION AND OVERVIEW

The common way of interacting and collaborating with people is changing continuously. In the marketing environment, the key factor propelling this change is the increasing presence of distributed working groups.

However, collaborating remotely is still a major issue. There are systems available for telepresence in corporate world. So we introduce an improved system that will be having more scope in telepresence environment.

The ARDROID robot will be powered by the ArduinoDuemilanove micro controller board with Bluetooth chip embedded on it .The Motor Shield board provided by the funduino system will be interfaced with Arduino for accessing the gear motors for movement of ARDROID robot. The robot design will be improved one on the existing telepresence robots as per to climb the slopes or terrains .The robot telepresence application will be connecting to the micro controller via Bluetooth for transmitting the control signals to the boards whereas the users on the remote location will be logging on to the system using the android API's server for transmitting control signals to robot and viewing live audio / video environment from robot.

The ARDROID robot requires no gudiance excluding initial power on with logging to app. The robot is based around an embedded computer that controls the movements. The ARDROID is Bluetooth enabled and communicates with an Android Application. The API for telepresence runs on the device providing high quality audio and video. A control interface runs on the remote user's android cell phone allowing full control of the ARDROID and completes the audio/video call-in platform.

The ARDROID also features the ability to tilt the tablet up/down via the control interface providing a wide visual range and sharp accuracy. It can also pan the device head left or right with the optional motorized 180° or 360° pan mast.

The aim of our project is to develop a telepresence robot of unprecedented social intelligence, thereby helping to pave the way for the deployment of robots in environments such as in schools, colleges, offices, hospitals, etc.

ARDROID is developed on Android platform, which has 70% users in the world that makes it global.

The overall cost of ARDROID is around Rs 25k to 25k which is affordable for normal users. It is more flexible and hence it can be traversed in any environment.

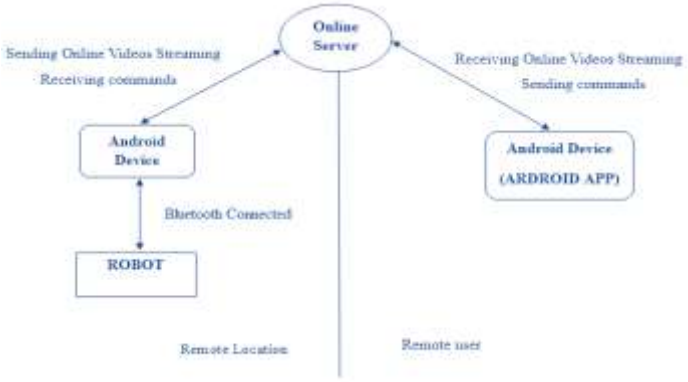

Figure 1: Block diagram of ARDROID

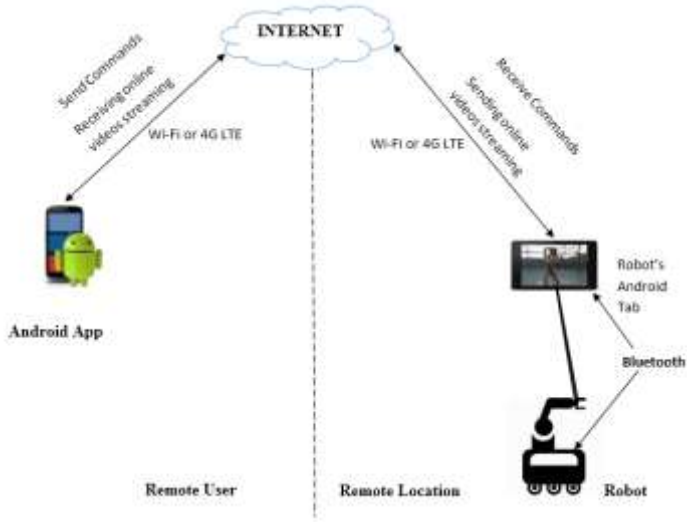

Figure 2: Architecture of ARDROID

The Architecture of ARDROID shows that the Ardroid app on the remote user side allows the user to send commands through a Wi-Fi or 4G LTE network to the robot's android tab which is connected to the robot via a Bluetooth connection. The robot with its android tablet is located at the remote location. After receiving the commands from the remote user the robot will move according to the commands given by the user. At the same time the robot will send online video streaming of the robot's movement to the remote user.

III. IMPLEMENTATION DETAILS

Our implementation of ARDROID consists of software and hardware specifications.

The software specifications include:

- **Android Studio**: Android Studio is the official IDE for Android application development.
- **Arduino Sketch Compiler:**Arduinois an open source computer hardware and software company and user community that designs and manufactures microcontroller based kits for building digital devices that can sense & control the physical world.
- **Sinch SDK:** The Sinch SDK is a third party service that makes adding voice calling and/or instant messaging to mobile apps easy.

The hardware specifications include:

- ArduinoDuemilanove board (AT mega 328P)
- L293D motor driver Shield (Dual H-Bridge)
- Bluetooth Module
- Robot Body Components(Robot Chassis, DC motors, Caterpillar wheels, batteries)
- Android Device (Tablet)

The ARDROID robot consists of a remote user and a robot at remote location. The remote user has the ardroid app which allows the user to send commands to the robot's android tab through Wi-Fi network. At the same time the robot's android tab will send live video streaming of the robot to the remote user.

The implementation of ARDROID: Arduino and Android based Internet Controlled Telepresence Robot consists of following steps:

A. Steps at robot site:

1) Power ON the Bot (Arduino board).
2) Login to Ardroid App on tablet.
3) Wait for remote user call.

Figure 3: ARDROID Telepresence Robot

B. Steps at remote user site:

1) Login to Ardroid remote user app.
2) Enter the recipient name.
3) Make a call.
4) Once connected to robot site, user will see live video streaming.
5) Use buttons for navigation and move the robot.

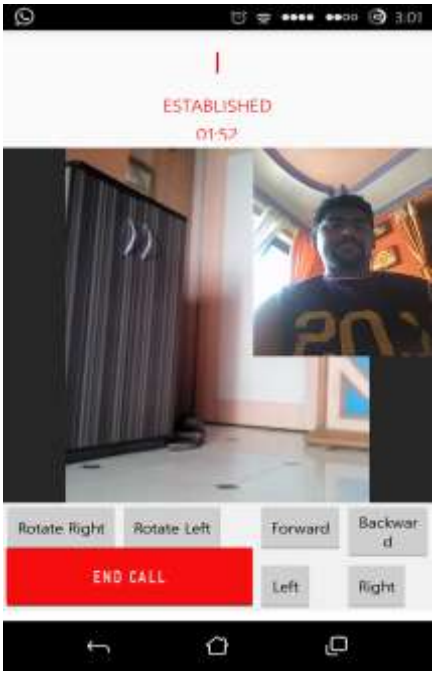

Figure 4: User Interface example of Ardroid

As shown in figure 5 above, the User Interface of Ardroid Application is quite easy to comprehend. Buttons are used to invoke different functions and issue commands. It consists Login, End call, rotate right, and rotate left, left, right, forward and backward buttons.

IV. MODULES DEVELOPED

MODULE 1: Login Page
The login page module of the ardroid app allows the remote user to login into the ardroid app. Before login to the app, the remote user must enter his/her name.

MODULE 2: Recipient Page
After the remote user logs-in to the app, the user has to enter the recipient name to whom he/she needs to make a call.

MODULE 3: Video Streaming Page (Remote User App)
Once the remote user's call is connected to the recipient at robot site, the user will receive live video streaming of the robot site. Also the user can use various buttons (left, right, forward, backward, etc.,) for navigation and hence to traverse the bot.

MODULE 4: Video Streaming Page (Robot App)
This module will allow the recipient to receive the live video streaming of the remote user at the robot site.

V. CONCLUSION

The paper presented a framework with android studio, arduino studio and a third party service sinch for controlling our telepresence robot ARDROID using internet.

The main purpose of ARDROID is to allow a user to interact with other users and colleagues in their environment and at the same time allows the user to control the bot, and receive the live video streaming of the bot through internet. The bot can travel in any of the environmental conditions thus making it flexible and portable.

In the future, we will add the modules for robot location identification using GPS for identifying the current location of the robot, Raspberry Pi integration to Ardroid.

VI. RESULTS

Figure 5: Login Page of Ardroid

Figure 6: Recipient Page of Ardroid

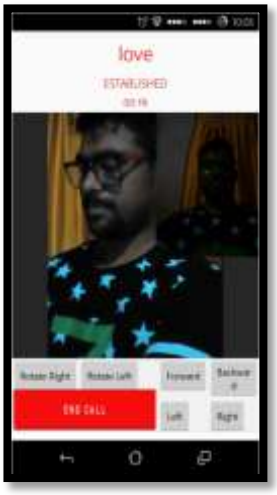

Figure 7: Video Streaming (Remote User)

Figure 8: Video Streaming (Remote Location)

Figure 9: ARDROID Telepresence Robot

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