

Virtual Pinboard - A Method for Displaying Information using Web Based Augmented Reality on Smartphones

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Abstract

A pin board is also known as a bulletin board or notice board. It is a surface that facilitates the addition and removal of messages and is used for posting important dates, projects, schedules, important announcements and public messages, for example, to advertise items wanted or for sale, announce events, or to provide information. Generally made of materials like cork, rubber or foam, pin boards are widely used in universities, corporate workspaces, local shops, cafes and at many sports and cultural events. The beauty of the pin board is its simplicity and versatility. Augmented reality (AR) and virtual reality (VR) are technologies that have seen a lot of progress in the past decade and are continuing to rise in popularity. Their applications are now found in almost all the fields and more devices are built with AR/VR support. Considering the global pandemic situation and the processing capability of current smartphones, we propose a way of contactless display of information virtually using augmented reality on handheld devices (Smartphone and tablets). Virtual pin boards can be used in numerous places, for example in schools, universities, workplaces, homes, fairs, tourist locations and crime scenes, etc., as a means to display information.

Keywords: *augmented reality; Smartphone; pin boards; virtual reality*

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Introduction

This paper proposes a way of implementing virtual pinboards using web based augmented reality. There is a rise in the number of devices and applications that support and provide AR/VR capability. Users would only require a smartphone with a browser that supports augmented reality functionality with camera access. Virtual inboards are versatile and easy to implement and, therefore, can be used in numerous scenarios. For example, in a university, workspace or apartment, a user logged in to our platform will be able to view public virtual pinboards based on the location of the device, or a simple QR code can be scanned by anyone, which will output a link, with which they can access a specific pinboard at that location, or a private virtual pinboard created by an individual user can be viewed by that user alone in any location. The possible uses are virtually endless. These virtual pinboards can be used to display content-rich and interactive information in a way that was never possible before. It also saves the cost of having to purchase physical pinboards and can also be used in places where it would be impossible to have physical pinboards due to space constraints or other reasons.

QR codes and links will be our beginning point. We use QR codes for the following reasons:

- They can be used to represent links.
- They can be easily scanned by smartphones.

Additionally, location data may be used as a measure to restrict the access to the pinboards only to certain areas.

Though marker based systems have their uses [1] and can be used on mobile platforms to display information, they can be restrictive in some ways and also require more processing power. Thus we take an approach that uses links, QR codes and/or location data in order to display information in a manner that is convenient to users. We identify the bottlenecks and account for any pitfalls, and identify ways to overcome them.

Related Work

A huge amount of scientific literature and research work exists on Augmented Reality [2] and its applications. Augmented reality provides several possibilities and advantages in various sectors like manufacturing, retail, marketing, education and much more. There is a vast development from the increasing adoption of AR on smartphones to wearables like head-mounted devices. Augmented reality can be used for object recognition and tracking, exploring virtual worlds, games, navigation, etc. Huge advancements in processing power of computing devices has enabled the use of compact and powerful processors in handheld devices, like smartphones and tablets, head mounted displays (e.g. glasses) and gaming devices. We choose to develop this application for smartphones as there are more than 3.7 billion people who use smartphones worldwide and smartphones are becoming ever more capable of handling tasks that require greater processing and graphical power. Studies on implementing augmented reality using smartphones study the performance, networking capability, graphics stats and other factors. Considering the wide use of information boards and the advantage virtual pinboards can have in multiple scenarios, we propose a system that

is able to implement the same, using markerless augmented reality with the help of just a link or QR code.

Problem Statement

Our goal with this project is to create a platform where users can interact with virtual pinboards using Augmented Reality. The only requirement is to have a smartphone with a web browser that supports AR functionality. Virtual pinboards can be pinned anywhere in the user's surroundings. Users can see, and interact with the pinboards using smartphones, tablets or smart glasses. Virtual pinboards can also be shared with the users' social media contacts for collaborative use, making it a unique platform to implement pinboards.

We believe that having a virtual pinboard would be very helpful to people. Given the current global pandemic situation this project will be able to aid in contactless project planning and other tasks where pinboards, bulletin boards and other such physical boards are used.

Proposed System

The basic feature of our application would be to overlay the camera output with a pinboard which consists of text, images and other content. Our implementation uses a markerless approach for augmented reality where a link would be enough to access any pinboard. QR codes can be used to store the link addresses. Upon scanning the QR code any user would be able to access the link which can be opened in a web browser. Using a markerless approach gives the user more freedom and also ensures better quality in rendering and also requires less processing power than marker based approach. Further details will be elaborated in the following sections

a. System Architecture:

The system resembles a client server architecture. The user's web browser is the client and the backend application runs on the server. All of the data and application logic is stored on the server. The server responds to client's requests by interacting with the database and sending the appropriate content. On receiving the requested content, the client's web browser stores it in the cache. Once camera access is enabled, just pointing the camera to a surface and tapping the screen will result in the pinboard being rendered in real time in camera feed on the screen. Any changes or modifications made by the user will periodically be communicated asynchronously to the server, and will be saved on the database. An overview of the working is depicted in Figure.4(a). The detailed description of the request-response mechanism is shown in Figure.4(b).

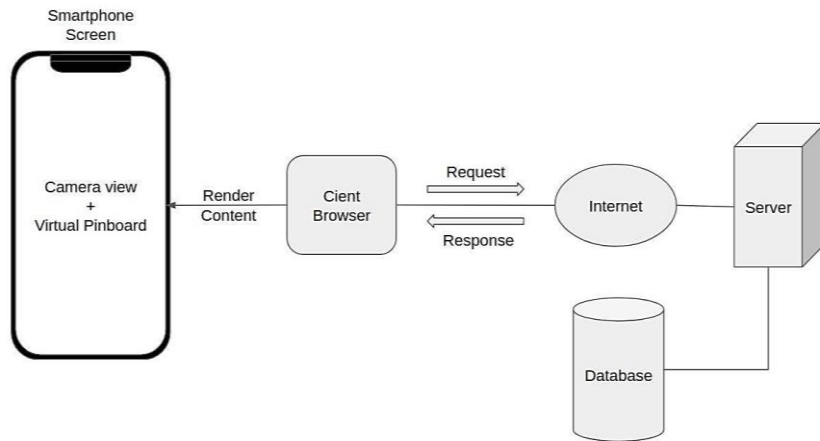


Figure.4(a). Basic Overview

Breaking down the client side, there are five main functions. First, the client needs the right link in order to access any pinboard. Pinboards can be private or public. A private pinboard would only be visible to the individual who created it and therefore can be accessed through his/her account on the platform. Public pinboards, on the other hand, can be accessed by anyone who has the link. We will focus on the implementation and working of public pinboards henceforth. Therefore, we will use QR codes as the first step through which users can access a public pinboard. Most smartphones can scan QR codes and links can be opened in the browser. Thus, generating and scanning QR codes becomes part of the client side functionality. Next, the browser requests the user for camera and location access. Simultaneously, the browser sends a HTTP request to the server requesting for the appropriate content. The fourth responsibility of the client side application is to cache the content received from the server and to render it. And finally, any changes or actions by users will be asynchronously updated to the server.

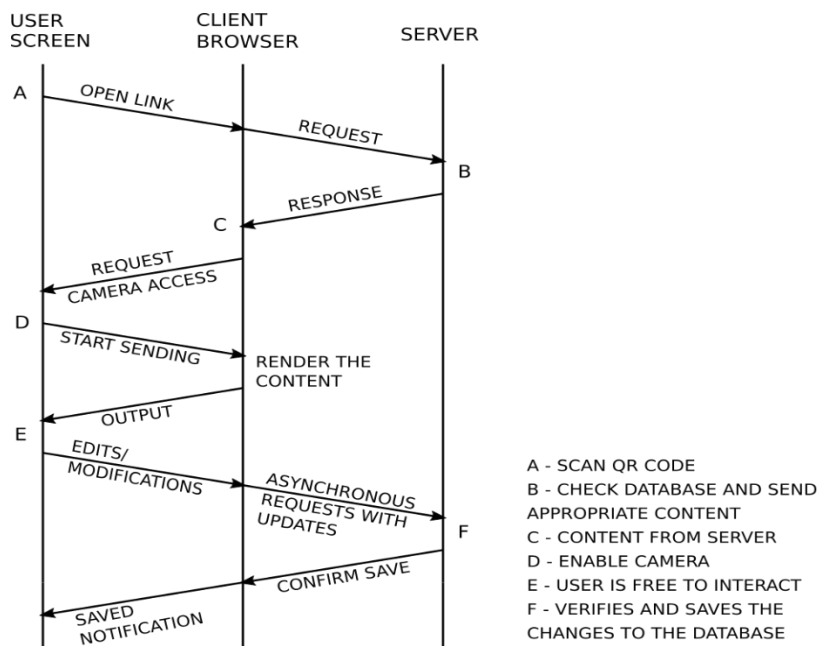


Figure.4(b). Working Mechanism

The server performs the following tasks: Responding to the client requests; Authenticating users; Verifying users' location based on their IP address to check if they are in the vicinity of the pinboard; Storing data and user information in the database. The server has a simple architecture that runs on Node.js which is a fast and highly scalable JavaScript framework. The owners of pinboards can make any changes in the appearance, accessibility and content. These additions, modifications or deletions are the administrative privileges that are offered to users. The server application will reside on Google Cloud Platform.

b. Implementation Methodology:

Since our application is web based, we use JavaScript frameworks and libraries on the client side for scanning QR codes and rendering AR content through the web browser (three.js & webXR API). On the server side, we use node.js along with SQL database. And we use frameworks for generating QR codes and for location verification (IP Geolocation API) using browser IP address.

The AR-Pinboards will be created with default attributes. Then, users will be able to change the AR-Pinboard attributes like name of the AR-Pinboard, view or modify access to the pinboard, Privacy of the pinboard as public or private, pinboard features, such as size, shape, color, border, etc.

The steps to create and use a new AR-Pinboard will be:

- Select create new pinboard
- User has to aim the smartphone to the place where he/she wants the AR-Pinboard to be (anchor position).
- Tap the screen.
- The AR-Pinboard will remain fixed on its anchor position, and now start inserting items to the new AR-Pinboard.
- The user can then add items and notes to the pinboard and interact and keep it private or share it as required.

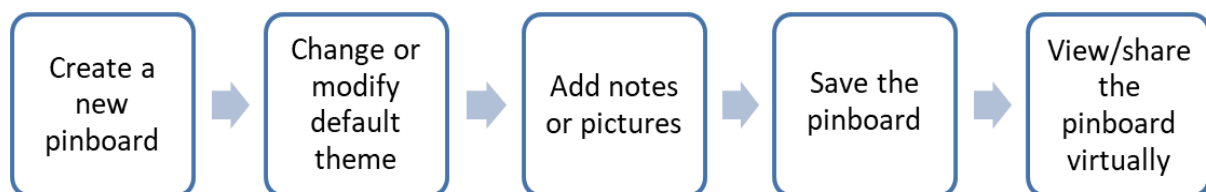


Figure 4(c). Flow diagram of steps to create and use AR Pinboard

Result

The result shows that pinboards can be pinned to any surface. We observed that greater processing power results in a smoother and faster experience.

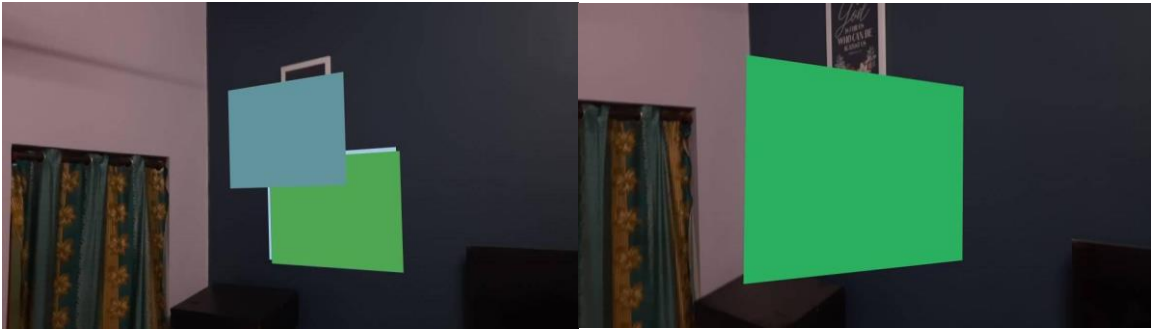


Fig 5(a). Pinboard in mid-air

Fig 5(b). Pinboards on the wall



Fig 5(c). Pinboards of different sizes

Fig 5(d). Pinboard attached to a table

Figures 5(a), 5(b), 5(c), and 5(d) represent some of the different types of pinboards and scenarios where they can be used.

Conclusion

The system we have proposed to implement virtual pinboards can be used to pin text notes, photos, and freehand drawings in a dynamic manner combines the ease of use and versatility of physical pinboards on a virtual platform. We use QR codes and links as a starting point using which content can be obtained. Once the content is received from the server any interactions and changes made by the user are communicated asynchronously by the client browser. This ensures a smooth, uninterrupted user experience. Pinboards can be pinned anywhere, this gives the user freedom in setting and adjusting the position in a convenient manner. Since the application is web based, it can be easily accessed by users having a smartphone with a web browser. We implement the server on Google Cloud Platform for ease of setting up the server and access to analytics. Virtual pinboards can be used for various applications to: Easily attach information to items in a store, museum, gallery, crime scene, etc; Notice boards, bulletin boards in schools and universities; Treasure hunts for children and/or adults; Show location information for tourist tours; Family scrapbook that children can easily update remotely while they are on holidays; Leave messages to visitors.

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