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Real-Time Camera Tracking of Augmented Reality in Landmarks Environments

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Abstract

Augmented Reality is the hybrid of real world and virtual reality objects, where the system generated graphical objects are mixtured into the real world. AR will create the illusion that virtual and computer-generated objects are existing in the real world. It is completely graphical experience that is united with real world circumstances.
Here, the landmark has acquired as an input of the real time video image file by eyesight-based camera parameter approximation methods by using SFM (STRUCTURE FROM MOTION) technique. In this paper, we are going to superimpose real time video images of landmark with virtual system generated graphical video image. These SFM method which are already discussed earlier in some of the preceding papers does not work in practical time applications because of its excessive costness. But here, in this method we have achieved quick and perfect landmark estimation based on SFM and we can obtain the stereoscopic structure of a landmark by this method.

Keywords: Augmented Reality; Camera Parameter Estimatio; Landmark database; Natural features;Tracking.

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1. Introduction

One of the most recent advancement [1] in the well growing technological world is augmented reality, but it was around for over fifteen years, at present, in real time applications it exists only for the history of three years. Presently, this AR technology is popularly growing because of our mounting systematic technological lives. For the history of small number of years only, it is becoming very popular in this world. Augmented Reality means interacting with the real globe and virtual substance at the same time which will be augmented by computer generating inputs. That is, AR allows the computer generated content to be overlaid into an existing camera view of the real world. Augmented Reality (AR) means superimposing of some data's into the real surroundings [1], [3] and so the term augmented was referred as an observation of the real environment which holds still additional information. AR will create real time applications and it gives more natural and co-operative. AR is a more advanced technological application nowadays, so only it is very easily reasonable and also utilizable. AR, by means, is a way to increase our researcher's perception about the surroundings by superimposing virtual data sequences. It may be anything that is animation, 3D substances, messages and video on top of the real environment, which was captured through the web camera or camera on our mobile phones. By the combination of new developing technology AR plays a very important familiar role to the researchers. But, nowadays AR has 99% outdoor applications but usage is 90% indoor applications so there is a big bound when AR is used in indoor applications. The augmented reality software explores from beginning to end of its records for a match to the image, and then overlays a virtual image on peak of it's in a predefined direction, in the resulted video stream. AR system uses computer vision and acting on video input from which performs the essential position between real and virtual cameras. So we must need a system and a webcam.

AR is the one way to give practical and positional based learning to researchers providing obtainable world rather than by creating new environment. The researchers believed that augmented reality (AR) is the subsequently large example application in this world. When connecting the global networks with the tangible world and many substances, places and people it has, AR contains both a distracting technology and thrilling eyesight of the future. Nowadays AR projects are naturally focusing on individual researchers and it does not afford themselves to the company activities. And also AR projects are similar to entertaining devices for their tutorial value.

Augmented reality is totally diverse from virtual reality [5, 11]. We can see only the virtual stuffs on the real world which is so called virtual reality. But in Augmented Reality it still survives in the real world only [5]. It is augmenting the virtual data's on to the peak of the real environment. Anyhow it does not put back the real environment what we are experiencing, it grants us the tangible information. AR is used in so many numbers of areas. There are so many applications are going to come in future by this technology so that it is going to change the method where the people will access the data sequences or information nearby us. It is used in many applications, as the tourist guide, and it precisely looks like travel guidance for us. And also if we wish to go for theaters it shows the show timings and the ticket costs exactly. And also if we are in a supermarket, it shows the nutritional food items what we are looking for. In sports broadcasts it displays information correctly on peak of the playing field throughout the football games, also in theaters they use stereoscopic 3-Dimensional to enhance the skill for spectators surveillance of those films. So AR is used in many applications, which is like a browser in our pocket to the complete globe. These performances are entirely prehistoric by comparing more advanced developments in this AR view.

Landscape [4] is one of the most common observable surroundings for the researcher's atmosphere. The landscape is considered as follows, afforest, tons, construction areas, overpasses, and also it comprises the some observable features of an region of ground, pool, marines, and some other landmarks like ice-caped valleys & etc. The landscape is the geographic characteristics used by researchers and also others to discover their route back or over the area. A landscape will give the strongest influence and it creates a collectively, aesthetically, globally, or reliably desired result [4]. A landmark is a geographic features used by explorers and others to find their way back or through an area.

Augmented reality (AR) vigorously augments or develops the real natural world with system-generating virtual things [5]. Because of its technological issues it should be registered [3]. If the objects in the real and virtual surroundings are not appropriately combined with each other, then the damaged illusion occurs, when two world's coincidence each other. We must correct the camera's pose in order to obtain acceptable registration with limited systemized property.

2. Methodology

2.1. Tracking of Camera:

To solve the image registration problem, so we are using online reconstruction method and several maps. Here the map N*i* consists of collection of *L* points in its world coordinate V*i*. **P** is said to be the camera projection matrix. The N*i* coordinates for the jth points are, $Y_{jV_i} = \left(Y_{jV_i}, X_{jV_i}, Z_{jV_i}, 1\right)^T$ [3].

Let $y_{jV_i} = \left(y_{jV_i}, x_{jV_i}, 1\right)^T$ is said to be 2-D projection of Y_{jV_i} on its plane image. So the relationship between Y_{jV_i} and y_{jV_i} is,

$$Y_{jV_i} = \alpha C\left[Q|S\right]Y = PY_{jV_i} \qquad (1)$$

α is said to be an arbitrary factor, $Q = \lfloor q_x, q_y, q_z \rfloor$ and $S = \lfloor s_x, s_y, s_z \rfloor$ is said to be rotation and translation will relate the coordinate system of world and camera. C is said to be the camera intrinsic matrix.

An image from the camera or motion has received by the tracking methodology and it is maintaining the real-time estimation of the camera posture. By using this estimation, we are augmenting the existing video sequences with virtual objects.

There are two methods for estimating the camera posture so that we can increase the system's pliability to unpredictable motions, some clarification changes and landmark occlusions. The first method used here is optical-flow method and it is given by the Open CV (Open Source Computer Vision) [3] library which tracked some features from the preceding frame to the existing frame.

Then, by using a robust N-estimator it eliminates the outliers and computes the camera posture concurrently.

$$\min_{Q,S} \sum_{i=1}^{n} \gamma\left(\sqcup y_i - \varphi\left(\left[Q|S\right], Y_i\right)\sqcup\right) \qquad (2)$$

Where γ () is the Tukey biweight objective function, φ () corresponds to Equation 1, and $\sqcup y_i - \varphi\left(\left[Q|S\right], Y_i\right)\sqcup$ is said to be the reprojection errors. n is said to be the number of tracked features [3]. The equation 2 is solved by using the Levenberg-Marquardt technique. This effective use of iteration is starting with the preceding frameworks of camera position.

The second method is recovering the missing characteristics which are needed to increase the tracking constancy. Affine transformation is used which compensates attitude changes in the missing characteristics initial observation and also in the existing frame. The second method will calculate the affine transformation matrix over four couples of effectively tracking points in the environmental missing quality.

2.2. SFM (Structure From Motion) and SLAM (Simultaneous Localization And Mapping):

In earlier papers, some researchers discussed about the SLAM (Simultaneous Localisation And Mapping) technique [6]that estimates solitaryly about the camera or motion issues without any information of objective surroundings. Here in this article, we are prefering for SFM (Structure From Motion) technique, so there is no need of data information about the scene structures. The *simultaneous localization and map* (SLAM) is to develop a map by absolute performance of the surroundings and this map is used concurrently to find the way for automation and navigation [9] applications. There are so many numbers of researchers, for focusing the problem of SLAM. So only this technique is used in many vision sensors attracting tools for automation applications. Due to some problems in SLAM [6], this technique is going behind and many AR researchers are forwarding their look towards SFM (Structure from Motion) technique. It is one of the common most thrilling [9] regions of system sight research. Both the SLAM technique and the SFM technique are estimating the movement of the sensors and environment shape where the sensor is moving through the field. SFM has been attracted towards researchers because of its sturdiness.

Structure From Motion[11] method has a major common problem in computer vision, technique is one of the majority common problems within the computer vision. But it has a wonderful awareness towards the researchers over the past decades. We can estimate the 3-D image from the 2-D image which has computerisation and extension of the photogrammetry. An appropriate definition for SFM is: "*The estimation of the 3D structure of a usually rigid object and relative camera motion from 2D images hereof, when the external camera parameters are unknown but translating"*[8]. For more than the past two years, Structure From Motion (SFM) was developed into a field of computer vision information processing [10]. When camera is moving through a scene structure, it energetically recovers the structure and motion as of free real world circumstances. The main limitations for SFM technique is, it needs a static scene.

2.3. SFM Frameworks :

The most important requirements for SFM constructions [10] are:

- We should establish the more number of separately moving [10] substances,
  at the introduction of a arrangement and every time if the number also changes,
- We should fragment the feature paths into atypical moving substances in each of the framework,
- And calculate their 3-Dimensional structure and its camera movement for the framework with it's essential accuracy,
- And determine the geometric vagueness,
- And it should be strong for quality tracking's due to self-sealing, camera motion blur, etc.,
- And to level to practical recording [10].

- This are suggesting for the feature tracking, segmenting into separate objects, and 3-Dimensional restoration cannot be established out for different tasks, but it should be enclosed.

3. Implementation

Here, in this project, we are using AR Tool Kit which is called as a collection of software program used only for AR applications. Since AR Tool Kit is one of the most commonly and widely employed for AR research in this growing technological world. It is very easiest software which superimposes the virtual stuffs into the real world. In this experimenting project, we are using a standard specification laptop PC, RAM of 3.0 GB, a 1080x800 display, OS of Microsoft Windows 7 basic [4].

4. Experiments and Results

In this experimented project, initially we had captured the targeted [7] landmark circumstances in a continuous image frames which is so called video image. By using SFM technique, we had superimposed the virtual object as rectangle into the real world environment and the results are as follows:

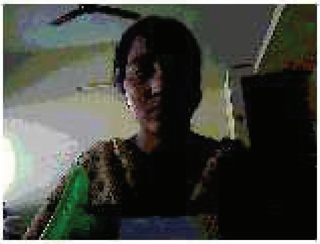

Fig 1:Input of the real time video image.

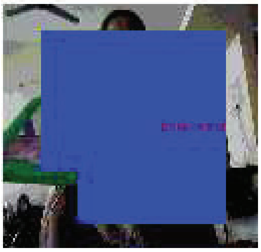

Fig 2:

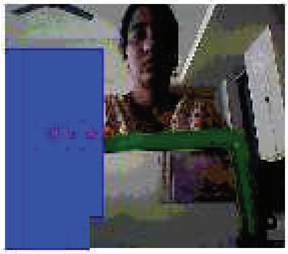

Fig 3:

Fig 4:

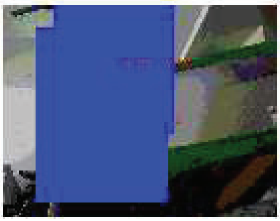

Fig 5:

Fig 2 represents that the object is rotated in clockwise direction in real time video process, similarly Fig 3 which is rotated in anti-clockwise direction, Fig 4 is rotated in vertical direction in real time video processing and Fig 5 is rotated in horizontal direction. These are the tracking of real time video image in different positions and blue color solid box is superimposed over that object in real time video process in all positions.

5. Conclusion

In this dissertational work, we had proposed a creative methodology for a Real-Time Camera Tracking of Augmented Reality in Landmarks Environments by using the real time video image which contains multi frames together [7]. In previous papers they have discussed about the still image [7] sequences but here we are discussing about the real time video image. The proposed technique tells about the SFM technique and we had confirmed that the obtained results have no consecutive addition of errors. In future, AR-landmark estimation we are going to perform in real-time hardware implementation. As a result of this test project, the accuracy of the Real-Time Camera Tracking of Augmented Reality in Landmarks Environments is reached to the higher level and also we are tracking [2] the objects present in the real time video image.

More number of AR projects is using customized hardware [3], so that their mechanism which is correlated with the data by recent technology in the real environment is complex. Apart from hardware, it is more difficult [2] to maintain. But here in this experimented project, the maintenance of hardware [3] is not difficult. The common problem in tracking camera motion is mainly depended on visual information [2]. The recovery of camera pose is intimated immediately so that the problem is reduced when we are estimating the 3-dimensional structure from multiple cameras.

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