Remote Vision System of an Explosive Deactivator Robot

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Summary—In this work, we implemented a telepresence system that will serve as a subsystem for an explosive deactivator robot. To do this, we developed a Smartphone application that achieves the effect of immersion in a transmission in real time and we did a mechanical system that replicates the movements of the Smartphone to move the focus of the cameras.

***Palabras clave*— Arduino, Bluetooth, stereoscopy, web server, servomotor, Smartphone, telepresence, transmission, Unity, virtual reality viewer.**

I. Introduction

Autonomous robots are currently being developed, which operate with a high degree of autonomy, which is particularly desirable in tasks that can be tedious or tedious for people, such as cleaning floors, mowing the lawn, etc.

It can be said that some of these robots are completely autonomous within the strict limits of their direct environment (for which it was programmed). But in reality, the world is dynamic and can often contain chaotic, unpredictable variables.

In these cases, it is required that a human operator, depending on the complexity of the operation, in this way can operate the equipment as if it were part of it.

Telepresence systems solve this problem, placing the observer in the real world that is captured by camcorders located in distant places and allow the remote manipulation of real objects using robotic systems. That is to say that the operator interacts in reality but is located in a different place to where he is at that moment.

In the case of deactivation of explosives, this system would contribute to stop exposing the experts to the risk of an explosion, giving them a real-time perspective to control the robot and take the respective deactivation actions.

II. Presentation of the Problem

The problem is the requirement of a real-time virtual reality communication system for the control of explosive deactivation operations.

The design of the real-time transmission system is the biggest complication because the transmission of real-time video wirelessly cannot be a very good performance because there are several external factors that prevent this process from occurring correctly, such as noise, transmission distance, resolution and processor speed.

In addition, the development of a stereoscopic application also supposes an important phase of the project, since it is necessary to cause of the effect of immersion to the user so that it can operate the robot like an extension of its body.

III. Objectives

A. General objectives

Implement a telepresence system for an explosive deactivator robot, using a virtual reality lens, a processor and a Smartphone.

B. Specific objectives

- Stream live video using web servers, which will be received on the Smartphone.
- Develop an Android application for stereoscopy in Unity.
- Implement a mechanical system that receives information from the Smartphone's gyroscope trough Bluetooth and drives servo motors controlled with Arduino.

IV. Description of the Solution

A. *Operating Diagram*

An IP camera was used to capture the video, which is uploaded to the internet via a Raspberry Pi 2, to a web server to be transmitted in real time through a Smartphone with Android operating system and displayed inside a viewfinder Virtual reality, as shown in the following diagram in Fig. 1:

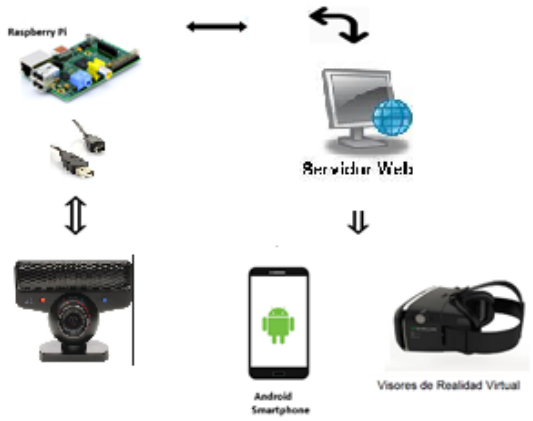

Fig. 1 – Operating diagram

B. *Video transmission via web server*

Raspberry Pi 2 was configured and prepared to recognize the camera and transmit the video through a web server as shown in Fig. 2:

Fig. 2 –Raspberry Pi 2 configuration

C. *Processing for stereoscopy*

We used the Unity platform as it has tools to create virtual environments, which we can adapt for our application, as shown in Fig. 3:

Fig. 3 – Stereoscopy in Unity

D. *Mechanic System*

A system composed of servo motors controlled by an Arduino that receives information from the sensors of the Smartphone through a Bluetooth module was implemented, as shown in Fig. 4:

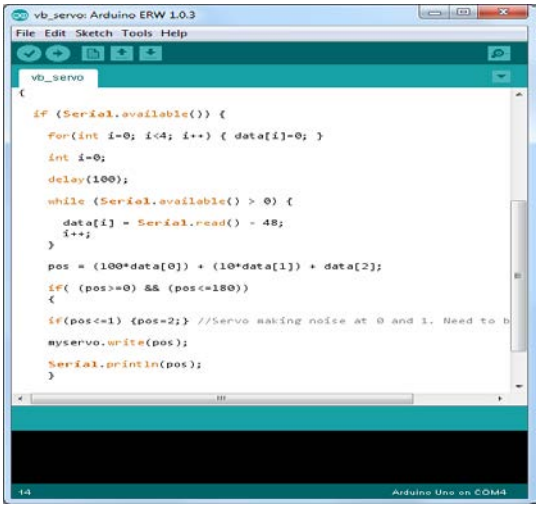

Fig. 4 –Arduino configuration

V. Results

A. *Video transmission via web server*

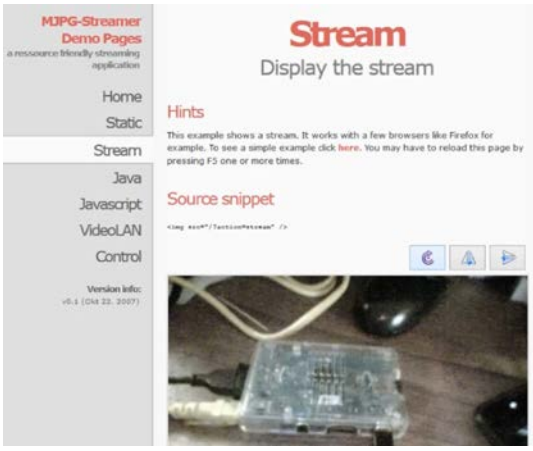

Fig. 5 – Transmission display

B. *Processing for stereoscopy*

Fig. 6 – Stereoscopic presentation

C. *Mechanic System*

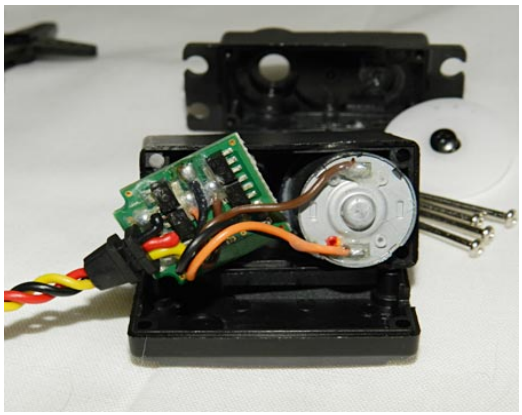

Fig. 7 – Mechanic System

VI. Conclusions

It has been necessary to implement a web server for live streaming from the processor, and a transmission delay of 1 second was observed.

It was verified that it is possible to visualize images and videos 360 ° using the platform Unity, to create native applications in Android, although this software is not oriented towards such ends.

The control of the servomotors presents noise coming from the sensors of the Smartphone, which can be corrected with a filter.

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