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TELEPRESENCE ROBOT USING IMAGE PROCESSING WITH PYTHON

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***Abstract*— This paper presents a telepresence robot . Telepresence is a wheeled, video-conferencing robot that revolutionizes the way one can work or learn in today's modernized life. "Telepresence Robot", as the technology is known, allows people to move through a building by remotely controlling the wheeled robot equipped with a gadget displaying the live video of its user's face.**

Telepresence robots typically use a tablet or mobile phone which provide video and audio capability that enables people to interact and participate in video conferences over the wireless internet connectivity. This robot gives their users the freedom to converse with anybody at the remote location like moving over to the desk of a colleague, say or accompany and voice your input whenever necessary rather than limiting the communication to a specific time in a special room. Also these robots cost much less and are more affordable than travel costs or any other expenses that come along the way. This technology has become popular in various application areas and is welcomed by different sectors as they reduce the travel cost and also the assistance of a third person.

Driving your own robot means that you are free to roam around and supervise the office, visit patients, attend meetings, monitor work sites or attend classes from anywhere in the world at the comfort of one's couch.

Keywords*— *telepresence robots, mobile app, image processing, telecontrol, video , control stability, Arduino, Ultrasonic sensor, raspberry pi, noobs.

I INTRODUCTION

Telepresence robot can be defined as a person as an observer, who is objectively present in a real environment from which he is physically separated. This allows people to participate in video conferences on a moveable platform from a remote location. They are designed to promote social interaction between people. Skype has the capability of a high performance audio- video conference system. The skype framework and API(Application Programming Interface), therefore has been used in various telepresence robots and telepresence systems. In the software part, a mobile application with a virtual control system has been developed . The robot can be controlled from any part of the world which can be operated using its built-in Wifi. For the two-way video interaction part of teleconferencing the robot used our own android mobile application. The robot maintains the control under supervision.Therefore as everything revolves around the internet and internet of things helps connect all the devices so that the data will be exchanged between all the objects. These objects include personal computers, laptops, tablets, smart phones, PDA(Personal Digital Assistant) and other hand-held embedded devices. These technologies create an interactive experience within a simulated Environment . Where can imagine world were created which we can sense.

This paper focus on the following topics

- Design methodology
- Working Principle

These topics help in understanding the concept of Telepresence better and application of these technologies in day-today life.

1 DESIGN METHODOLOGY

1.1 *Design of robot*

The hardware design of ROBOT has been done in such a way so that it provides a real time audio- video conferencing capabilities and can be remotely controlled with precision from a long distance. The developed robot is shown in Fig. 1. A comprehensive table specifying all the hardware details of ROBOT is shown in Table 1.The primary part of the robot's body consists of a static stand with an adjustable smartphone attaching system. The movement of the robot uses adifferential drive, which consists of 4 drive wheels with DC gear motors mounted on a common axis. The mechanism is that they are driven backward or forward. A webcam is placed at the bottom to take pictures which is used to detect an object or person and stop the robot. This helps to avoid collisions.

Figure 1: Physical prototype of the robot.

TABLE I. HARDWARE SPECIFICATION OF ROBOT

SPECIFICATION	
Height	95.98 cm
Base Height	8.62 cm
Base Width	36.56 cm
Weight	2.69 kg
Top speed	4.043 km/h
Battery Life	4-5 hours battery backup (rechargeable)
Tele presenter	Smartphone
Size of telepresenter	5"-10" adjustable
Navigation control	Mobile App

1.2. *TELE PRESENTER*

For the telepresence feature i.e. the key feature, ROBOT uses the videoconferencing feature of smartphones[1] . To achieve that, an android application in the robot's telepresenter smartphone is developed. On the desktop/remote user side, the Mobile application consists of remote control software and video[2]. Skype is the most popular and high-quality video communicator which works over the Internet . There are other frameworks for telepresence such as the Server and Client website, and WebRTC(Web Real-Time Communication).

2 . WORKING PRINCIPLE

The parts of the robot are connected to the drive present inside them and are given to the controller module (ESP8266).Arduino IDE(Arduino Integrated Development Environment) is the platform where the programs are written for ESP8266 board. It has a compile button which helps in compiling the code along with the upload tab which helps to upload the code on the board. It is used to send the data from the app to the firebase and vice versa. The necessary codes are dumped inside the module through the Arduino IDE to help the robot move in the direction as instructed. The ESP8266 module further works on the wireless internet so as to access and connect the robot and its associate app easily without any boundary or limitations.

The application created by us contains direction buttons to help the robot move in the desired path and is supported by the firebase. Therefore when the user changes the directions as FORWARD, BACKWARD, STOP, LEFT & RIGHT, the status of the firebase also simultaneously changes.

These changes are identified by the Arduino present and hence the wheel moves in the necessary direction as the user who is operating the app.

The Telepresence robot works according to the below diagram

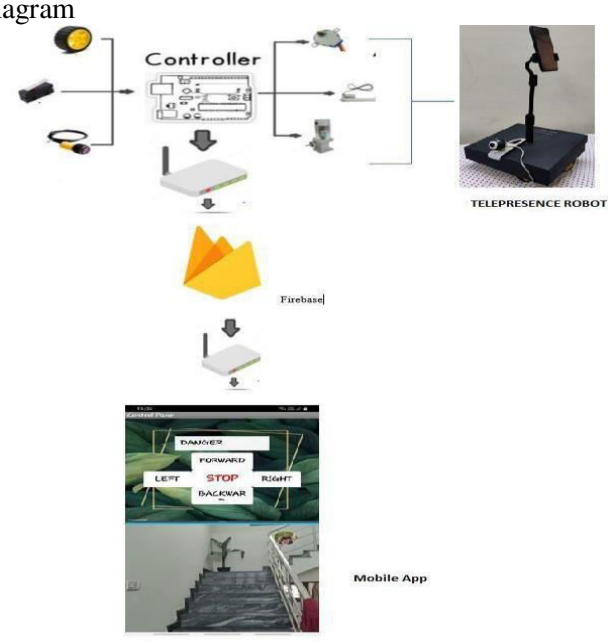


Figure 2: Workflow of the robot.

The telepresence robot also contains a camera associated with the module which helps in capturing the object and helps in identifying the object to avoid collision in case it is not visible to the user eye. The back of the robot also has the ultrasonic sensor and it senses its surroundings at the back and the status on the app changes according to the sensor's output. Telepresence may be a medium during which transducers, like video cameras and microphones, substitute for the corresponding senses of the participant. The participant during a position is read to remotely see and listen to from the primary person POV(Point of View) with the help of sensing devices in a remote location[3].

2.1 *FIREBASE MECHANISM:*

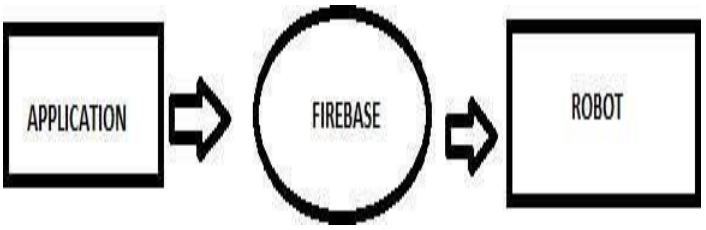
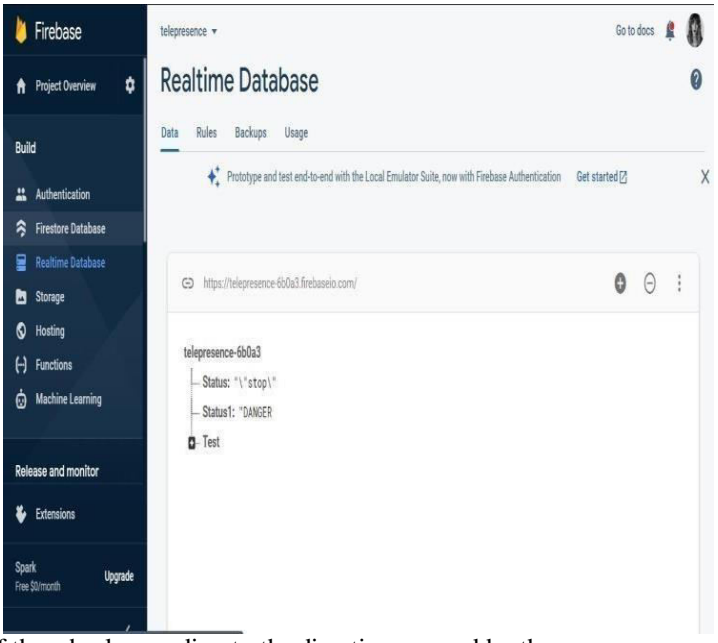


Figure 3: Operation of Firebase .

Firebase is a Backend-as-a-Service (Baas). It provides developers with a spread of tools and services to assist them develop quality apps, grow their user base, and earn profit. The app created from the android studio is supported by the firebase. So when the user uses the direction buttons to move the robot, the changes are reflected in the firebase. The firebase status changes to forward, backward, left, right and stop[4]. Therefore when the user press the buttons the status of the firebase changes accordingly and this change is identified by the module which then changes the control



of the wheel according to the direction pressed by the user.

Figure 4: Firebase Realtime Database working platfor

2.2 IMAGE PROCESSING USING RASPBERRY PI:

After installing the OS to the board The main signal processing chip unit used in Raspberry Pi connect all the necessaryhardware components and switch system is a Broadcom 2835 700MHz contribute which CPU on the facility supply[5]. core may be a 32 bit ARM1176JZF-S RISC(Reduced Instruction Set Computer) processor designed by Advanced RISC Machines. The Raspberry Pi design username and password. It mainly works on the python instead of using an SD(Secure Debian based python software by commands within the terminal window. operating systems[6].
This Raspberry Pi module features a Following packages are to be installed for implementing Samsung class 4 micro SD card preloaded with the the proposed model[7]. Thus based on the output from the image processing the robot associated with it stops and sends the identification of the object to the user application.

2.3 ULTRASONIC SENSOR:

The sensor senses and if any object appears within the certain range, the sensor senses and sends the message as DANGER or SAFE and if the relied message is danger then the a pop up appears and identifies the object as the result of image processing done using the raspberry pi [8]

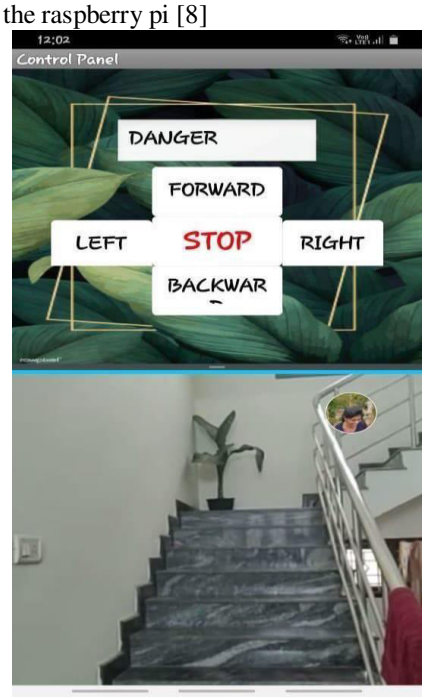


Figure 6: Visualization of the application

2.4 ANALYSIS ON THE ROBOT:

Speed = circumference * rpm
(circumference= diameter *pi)

Therefore,
Speed = diameter * pi * rpm
RPM of single shaft of the motor= 60 RPM
Diameter of the robot wheel = 54mm

On substituting,
Speed = 54mm*60*3.14
Speed = 10.17 rpm
The speed of the robot is 10.17 rotation per minute

3.CONCLUSION

The methodology adopted in this project aims to develop the existing telepresence robot combined with new technology. Application of Image processing and object detection to eliminate unnecessary obstacles and to improve efficiency of the existing telepresence robot. This project is influenced by the complex integration of image processing and virtual reality. Nevertheless, we'll continue performing on the approaches to handle intentional non-control together with shared control in order that users can deliver commands only they want to try to to so, thus enlarging subjects' telepresence experience.

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