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Modern Technology for Image processing and Computer vision -A Review

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A B S T R A C T

This survey outlines the use of computer vision in Image and video processing in multidisciplinary applications; either in academia or industry, which are active in this field. The scope of this paper covers the theoretical and practical aspects in image and video processing in addition of computer vision, from essential research to evolution of application. In this work a various subjects of image processing and computer vision will be demonstrated, these subjects are spanned from the evolution of mobile augmented reality (MAR) applications, to augmented reality under 3D modeling and real time depth imaging, video processing algorithms will be discussed to get higher depth video compression, beside that in the field of mobile platform an automatic computer vision system for citrus fruit has been implemented, where the Bayesian classification with Boundary Growing to detect the text in the video scene. Also the paper illustrates the usability of the handed interactive method to the portable projector based on augmented reality.

Introduction

Augmented reality is the integration of digital Information in the core of virtual reality. Virtual Reality aims to create an artificial specialized Application, (AR) means that we can experience and explore interactively through our sense of Vision. (AR) system is a commixture of real information and computerizes information in a real interactive environment Other researchers say that: (AR) is new computer science field that known as a subfield of the image processing that realize a Mixed Reality (MR) ., many institutions such as such as NASA. US Air Force, and the Massachusetts Institute of Technology, and the University of North Carolina were made their researches on AR topic In the beginning of 2000 AR field start to be independent research scope that shows a diversity of AR systems and I/O devices. Like mobile tablet, smart phones and PCs. Furthermore, there are many applications of AR Range from simple services (e.g. personal assistance, announcement, sailing, and guiding services) to Industrialization, trade, medical, warlike Gaming and educational states .The AR field has two generations the first one is the desktop augmented reality (DAR) and second one is mobile augmented reality (MAR) that connected to the wireless devise such as the smart phones and tablets. Fig1

MAR applications are designed by combining the distributed computing devices such as mobile or the tablet closely with the augmented reality. However, a few issues arise for the MAR designer our goal.

In this survey we investigate the interaction design of AR, Define the Augmented Reality from our view that help the researcher to begin with AR and show the Major Challenges for Augmented Reality Systems. First, we introduce some experiment which may be seeing as unrelated to AR and bush the reader to our concept of AR scope is collection of field that any one can do his research in. Second, view the AR system major design and list examples of some design problem in subsystem. Third, introduce improving AR design system rely on our examples. Finally, report how these techniques [1,2]

improve (AR) application]. Augmented reality has applied in many applications, which are need combination between the real and virtual in real time. The most important entity to the augmented reality is intensive 3D models that is used for smoothing the virtual object of the camera images to close the virtual object more and more from the real scene, in addition of controlling the illumination taken into consideration the shadow and occlusion handling, but these tow point need prior Knowledge about the 3D structure in real scene [3] The importance of 3D model is used in camera model tracking, [4]. Recently, they developed depth cameras, which achieve intense depth measurements that are needed in the realistic AR applications with real time. [5]. Currently, working with 3D models, will create a gap between real models and the 3D model that used in applications, so this paper will try to reduce this gap depending on depth imaging in real time. This part of work can be summarized in three main steps: the first one is to detect the geometric differences between the real model and the 3D model that fetched by depth camera in real time.

The second step, the detected differences are used to Adjust the 3D model to be close the real scene. Whenever the geometric differences that detected is very accurate the adaptation 3d model will be very close to the real one. So they must control the intrinsic and extrinsic parameters carefully [6,7] .

Contributed papers on image and video processing may be focused on particular fields in image and video processing (e.g., augmented regality, video compression, text detection), distinct functionalities and on specific mechanization (e.g. Demystifying, compression, identification, Classification, Detection, and segmentation), within the context of different activity sections(e.g. multimedia, tourism, , robotics, communications, commercial) employing various data formats (e.g. gray scale, multi spectral, 2-D, video, color, stereo, 3-D).

Fig1: The MAR and DAR.

ENHANCEMENT SYSTEM

Image processing enhancement systems face a big challenge in what field and how the researcher can begin? in this paper we will propose six experiments that will be implemented in three main points of view Fig2.first point is the AR field that as we see three of experiments related to AR scope in this field we will start with mobile application based on AR in

Experiment (1) then we will go deeply to enhance the gap between AR and the 3D model in Experiment (2). After that we will focus on using one handed interactive method in the portable projector in Experiment (3). Second point is focused on video scope: on one hand is how to detect the text from multi oriented video Experiment (4) and, decrease the size of the video on another hand, that appeared in Experiment (5) The third point is how to combine the computer vision with image processing to come out with outdoor effective system that using for pre-grading of citrus in Experiments

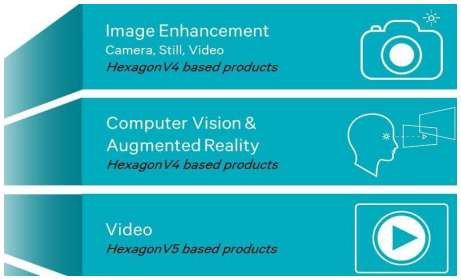

Fig2: The main point of the study

Methodology

Experiment 1

The main purpose of this study is to enhance AR application in the mobile field that serve the users requirements and challenges so we designed and optimized a new system that respond to the upgraded of user demands.

In this experiment we focused on simple approach of enhancing a very useful mobile application by solving the challenges and the problem that faced the users in any application, in this experiment the researchers did a heavy load survey in the best way to design software application for mobile augmented reality MAR by proposing a set of interactive design principles to develop (MAR), which is differ from the desktop augmented reality of depending meanly on real time so MAR application is need to employ either as a guide during the initial stages of the design process or benchmark to assess the performance. Most MAR applications are expand the space for the users to interact with their environment using their smart phones or tablets which are primarily developed in two approaches: the first technology-driven approach is adopting a theoretical viewpoint without depending on the user applications, in this approach designer combine design from related fields such as mobile and distributed computing and augmented reality. The main problem of this approach is ending with an application that can not satisfy the user needed so they designed a good hard work but no one use. The other is the user application approach which depends on the user requirements to design the application [8].

In this experiment the researchers were very careful to proposed design approach which is can pass all the challenges in MAR application that we are summarized them on three main points :the first one that it is real time data retrieval application ,second one is object detection and recognition the third one that it is tracking detection application because of that the researchers are follow group of principles that solve the challenges and problems for interaction application of MAR system in the following brief point about the propose challenge of ***AR Applications.***

The researchers employed the previous principles in comprehensive application that take the results of the study From 33 users experience and usability in addition of excitement fields to have enhanced travel guide application Fig3.based on augmented reality which is differ from others applications with tow point:

The first one that this MAR application is combined between the old literature with a set of very useful properties that enhance the design towards the best in augmented reality environment which is validate the users propositions.

Second one goes beyond an update the most important features of MAR applications by taking the positive points from the user experience and open the gate for updating and enhancement.

CorfuAR travel guide application distinguishes from other MAR applications that pass these challenges:

1- The diversity of MAR design.

One of the most important point that researcher face in their work is the Isolation key of design elements for MAR application , MAR design diversity presented by many approaches such as technology-driven, interaction, solely experimental and theoretical work do not present empirical evidence**.**

2- The diversity of AR application.

There are many applications on AR field that differ in several aspects such that the individual-centric services like personal assistance and navigation to industrial, military, medical, exciting, advertising, and educational field thus it's hard to find single design that combine this diversity of AR application.

3- Combined the content with menus and options.

How the user can work with flexibility with an application organize, and present data in a way that the users can not be overloads from the amount of available information.

4- **MAR applications are highly decentralized**. How the application of MAR can focus in many domains of interest in many scopes which contain search for information scope, real-time information retrieval, information visualization and many scopes that application need Fig2

Fig3: CurfAR

5- the user needs.

It's very difficult for users to express their needs from the technology applications, that they do not know its potential.

6- Small and light weight display size.

Usable interfaces are very sensitive mission, in a small display size, and using the old types of interfaces that users have previous knowledge is not applicable in MAR application.

7- One hand application.

It very important point for the users to use one hand to hold the most AR systems and use the other hand to interact with the application. Such as is using smart phone as MAR in this case the user must hold the phone in one hand we will see more details about this subject on experiment numbers [3].

Experiment (2)

In this experiment the researcher try to minimize as much as they can from the gap that appeared between the augmented reality and the 3D model in the real time by depending meanly on the depth imaging by starting from the idea of AR which is interactive combination between the real objects with virtual objects in the real time, they continued the others works in 3D modeling and exploit the reaches of the depth camera to overcome some drawbacks that faced the researchers in the old work such as the difficulty of setup in the camera which has tow modes of work: colors and depth .

Challenge of work

This methodology is basically try to focus in using the 3D modeling that is needed in enhancement AR so the objects will be very close to real in addition of making the needed updating on the 3D to adapt it with the changes that were done on the tracked scene such as moving or adding another objects in the scene. So they will enhance the system from Fig4.

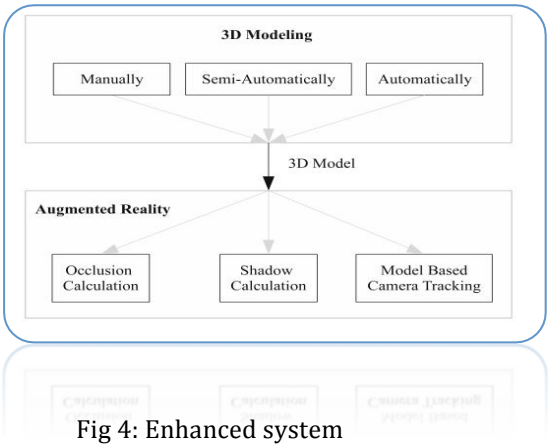

Fig 4: Enhanced system

The 3D models are very important in using the depth camera that because it will give the exact scene on real time so it is better in the mobile devices like UMPCs than the 2D that because using 2D will lead the user to take multiple viewpoints and after that he will face a hard point in the pixels mapping in addition that the 2D camera or the color camera are not accurate because of movement in the object tracking process. Moreover that the creation process of 3D is offline process, which it prevents the changing and adaption of 3D model.

The Proposed Method

The researchers are passed the challenge of the work by presenting these main points:

Detection The system is depended on using the 3D model in AR ,at first step there will be no differences between the real model and the virtual one(3D) that will be captured by camera(Depth camera).Thus they need reconstruction algorithm based on camera movement which will give the differences in the measurements that they must detect which they called the geometric differences and they started from these differences to complete the proposed method [9,10].

Tracking. This process will be after the 3D model reconfiguration or reconstruction stage then the camera start the tracking process which is lead the system to know the user's viewpoint to retrieve and present related virtual content. More accurately, it must know the right position and orientation of the system display in a physical coordinate system with known mapping to a virtual one. The institution of position and orientation parameters is known as tracking.[11,12]

Registration after the Tracking process in 2D phase we need to combine it in real time with depth phase to

start the registration process at coordinate system to achieve accurate registration to the final alignment of real and virtual information which is presented to the user. The Registration process must be made to every pixel accurately at interactive frame rates to preserve the illusion of real and virtual coexisting in the same domain. Fig: (5)

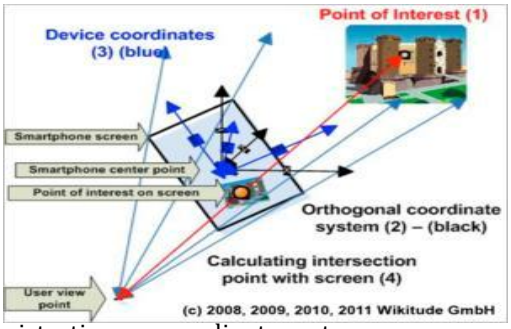

Fig: 5 registration on coordinate system

Camera Calibration

In this paper they use tow type of camera the time and flight camera (depth camera) and the color camera which means that they depended on the measured transformation between them to make the desired adjustment, in addition of focusing on the camera calibration process for the intrinsic parameters such as the (focal length and the principle point) and the extrinsic (translation and rotation) which are played an important role.

Display: AR system must be able to combine a mix of real and non real. The display from this point must allow the user to see the real world overlaid with 3D graphics. It should also be tracked at interactive frame rates.

Real-time systems

The critical system is based on the real time which means that the virtual and real must be synchronized, and the real world "runs" in real time. Therefore, efficient AR systems must be based on real-time performance. Accurate time stamps must be available. Operating systems must not compulsory exchange out the AR software process at any time, for compulsory durations. Systems must be built to guarantee completion within specified time budgets, rather than just "running as fast as possible. Based on the time of flight simulation process [13]. Constructing and debugging real-time systems is often painful and difficult, but the requirements for AR must satisfy the real-time performance.

Quantitative evaluation for this method

Augmented Reality is an area perceptual studies that based on psychophysics. It shows how much is the speed of the user detection process? How much the speed of error detection while moving?

Experiment (3)

In this experiment the researchers are progressed at the level of enhancement in AR to have new application that satisfy one of the viewpoints that We talked about it before This one handed interaction AR application is illustrated how we improve a new software interface in AR. So we can find away to present it in screens, and by years this technology developed and open the chances for many other challenges to appear one of these challenges is how to make this augmentation instantly in the real domain.

In this work we will perform four methods which are Projection curser with explicit click, Projection Curser with Crossing, On-Device Touch Screen with Explicit Click, and On-device touch screen with crossing. The four methods are shown in Fig9.And we will compare between these four methods in experimental based and the result will be how the degree of satisfaction are the people how they submitted to these experiments.

Confusing may happen when we talk about this experiment, we now interesting in the way that we dial with projector not the projector them self. In other way we aim in how users enter their command to the projector.

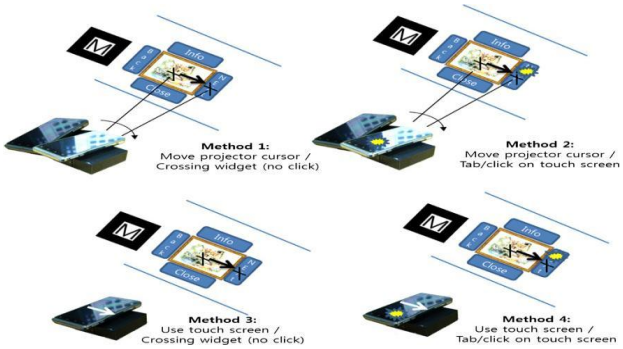

Fig6: Four interaction techniques

Projector-based AR system

The model will contain smart phone, Pico projector by Samsung, and USB camera are assembled together and every day we have a new device that support this idea.

Calibration

The standardization will be done by put a marker to the pose of the projector and by the vision tracker for

the camera, the other factor will adjust manually like the virtual view and thefactor of the display scale as shown in Fig.7.

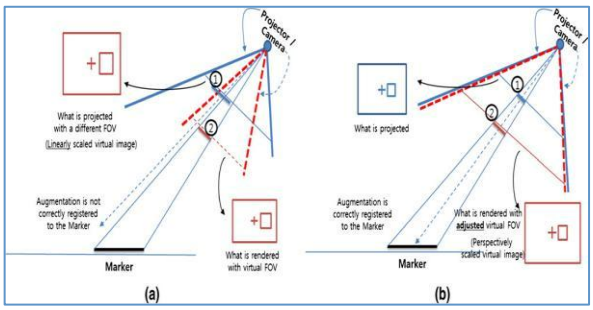

Fig.7: Registration is not correct (a) because of gab between physical and virtual field of view are not calibrated (b) is correct.

CONCLUSIONS

The framework which is implemented in this paper focused in enhancing the newest scope in image processing, augmented reality, where most of the researcher efforts have concentrated in it in the latest years. The AR technology is needed to be more enhanced and developed to exploited this field as much as we can in the updated user applications while the researchers know very little about social issues and what real users demand. The main challenge is to bring AR to one of the most extensive systems. New AR interaction techniques must be developed and evaluated. Most systems presented so far have been spatially restricted to laboratory or small workspace set-ups. Progress in battery and CPU technology made it possible to carry computers powerful enough for AR.Enhancing and development a study and awareness configurations is important for motivating adoption of AR in many workplaces where cables must be avoided. user-based experimentation in AR rarely have evaluation study so addresses this gap by providing formal user studies and empirical data always raise up. The processing capacity of the computational units has increased tremendously, along with transmission bandwidth and memory capacity and speed. This development of technology with increasing the offered of research enabled the transition of augmented reality onto next generation.

As a future work after updating and developing AR system to interact with the real space more we must find new techniques to model the 3D object in all shapes and faces such as the spherical shape and make a new method to adjust the 3D model using by edge stitching, the ultimate goal will be to generate virtual objects that are so realistic that they are virtually indistinguishable from the real environment. Real photo has been demonstrated in newest films, but accomplishing this in an interactive application will be much harder. Lighting conditions, the reflection concepts, and other properties must be measured automatically, in real time. More progressing lighting, texturing, and shading must run at efficient way to rate the future scene generators. to be very accurate in the registration process, without manual interference or enhancing.

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