A Proposed Registration Method Using Tracking Interest Features for Augmented Reality

Dr. Abdul Ameer Abdulla
Computer Sciences Department, University of Technology/ Baghdad
Dr. Yossra Hussain Ali
Computer Sciences Department, University of Technology/ Baghdad
Ikhlas Watan Ghindawi
Computer Science Department, University of Technology
Email: ikhlas_watan@yahoo.com

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ABSTRACT

An Augmented Reality (AR) incorporates a mix of genuine and PC created scene segments. AR frameworks enhance a client's impression of this present reality with information that is not entirely of the scene. A key test for making an expanded the truth is to keep up precise arrangement amongst genuine and virtual thing.This exploration delineates a method to build up the enlistment extent of a dream based enlarged reality (AR) framework, also explores a simple method for detecting and tracking natural features in video stream. In this method, a reference image has been used as a tool to find the a proper position of an object. This method first uses Harris Corner Detector to detect the interest features and find the correspondences using cross-correlation method then it used the Random Sample Consensus (RANSAC) algorithm to find the Homography matrix .After acquiring keypoints in the video frame, a Kanade–Lucas–Tomasi (KLT) feature tracker optical flow tracking algorithm has been used to track the motion of these keypoints frame-by-frame. By maintaining the correspondence between the tracked keypoints and those on the clean marker image, a new homography for every frame has been computed. This allows tracking the orientation of the marker as it moves in the video frames.
Experiments for assessing the possibility of the technique are implemented in order to illustrate the potential benefits of the method, in which result's that to the target registration error (TRE) reach 0.0020 , root mean square error (RMSE) is 0.003 and average time for whole dataset is 2.5 s

INTRODUCTION

Augmented Reality (AR) is an innovation which permits PC delivered virtual symbolism to exactly overlay physical articles constantly.. Not at all like virtual reality (VR), where the client is completely splashed in a virtual area, AR allows the client to interface with the virtual pictures using genuine things in a consistent way[1]. Azuma[1] gives a typically recognized significance of AR as a development which
(1) Consolidates real and virtual symbolism.
(2) Is intelligent continuously.
(3) Registers the virtual symbolism with this real reality.

As such there are numerous conceivable areas that could profit by the utilization of AR innovation, for example, engineering, entertainment and education.

Augmented Reality (AR) makes an area in which virtual items are superimposed on client's point of view of the genuine environment. Augmented reality has gotten a lot of consideration as another technique for showing data or expanding the reality of virtual situations [2,3]. Recognizing and tracking is a helpful procedure of registration process, in which gives recognition applications a basic approach to assess the position and introduction of an item in a video succession [4].

To execute an augmented reality framework, we should take care of a few issues. Geometric registration is particularly the most essential issue on the grounds that virtual items should be

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2412-0758/University of Technology-Iraq, Baghdad, Iraq

superimposed on the perfect position as if they really exist in this real reality .One of the major methodologies to the enlistment between the genuine and virtual universes is the vision-based technique [5,6,7].

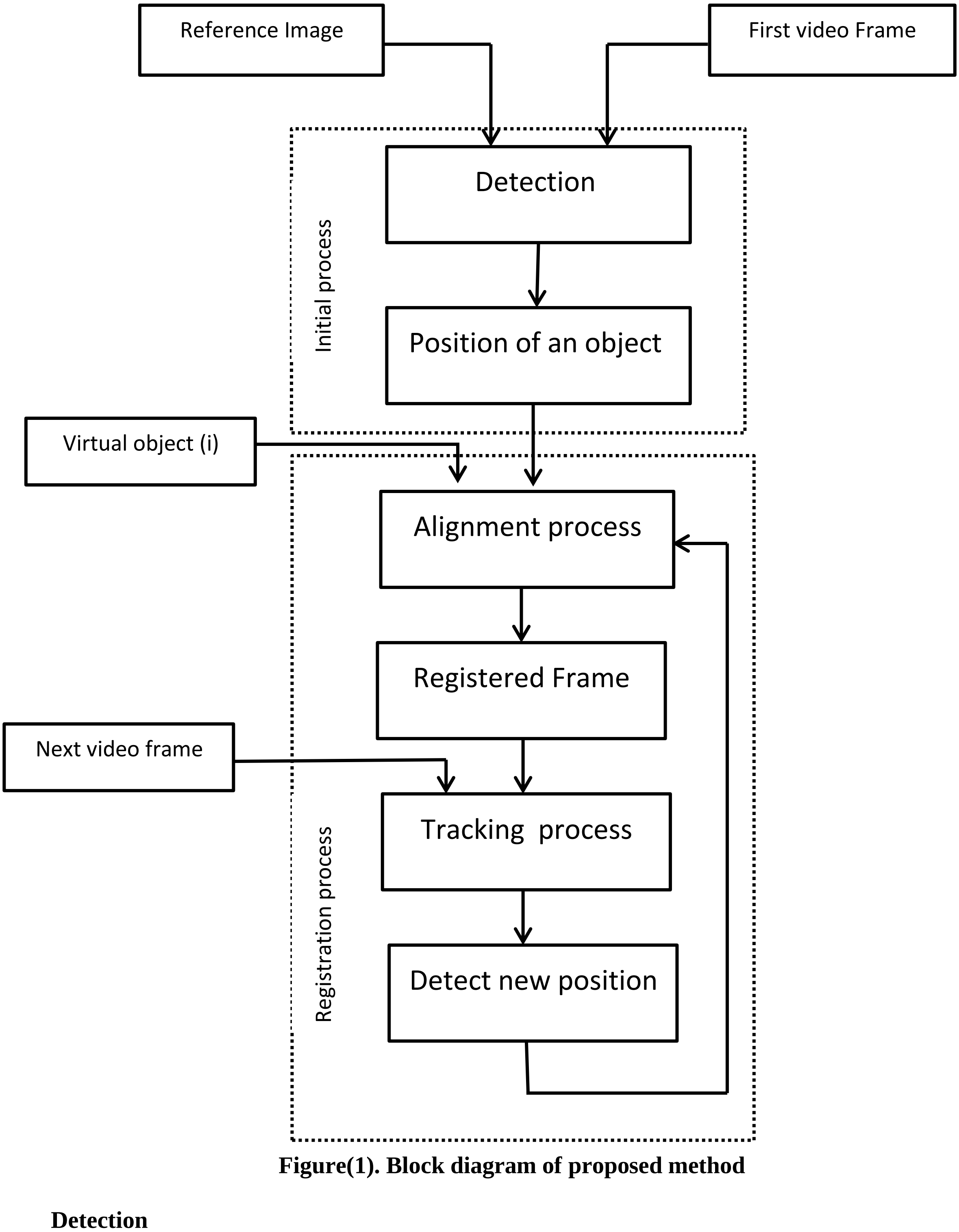
Following techniques are a standout amongst the most essential issues in the field of Augmented Reality (AR). AR systems overlay virtual articles onto this genuine reality to help their client do a development in this genuine reality. A great part of the time, AR systems need to know exact geometric relations between genuine things and clients' audit position to discover virtual articles onto the appropriate position of this genuine reality. Tracking strategies decide these geometric relations. Different tracking techniques have been produced in the field of AR , and it is imperative to choose the proper tracking strategy for the application necessities [8-12].

Related Works

An abundance of exploration, utilizing an assortment of detecting advances, concentrate on tracking and registration for augmented reality applications. Recent tracking systems trying to, solve the, problems of any technology, [1]. A.State [13] produced a hybrid framework with, features based vision and an attractive tracker,. E.Foxlin [14] developed an inertial orientation tracker with three orthogonal rate-gyro sensors. To remedy for the float created by the gyro, information integration. A complementary Kalman Filter performs information combination and blunder remuneration. T.Auer [15] proposed a comparable vision-attractive half and half framework utilizing corners as visual elements. The information from the, attractive tracker is utilized to foresee highlight positions and bound the outcome from the vision, framework., Y.Yokokohji [5] exhibited a hybrid framework joining six straight accelerometers and a vision tracker. The accelerometers anticipate head, movement to, make up for, framework delay and an EKF is utilized for, information registration. L. Duan [16] intrduced a novel feature tracking strategy combining wide and narrow baseline matching techniques for AR systems,. X. Yang [17] presented a hybrid tracking system which combines a visual tracker with an inertial tracker based on an adaptive Kalman filter.

Proposed Registration Method

The proposed method consist of three stages, the first is detection stage (section 3.1),that detect the natural features from frames . This stage utilizes a reference image as an instrument to perceive the object and detect its position . Second stage (Section 3.2) ,that is alignment process of virtual object into video frame in specific position ,that contain several steps (resizing, transformation, blending). Third stage (Section 3.3) ,that is tracking , which track the position and orientation of that object in whole video sequence. Figure 1 shows the block diagram of proposed system.



Figure(1). Block diagram of proposed method

Detection

The detection stage uses a reference image that represent image of an object inside the video frame which uses to imposed the virtual object . In general ,extract features from reference image and video frame uses to detect and recognize the object inside frame .

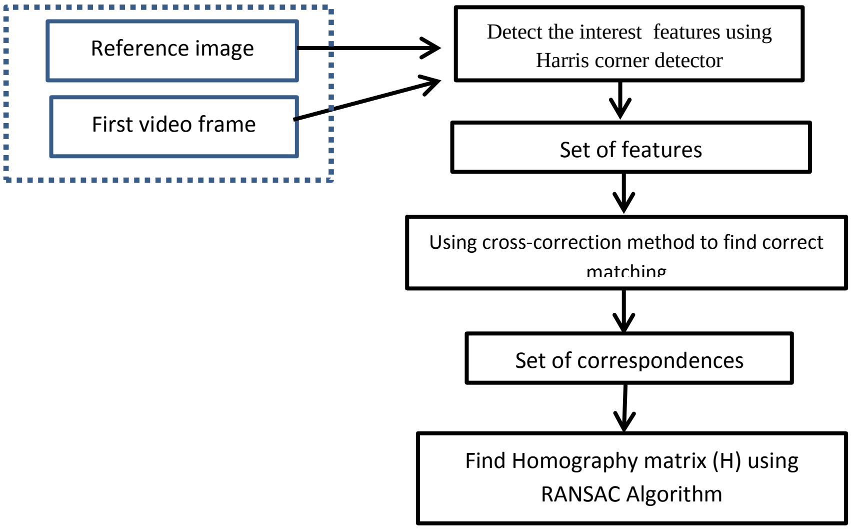
Before registration, two control images are initially chosen to distinguish the component focuses and discover their matches in the two control pictures.. In the, proposed method, the detection method is used the, Harri's Corner Detector to find the feature points,and using the cross-correlation method to find matches between the sets of keypoints. These components focuses will be the reference focuses in the whole expansion process. This gives a set of keypoints in the video frame that are located on the reference image. It also gives correspondences with keypoints in the reference image, which kept so as to have the capacity to compute a homography at each successive frame.

Implementation of RANSAC algorithm is used finally to find a homography between the two sets of keypoints,which used to determine the translation and rotation for the object inside each video frames .From here, this stage passes the Homography matrix(H) to the tracker.

The complete algorithm is described in algorithm 1and figure 2 shows the block diagram of detection process .

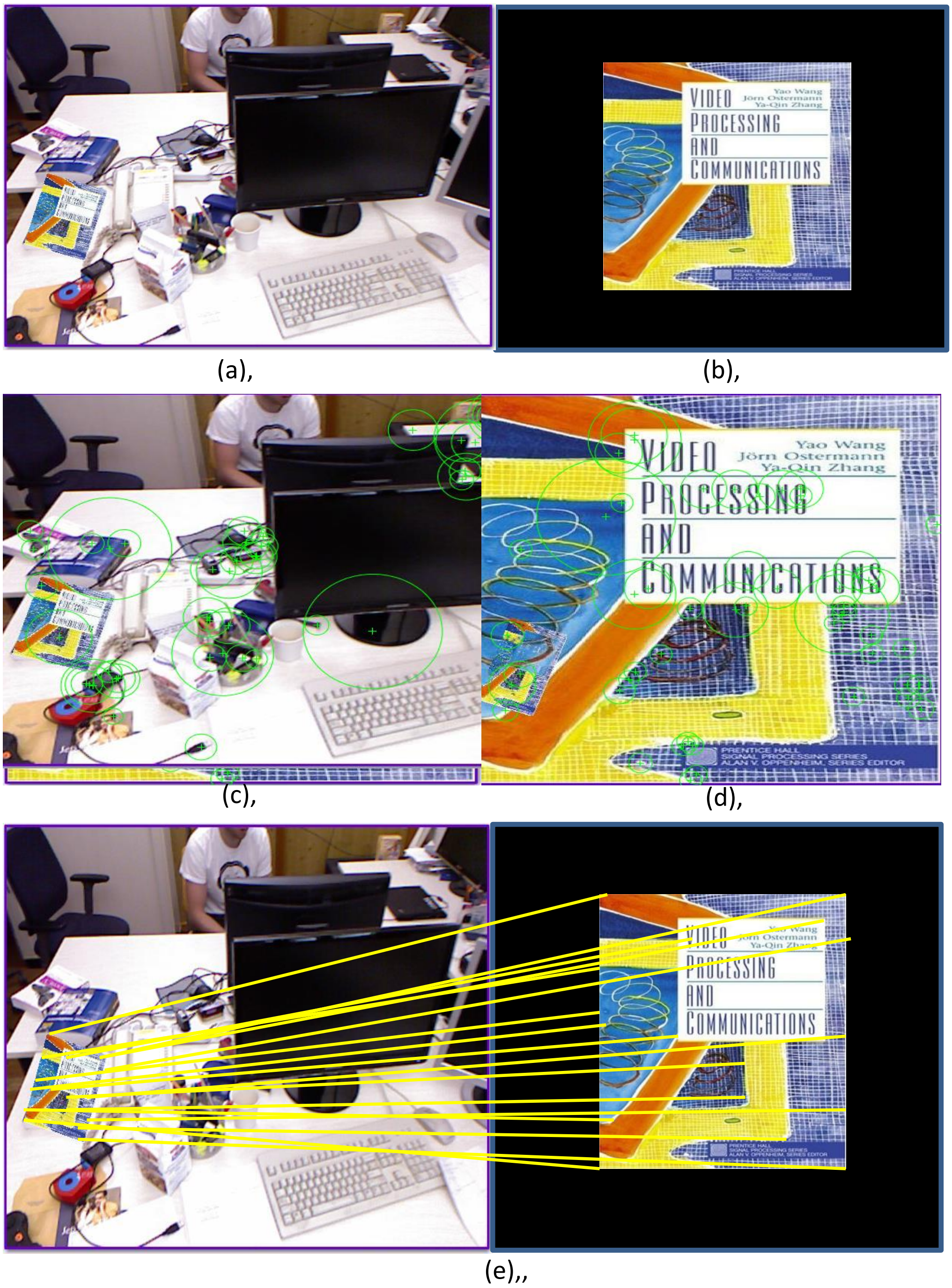
Algorithm (1): Detection Process
Input: Reference Image,First Video Frame.
Output:Homography matrix (H).

Process:
Step 1: Extract interest features from reference Image using Harris Corner Detector,.
Step 2,: From first video frame extract features using Harris Corner Detector,.
Step, 3: use the, cross-correlation measure to find the correspondences between two sets of features
Step 4: Find the homography (H) between two images using the RANSAC algorithm



Figure(2).Block Diagram of Detection Process

Figure 3. shows the phases that the reference image and video frame are passes through it ,where it shows the feature points locations in each image and their matche.

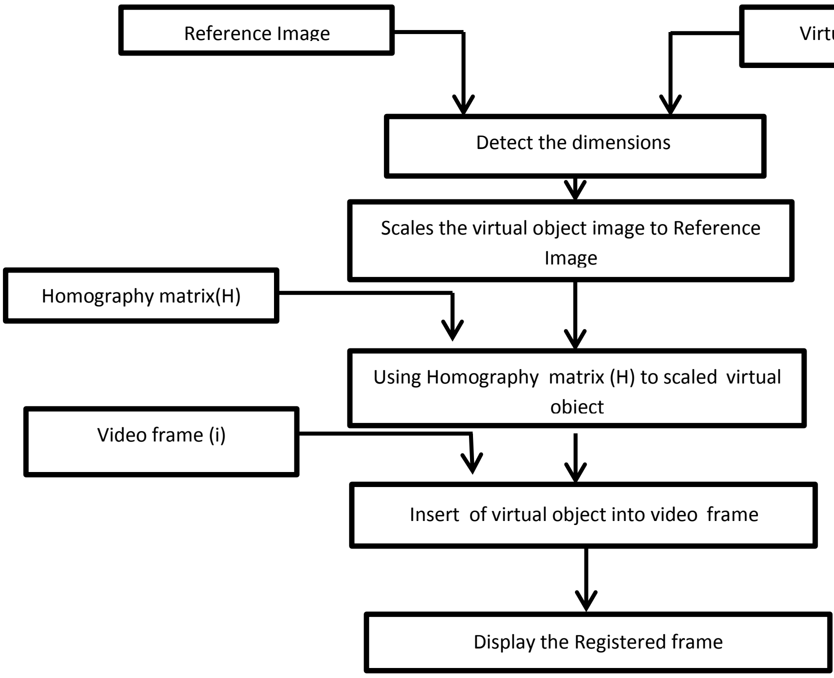


Figure(3). Show the processing in details where, (a) the, camera frame image , (b), the reference image , (c,) corner features in camera frame ,(d) corner features in reference images ,and (e) is the right correspondences between two images.

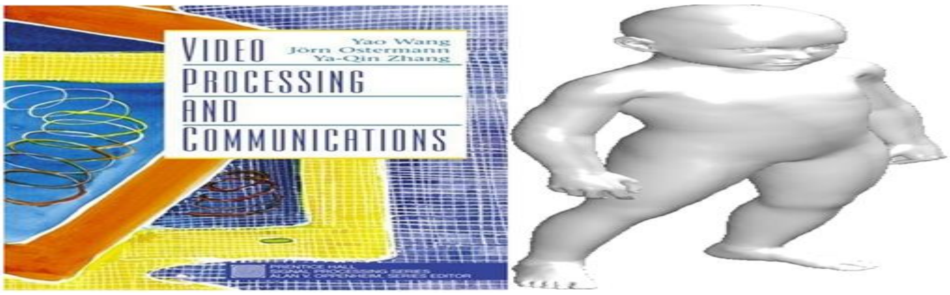
Alignment

This stage work to align virtual object in specific position inside video frame . Virtual objects, inserted and aligned in the video frames sequence by create the appropriate sizes and find best geometric transformation between virtual object image and reference image , and finally insert the virtual object inside video frame . This is accomplished by configuration the size of virtual object image and reference image so that the, size of virtual object image will be equal to size of reference image, then the geometric transformation between virtual image in new size and reference image will be find in order to produced "Virtual Framed Scaled" which used to estimated geometric transformation between video frame and virtual object image and finally , insert transformed virtual image into video frame. This stage in steps is explored in algorithm 2 and figure 4. Figure 5 shows the phases that the virtual object and reference image are passed through the process to produce the registered video frame.

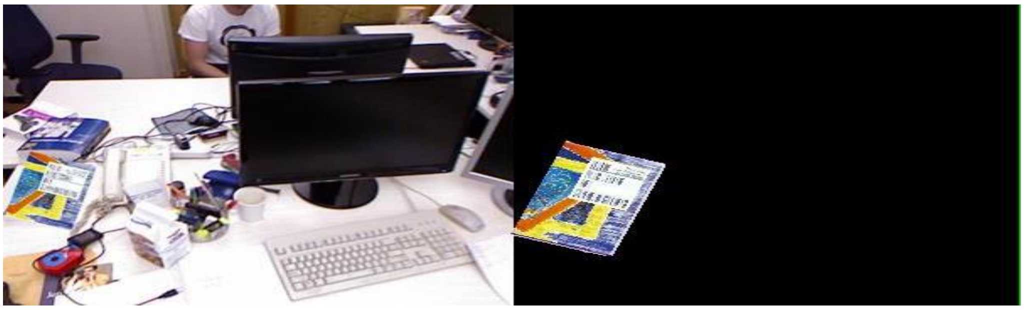
Algorithm (2): Alignment Process Input : Reference Image ,Homography matrix (H),video frames,virtual objects. Output : Registered video frames
Process: Step1: Read virtual object (i). Step2: Get Reference and virtual object images dimensions. Step3:Find transformation that scales the virtual object image to reference image size. Step4:Apply estimated Homography matrix(H) to scaled virtual object image. Step5:Inseret transformed virtual object image into video frame. Step6: Display the registered video frame.



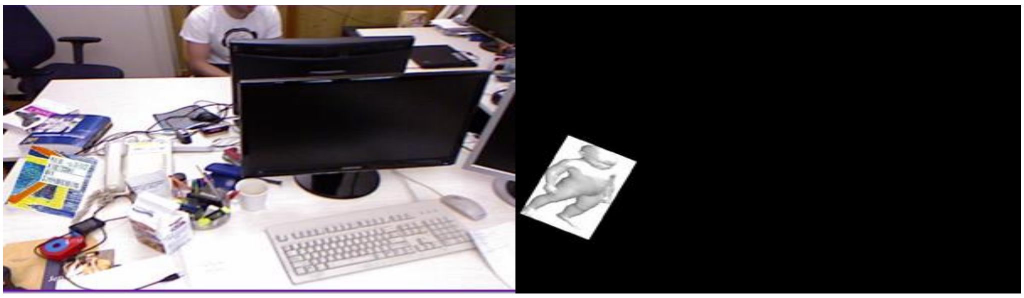
Figure(4).Block Diagram of Alignment process



(a) configuration the size of virtual image and reference image



(b) transform the reference Image to camera frame



(c) transform the virtual image to reference Image

(d) Output image after registration process

Figure (5).The implementation of Alignment process on images

Tracking

In order to tracking the movement of the object in video frames , the KLT algorithm [3] has been used .The main objective of the KLT algorithm is, given two frames from a video and an arrangement of keypoints in the primary frame, discover the positions of those same key focuses in the second frame.

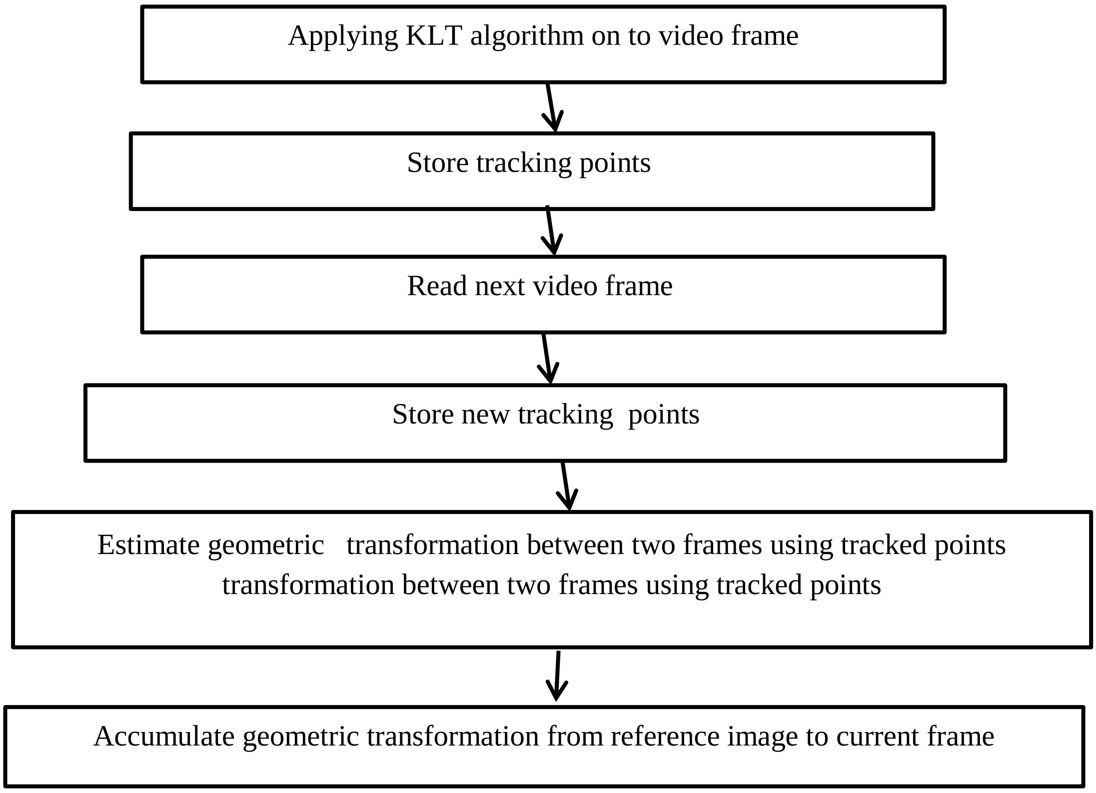
Using the KLT algorithm is only on step of tracking stage where , The main idea is find the points (tracking points) from each two successive video frames using KLT . The tracked points has been used to estimate geometric transformation between two frames in order to, detect the new, position of the object, .After the, new position has been known , the homography matrix between current frame and reference image has been calculated .The tracking stage take two video frames as input and produced a homographu matrix (H) as output.

Algorithm 3 represent the steps of this stage in some details and the figure 6shows the block diagram of process .

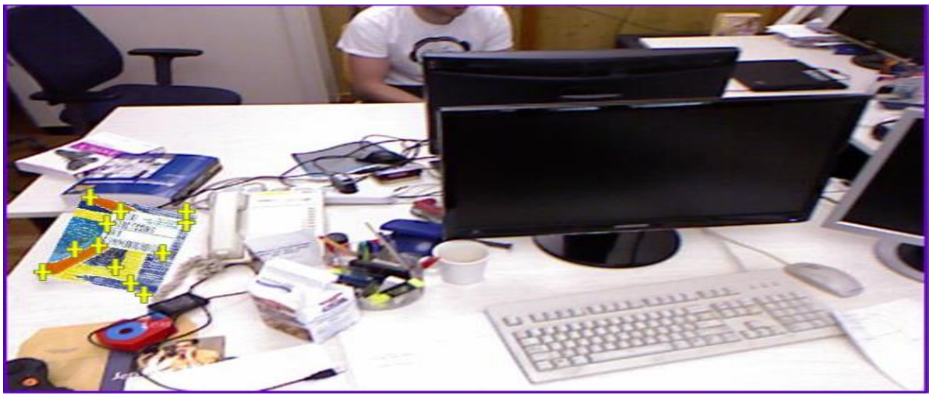
Algorithm (3): Tracking process
Input : Video frames
Output: Homography (H)

Process:

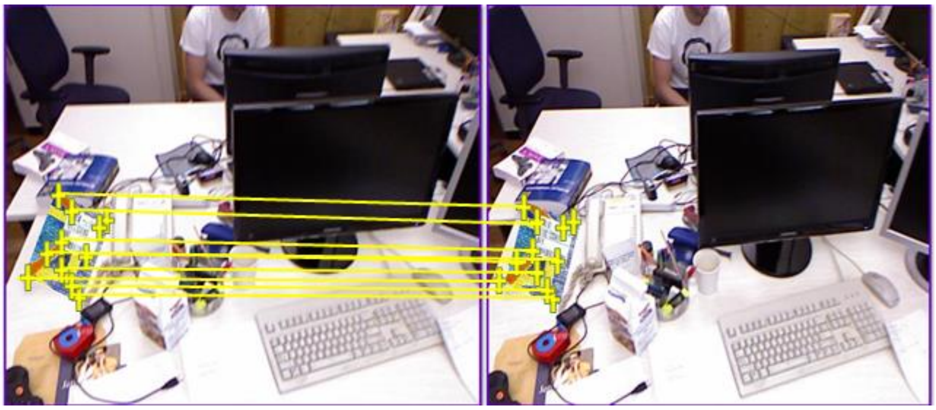
Step 1: Apply KLT algorithm on to video frame (i).
Step 2: Store the tracking points.
Step 3: Read next video frame .
Step 4: Find newly tracked points.
Step 5: Estimate geometric transformation between two frames based on tracked points.
Step 6: Accumulate geometric transformation from reference Image to current frame to produce Homography matrix(H).



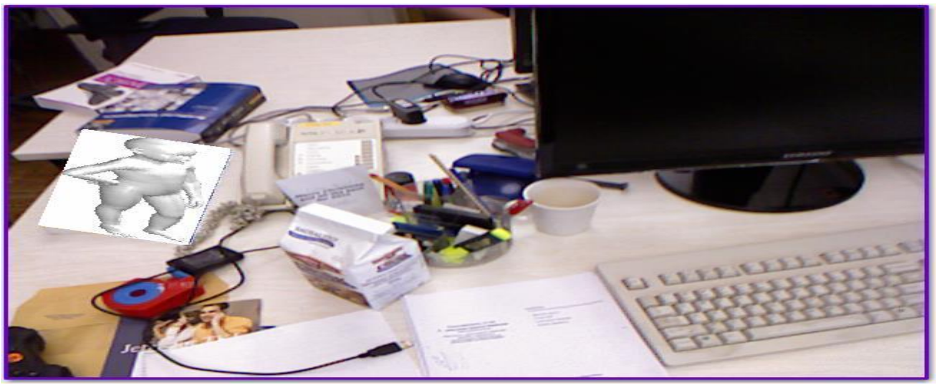
Figure(6).Block Diagram of tracking stage



(a)



(b)



(c)

Figure(7).The images phases of tracking stage

In figure 7 found what that happened to the images in tracking stage ,where in (a) displayed the tracked points inside object in video frame(i), (b) shows the matched points between two sets of tracked points in two successive video frames and (c) displayed the finally registered video frame after inset the virtual object process.

Experimental Results

To implement the proposed method , AR database which have 10 video sequences has been used , each of them have 120 frame with (640x480) resolution .Most registration techniques using Target Registration Error (TRE) to evaluate the quality and performance of these techniques. In this method target registration error and root mean square error has been used to evaluate the accuracy of it . Table 1 explain the results for all video sequences and figure 8 shows some samples of video frames which are used in implementation the method.

Table(1). Experimental results of proposed method

	TRE	RMSE	TIME/Sc
Squence1	0.0037	0.0041	2.5
Squence2	0.0037	00041	2.5
Squence3	0.0067	0.0063	2.3
Squence4	0.0072	00067	2.4
Squence5	0.0038	0.0041	2.5
Squence6	0.0020	0.0032	1.7
Squence7	0.0037	0.0041	2.5
Squence8	0.0037	0.0041	2.5
Squence9	0.0038	0.0041	2.5
Squence10	0.0028	0.0032	1.8

Figure (8). Samples frames of AR database

Comparing with [5] the TRE is decrease from 0.31 to 0.0020 and RMSE decrease from 0.76 to 0.0032 .

CONCLUSION

In this, research, a simple registration method is proposed based on the, feature recognition and tracking strategy in computer vision, and it is helpful for, understanding the augmented, recreation between the, perspectives of a real scene and a virtual item in a image based structure. The method, is effective for augmentation by simply specifying tracking points on which the virtual objects will be superimposed.

The method has achieved robust registration by proposed feature detection algorithm and KLT tracking algorithm and efficient suggested alignment method .

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