Use of A* Path finding Algorithm in Augmented Reality – A Case Study

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Abstract

Augmented reality may be defined as the perfect blending of virtual world with the real and rational world. In fact it is the most spectacular scene of technology where the virtual world fuses into the real world. The Android mobile device's possesses excellent penetration properties. Applications of Android can be set up using augmented reality. One of such is a guided tour application where an android device will be able to take a guided tour of a particular area of high importance with the use of Wi-Fi facility. Map is a fundamental representation of any spatial domain .Representation of maps using graphs is a trivial task. In the proposed work the maps are represented as graphs. The A* path finding algorithm is used to traverse the graph to find the path between the source and destination

Keywords: Augmented reality, Android devices, A Algorithm.*

1. Introduction

Technology is advancing at the pace of light. With the advancement of technology men felt the need of virtualising the whole scenario of technology which gave birth to another fascinating seed of modern technology known popularly as "augmented reality". Augmented reality is a marvelous technology fusing the real world with the virtual world in a perfect style of blending the two without losing each other's individuality. Recent developments in the field of augmented reality are remarkable. With the power of augmented reality in hand men got the wings to fly beyond his limits. Augmented reality is an area of computer science research .a very perfect blending of hardware, graphics and software can be witnessed in augmented reality. Augmented reality connects the user to the real world through virtuality giving the user a perfect experience to satisfy visual perception. There are various applications of augmented reality such as: 1. GPS (global positioning) 2. Palm top 3. Smart devices. Thus , the contributions of augmented reality in the field of technology has been revolutionary. Thus as a result of augmented reality users need not have the conception of virtuality to be different from reality as augmented reality stands a bridge between the two thereby displaying its tremendous potential.

2. Literature survey

Augmented reality has addressed a variety of application areas including aircraft cockpit control, assistance in surgery, viewing hidden building . In the last few years, the amount of various mobile devices and their computational power are dramatically increasing (Sharples et al)

2010). According to Azuma et al. (2001), the goal of AR is to use 3D virtual objects as tools to enhance users' perception of, and interaction with, the real world, by causing 3D virtual objects to appear seamlessly within the 3D environment of the real world. However, AR technologies can be designed to interact through many sensory channels (e.g. auditory, visual, olfactory, and haptic) which renders definitions focused only on visual data insufficient to deal with future developments in AR. location based services such as 'Yelp', a website that collects shop and restaurant reviews for cities in North America, Ireland and the UK (Giles, 2009) are limited in their use. High quality audio adds to the immersion of a augmented reality application. [Hrm, 2004] researched the requirements that augmented reality audio needs. In particular, the usage of AR is facilitated because of the innovative characteristics of the last device generation (on-board camera, accelerometers, compass, GPS etc.), combining instantly the preview made by the video camera with the AR information. Using this approach, mobile devices expand the users' perceptions and interaction styles by providing context and location awareness: This work aims in exploiting the features of the mobile phone and the features of the Augmented reality, and also uses the A* algorithm for the tour of a campus.

3. Proposed work

The figure shown is the proposed work. It is based on the application of augmented reality. It is a guided tour application which is based on augmented reality to be supported by android devices. This application focuses its attention to be used in areas of public interests such as Schools, Colleges, Universities, Multinational companies, Industries, Agricultural sector, Government institutions. The model consists of an android device (client module) and a server module connected by a wireless network. The wireless network acts as an intermediate between the client and the server. Thus the proposed work will lay emphasis on virtual mapping of a place to be sent to an android device when it enters a particular area of public interest, provided that the area possesses a wifi connection of optimum speed. Thus when an android device will enter a wifi enabled region of public interest, the wifi will connect to the android device giving it a welcome message to that particular area and assuring that it will provide an accurate guided tour of the particular area (provided the user authenticates its device with the server). After a few seconds the server asks permission of the device to connect to it through the wireless network. After the authentication is over, the server sends the full detailed mapping of the particular area along with various information, which may be useful to the user. Thus the user enjoys this application of augmented reality which fuses virtuality into reality.

The methodology used in this proposed application of Augmented reality is the method of "A* path finding algorithm and the algorithm to convert maps into graphical representation. These methodologies and their concerned algorithm in a systematic way are explained below.

- ❖ A* Path finding Algorithm: It is a systematized algorithm used in the field of computer science for finding the path and also for graph traversal. The algorithm in detail
  - ▪ The starting square is is added to the open list.
  - ▪ Repeat the following
    - ○ We look upon the lowest F cost square at the open list. We refer this as the current square.
      - ▪ Switch it to the closed list.

For each of the 8 squares adjacent to this current square…

If it is not walk able or if it is on the closed list, we ignore it. Otherwise we go for the following.

If it is not on the open list, we add to the open list. We make the current square as the parent of this square. We record F,G,H costs of the square.

- If it is on the open list already, check to see if this path to that square is better by using G cost as the measure. A lower G cost signifies that it is a better path. If so change the parent of the square to the current square and we recalculate the G & F scores of the square. If we are keeping our open list sorted by F score we shall need to resort the list to the account for the change.

  - ▪ Stop when we :
    - ○ Add the target square to the closed list,in which the case path has been found out or when
    - ○ Fail to find the target square, and the open list is empty. This case signifies that there is no path.
  - ▪ We finally save the path. By working backwards from the target square, go from each square to its parent square until we reach the starting square. That is finally our path which we aimed for.

4. Implementation

Android is an open source operating system. Android is an open source project initiated by Google Inc. It is a platform for mobile devices, including the operating system, a Software Development Kit (SDK), an application framework and key applications. Most parts of the Android project are release under the Apache 2.0 open source license. Augmented Reality (AR) blends virtual objects into the real world. The fig.1 represents the overall architecture of the framework. Client module will be deployed in the Android device. The server module is deployed in the server .The medium of communication will be the wireless communication channel.

User interface design: the user interface provides machine & human interactions. It is a platform where the machine & human interactions will take place. In the proposed model stated above the user interface is a digital display of the android device where the user will be able to perceive information and act according

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to the desired process which is being sent by the server. The user will be able to perceive that the server wants its acceptance to carry out the desired process of augmented reality. The user interface will narrow the gap between the human understanding and machine logic. It will exist specifying provided that:

- Inputs exist in order to manipulate the data's
- Output exists to define the server the acceptance level of the user.

The user interface of the proposed model will be connected to the client authentiction.

Fig.1.Overall Architecture

Client authentication: the server will prompt the device urging its authentication so that it connects successfully to the server module for carrying out the particular operation. In this proposed model the server will ask the client for its authentication so that it can connect with it and enjoy the application, the client authentication in the proposed model has a great role in the security aspects. The client authentication is utmost needed so that any other unauthorized member cant access this application. The server asks the client an authentication code for verification. As the client provides the code correctly, the client and the server are being paired but if an unrecognized code is being provided the authentication process will fail for the time being. An attempt can be made by the user only three times for providing the correct code,else the process of authentication will stop for the next 18.00 hours. This is done for high security reasons in places of public interest so that there remains authenticity and security in the area. The client authentication will be the first step towards connecting the android device with the server so that it enjoys the benefit of the application. The client authentication will be connected to the server module via a wireless network which will act as a medium of communication between the client and the server with the user interface.

Wireless network: It is a cable less network which will be connecting the server with the client. Commonly known as wi-fi. Thus in the proposed work the wireless network will play an important role in connection of client with the server.

Fig 2.Design of the proposed model

Server module: The Architecture of the server module is given in fig. 2. It is a pedestal compute module or a software program or a computer on which that program runs providing a specific kind of task or service to the client module. In the proposed model the server module holds a great significance since it is the only which provides as all in all to the client module for using the application of augmented reality. The server module will hold all the information and data required initializing the application and also it will authenticate itself with the client only when the proper code is provided. The sever in this proposed model will contain partial maps with pictures which will be displayed to the client upon initializing itself with the access code. After the authentication is over will correct code the server diverts the signal towards two sectors. They are:

- Source
- Destination

This diversion is for a complete systematic approach towards the use of the application. Whenever the user enters its source and destination the server automatically retrieves its memory in which the partial maps and pictures of the desired source and the destination are being located. Thus finally the server sends its data's to the information retrieval which further focuses on the partial maps and pictures and gives a graphical representation of the source and the destination. Thus the graphical representation will be further processed in the indexing table which contains nodes and each node will be represented by a picture of high clarity. Thus the user interface unit displays the source and destination of that particular place of public interest which the user opted for.

a. Server Module

Authentication module: The architecture of the server module is given in Fig.3. The authentication module will be authenticating the client module with the server module. The authentication is done by using an authenticating code. The authentication is performed due to security reasons so that each and everyone cant access the application. After the authentication process gets over it is being directed towards source destination server.
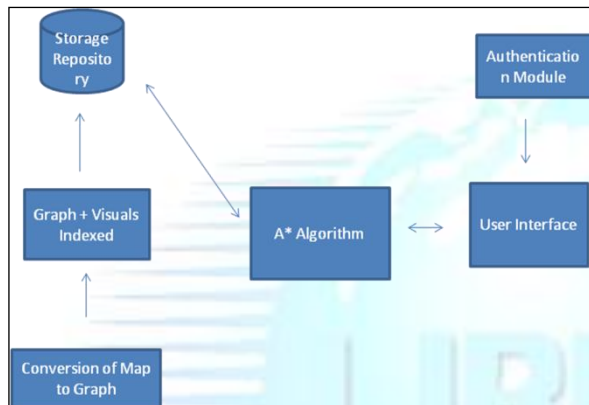

Fig.3. Server Module

Source & destination: The user enters its source and the destination where it wants to go, to the server. Thus the server receives the input from the client and will automatically direct towards the partial map of the place where the user wanted to go.

The server automatically processes the data's given by the user into partial graphs and pictures. The partial maps and the pictures are being converted into graphs and these graphs are processed further and sent back to the server and server sends it to the user interface device to give the user a clear view of the places which was opted for. The information retrieval system uses the a* path finding algorithm for finding the accurate path direction of the source and the destination.

5. Conclusion

Applications of Android can be set up using augmented reality. One of such is a guided tour application where an android device will be able to take a guided tour of a particular area of high importance with the use of Wi-Fi facility. Map is a fundamental representation of any spatial domain .Representation of maps using graphs is a trivial task. In the proposed work the maps were represented as graphs and the A* algorithm was used to find the path between the source and destination. The

future work would be to in clued video files embedded in the graph instead of still photographs for navigation with in a site.

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