Public Libraries Leading the Way

VR Hackfest

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We built the future of the Internet…today!

The eLibrary team at the Palo Alto City Library held a VR Hackfest weaving together multiple emerging technologies into a single workshop. During the event, participants had hands-on experience building VR scenes, which were loaded to a Raspberry Pi and published online using the Distributed Web. Throughout the day, participants discussed how these technologies might change our lives, for good and for ill. And afterward, an exhibit showcasing the participants' VR scenes was placed at our Mitchell Park branch to stir further conversation.

MULTIPLE EMERGING TECHNOLOGIES EXPLORED

The workshop was largely focused around the A-Frame code, a framework for publishing 3D scenes to the web (https://aframe.io/). However, we also integrated a number of other technologies, including a Raspberry Pi, QR codes, a Twitter-bot, and the Inter-Planetary File System (IPFS), which is a distributed web technology.

Virtual Reality Built With A-Frame Code

In the VR Hackfest, participants first learned how to use A-Frame code to render 3D scenes that can be experienced through a web browser or VR headset.

A-Frame is a new framework that web publishers and 3D designers can use to design web sites, games and 3D art. A-Frame is an extension of HTML, the code used to build web pages. Anyone who is familiar with HTML will pick up A-Frame very quickly, but it is simple enough even for beginners.

For example, here is some raw A-Frame code:

```
<!doctype HTML>
<html>
    <head>
        <script src="https://aframe.io/releases/0.9.1/aframe.min.js"></script>
    </head>
    <body style='margin: 0px; overflow: hidden;'>
      <a-scene>
        <a-box position="0 1 -2" rotation="0 45 45" scale="1 1 1" color="blue">
        </a-box>
      </a-scene>
    </body>
</html>
```

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Figure 1. Try this code example! https://tinyurl.com/IPFSVR02.

Save the above code as an HTML file and open it with a WebVR compatible browser like Chrome and you will then see a blue cube in the center of your screen. By just changing the values of a few parameters, novice coders can easily change the shape, size, color and location of primitive 3D objects, add 3D backgrounds and more.

Advanced users can also insert JavaScript code to make the 3D scenes more interesting. For example, in the workshop, we provided JavaScript that animated a 3D robot head (see figure 1) pre-loaded into the CodePen (https://codepen.io) interface for quicker editing and iteration.

The Inter-Planetary File System (IPFS)

The collection of 3D scenes created in the VR Hackfest was published to the Internet using the Inter-Planetary File System (IPFS), an open source distributed web technology originally created in Palo Alto by Protocol Labs in 2014 and now actively improved by a global network of software developers.

IPFS allows anyone to publish to the Internet without a server, through a peer-to-peer network that can also work seamlessly with the regular Internet through HTTP "gateways". In November 2019, Brave Browser (https://brave.com) became the first to offer seamless IPFS integration, capable of spawning its own background process or daemon that can upload and download to IPFS content on the fly without the need for an HTTP gateway or separate browser extension installation.

Unlike p2p technologies such as BitTorrent, IPFS is best suited for distributing small files available for long periods of time rather than the quick distribution of large files over a short period of time. This is an oversimplification of what is really happening behind the scenes (part of the magic involves content-addressable storage and asynchronous communication methods based on pub/sub messaging, to name a few) but the ability to share and publish 3D environments and 3D objects in a way that can instantly scale to meet demand could have far reaching consequences for future technologies like augmented reality.

Figure 2. Workshop attendees.

IPFS can load content much faster, more securely (through features like automated cryptographic hash checking), and allows people to publish directly to the Internet without the need of a third-party host. Google, Facebook, and Amazon Web Services need not apply.

The same technology has already been used to overcome censorship efforts by governments, but like any technology it has its downsides. Content on IPFS is essentially permanent, allowing free speech to flourish but it could also make undesirable content, like hate speech or child pornography, all but impossible to control.

Toward 21st Century Literacy

Like our other technology programs, the VR Hackfest was designed to engage customers around new forms of literacy, particularly around understanding code and thinking critically about emerging communication technologies.

In 2019, we are already seeing how technologies like machine learning and social media are impacting social relations, politics and the economy. It is no longer enough to know how to read and write code that underlies the web. True literacy must also understand how these technologies interface with each other and how they impact people and society.

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Figure 3. The free-standing exhibit.

HTTPS://DOI.ORG/10.6017/ITAL.V38I4.11877

To this end, the VR Hackfest sought to take participants on a journey, both technological but also sociological. Once the initial practice with the code was completed, we moved on to a discussion of the consequences for using these technologies. With the distributed web, for example, we explored questions like:

- What are the implications for permanent content on the web which no one can take down?
- What power do gatekeepers like the government and private companies have over our online speech?
- What does a 3D web look like and how will that change how we communicate, tell stories and learn?

After the workshop ended, we continued the conversation with the public through an exhibit placed at our Mitchell Park branch (see figure 3). In this exhibit, we showcased the VR scenes participants had created and introduced the technologies underlying them. But we also asked people to reflect on the future of the Internet and to share their thoughts by posting on the exhibit itself.

Public comments reflected the current discourse around the Internet. Responses (see figure 5) were generally positive—most of our customers mentioned better download speeds or other efficiency increases but a few also highlighted online privacy and safety improvements. We recorded an equal number of pessimistic and technical responses to the same question, these often demonstrated either knowledge of similar technology (e.g. "how is this different than Napster?") or displeasure with the current state of the world wide web (e.g. "less human connections" or "more spyware and less freedom").

OUTCOMES

One surprise outcome was that our project reached the attention of the developers of IPFS, who happen to live a few blocks away from the library. After reading about the exhibit online, their whole team visited our team at the library. In fact, one of their team turned out to be a former child customer of our library!

The workshop itself, which was featured as a summer reading program activity, also brought in record numbers. Originally open to 20 participants and later expanded to 30, the workshop grew a waitlist that more than quadrupled our initial room capacity. Clearly, people were interested in learning about these two emerging technologies.

We also want to take a moment to highlight the number of design iterations this project went through before making its way into the public eye. The free-standing VR Hackfest exhibit was originally conceived as a wall mounted computer kiosk that encouraged users to publish a short message directly to the web with IPFS, but this raised too many privacy concerns and ultimately our building design does not make mounting a computer on the wall an easy task. Our workshop also initially focused much more on command line skills working directly with IPFS, but user testing with library staff showed learning A-frame was more than enough.

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Figure 4. Building the exhibit.

HTTPS://DOI.ORG/10.6017/ITAL.V38I4.11877

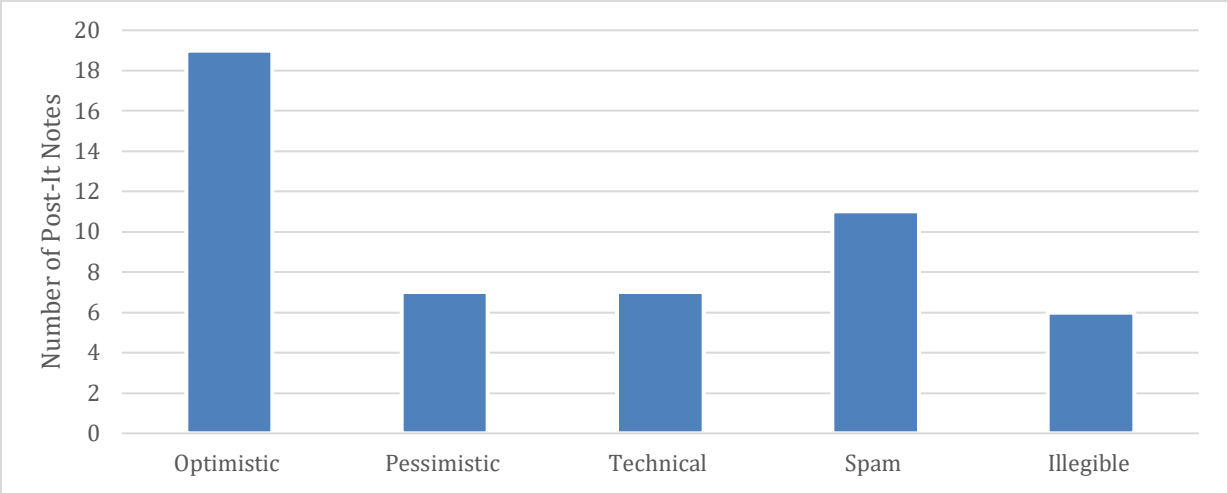

Figure 5. Exhibit responses.

Figure 6. Visit from Protocol Labs Co-Founders.

The VR Hackfest was also a win because it combined so many different skills into a single project. We were not only working with open source tools and highlighting new technologies, but also building an experience for workshop attendees and showcasing their work to thousands of people.

Future Work

Our immediate plans include re-use of the exhibit frame for future public technology showcases and offering another round of VR Hackfest workshops, perhaps in a smaller group so participants have the chance to view their work while wearing a VR headset.

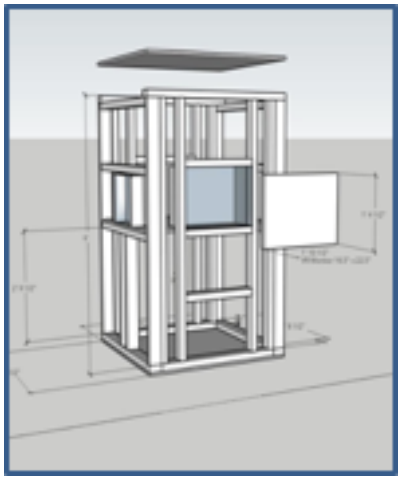

Figure 7. 3D Mock-up.

Beyond this, we also think libraries have the opportunity to harness the distributed web for digital collections, potentially undercutting the cost of alternative content delivery networks or file hosting services. Through this project we have already tested things like embedded IPFS links in MARC records and building a 3D object library. Essentially, all the pieces of the "future web" are already here and it is just a matter of time before all modern web browsers offer native support for these new technologies.

In general, our project demonstrated the popularity of 21st-century literacy programs. But it also demonstrated the significant technical difficulties of conducting cutting edge technology workshops in public libraries. Clearly, the demand is there, and our library will continue to strive to re-imagine library services.

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