Analysis of Virtual Tourism with Drones: Experiments and Lag Compensation

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Overview

Tourism often see as a kind of activity which is cumbersome, expensive, and even dangerous. While virtual tourism can reduce these problems. Virtual tourism recreates the real venues in computers as 3D models to let tourist can watch the video by premade or prerecorded.

According to the paper, they use drones flying to the target venues and record the video, then these videos send to tourist at home by VR devices. Watchers could control the orientation of drone by move their head.

Problem

Tourism always involves troublesome or expensive or dangerous physical movement.

Purpose

To solve the restrictions on tourism.

Related work

We can find kinds of information on those websites of tourist information systems. Like vacant hotel rooms, maps, weather or outdoor activities. Virtual tourism always associated with real touristic sites to create 3D models. Also, it often use geo-information systems to render the 3D models.

Using drones in virtual tourism have not been proposed now. most of projects and papers of drones are based on indoor usage and they always work in nearly perfect room and under the optimal conditions, like no wind, IR-markers or Laser-Triangulation for an accurate self-location.

There are some impressive examples, one of them is “The Flying Machine Arena-Quadrocopter Ball Juggling” it makes two drones play tennis with each other.

Because of unpredictable weather and suddenly appearing obstacles, navigate is pretty difficult in outdoor areas. A project named “Paparazzi” now taking up this challenge. It has a powerful autopilot system and the system is using on fixed-wing aircrafts as well as multi-copters.

Solution

Use UAVs to fly at the target location using virtual tours and then send their recorded videos to visitors at home or anywhere. Thus, visitors can really have no restrictions to visit anywhere they want. The user should be free to define the location of Virtual eye as far as possible and what it is viewing.

Methodology

The way is to use cheap off-the-shelf drone as a flying camera and be used in a live scenario by tourists to remote around remote areas and ideally be immersed in the application such that the tourist has impression of really being there.

The development of the control application is divided into three main components of the development model. Firstly, the server application responsible for direct control of ARDrone sends the calculated navigation vector to ARDrone. The second major component defines the graphical user client. Finally, existing SDKs for this purpose must be modified and expanded to allow users to use a wide variety of control devices.

Problems and solutions:

(1) ARDrone 2.0 is very susceptible to external influences, like moderate wind, which makes it difficult for them to provide a stable video sequence user.

(2) It must be modified using a controllable front camera on the spherical connector to solve the problem of the rigid mounting of the video cameras leads to an undesirable side effect problem.

(3) The transfer delay of video and navigation data control packets that are partially summed by the different transmission method and encoding steps up to 2 seconds.

(4) Due to the lack of battery capacity of the existing 1100 - 1800mAh, the maximum possible flight time is 18-20 minutes, without return to the ground station. One solution is ARDrone's base weight requirements are reduced or higher, to develop capacitive LIPO batteries and the other solution is the targeted intelligent management of several available UAVs will deliver the

connected client stream to the next available fully charged UAV at the desired return time to ensure that the user is seamless and significantly longer of the flight experience.

(5) Giving the user complete freedom to control his virtual eyes is not possible. The virtual route of the GPS mode point must be pre-defined and the ARDRone will travel with certain tolerance on the route. Therefore, the user can only directly control the virtual journey of the flight speed, rather than UAV navigation direction.

1. GPS: Using GPS could help drone to correct the position automatically. The ARDrone 2.0 need GPS-based navigation continuous correction, so users can rotate entire drone on z-axis when travel to the next waypoint.
2. Virtual Reality: The ARDrone 2.0 and SDK provide many real-time symbol and character recognition. It could implement methods and algorithms for visual recognition of client/server to provide more information about interactive elements like video or audio to users' devices.
3. Application: The basic structure of virtual tourism application is divided into two parts: server application and client application. All the drones connect to the server accepts clients requests. The client application allows TCP connection to the server application further semi-automatic navigation of the ARDRone 2.0. Also have an instrument to display the current status and the sensor can accept the command then give an accurate feedback.
4. Lag Compensation and Video Bitrate: ARDRone 2.0 and SDK provides more symbol or character recognition to the developers who control APP for real-time. All necessary calculation is directly in the ARDRone hardware/firmware and results processing client application. Moreover, the solution possible implement more method and algorithms. Two pincushion image for each eye will be corrected in the headset by lenses.3-axis gyros, accelerometers and magnetometers make it absolute orientation tracking without drift.

Evaluation

In order to prove the results of the ARDRone 2.0 GPS receiver, in particular the accuracy value, measured the GPS data received four times on the same point that the UAV stayed on the ground (refer to the GPS value on Google Map). Over short 5 seconds and 180 seconds long. In order to show how different environmental conditions in large buildings reflect or thick clouds absorb some of the received GPS signals, chosen a position to represent some of the worst conditions: a street about 20m width surrounded by about 10-12m high buildings and very cloudy weather conditions. The other represents some of the best conditions, a spacious free parking area of about 100mx100m in size, without any surrounding reflective objects.

In the result of experiments, many possible tourist sites may not be suitable for GPS-based navigation of UAVs. Requires good weather conditions and an open area with the smallest large object that reflects the GPS signal to precisely control the UAV and run smoothly between designated waypoints. In addition, alternate implementations of location tracking, such as DGPS (Global Positioning System), should be used to improve accuracy.

Conclusion

Quadcopters is a autonomous navigation which is fitted to develop and test flying robots in some certain areas. This work aims to develop a server management system which can align the camera and the user. It allows the user can control the direction of quadcopter by using ARDrone 2.0 through the internet from anywhere on the world. The author concluded two methods (hardware/firmware in current model needs to be optimized OR new a quadcopter model) is fulfills more of the given requirements for use the Virtual Tourist in tourist. Furthermore, they analyze the expense of internet lag compensation. The virtual tourist using drones is possible in theoretically by the result of bitrates.

In the future, “ArduCopter” based on APM 2.X autopilot possible alternative to ARDrone. Because the DIY system probably use more much higher capacities batteries or higher possible additional weight to transport the cameras.