ARTICLE

Implementing Library Maker Projects Outside of the Makerspace

A Case Study

Monica Maceli

ABSTRACT

The popularity and relevance of the library makerspace has been well-established and documented in the previous decade of researcher and practitioner work, including numerous hands-on guides from a variety of dimensions relevant to starting and operating a makerspace. Less studied, however, and the focus of this work are the applications of maker technologies within wider library work. Prior qualitative research conducted by the author included interviews with librarians to understand and document their use of maker technologies, such as the Raspberry Pi single-board computer, to support broader library work outside of the makerspace. The findings indicated that common use cases included running library display screens and collecting patron traffic numbers and environmental data. The objective of this subsequent case study is to examine the potential for wider use of such projects by librarians in an academic library setting, by introducing these projects into a new library setting and assessing the related code and educational materials developed by the researcher. This work reports on the findings of the case study, in which the projects were successfully operated in several usage contexts, as well as the challenges and broader implications for adoption within libraries of all types.

INTRODUCTION

Library makerspaces have become a well-established community offering over the past decade, driving libraries to tackle space, supplies, programming, staff education, and other issues in support of such relatively novel services. These, and other relevant dimensions, have been extensively studied in the scholarly literature in this area. An understudied aspect, however, and the focus of this work are the potential uses of maker technologies, such as single-board computers and microcontrollers, more broadly within libraries and not simply confined to the makerspace.

Prior work by the author explored the research questions of how and why librarians have used maker technologies (such as the Raspberry Pi and Arduino) in projects outside of the makerspace, and what were the successes and challenges of these projects?[1] Within this previous research study, 12 librarians who had created such maker projects were recruited to participate in semistructured interviews. The interviews aimed to better our understanding of the possibilities for such projects, as well as common use cases, challenges, and successes. Participants in this earlier study expressed that they highly valued the creative, low cost, and malleable nature of these maker technologies. These librarians' maker projects had included: displaying digital signage, hosting online public access catalog (OPAC) stations, tallying reference desk interactions, counting patrons at the gate, and monitoring 3-D printing statistics, among others. Though

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participants also encountered technical and organizational challenges in their use, there was a clear enthusiasm around these technologies, though the initial hype seems to have faded across the library community more generally. Participants relayed a potential series of benefits to librarians and library staff were these technologies to become more widely used. These included: having greater control over our data, software, and hardware; opportunities to connect with other professional colleagues; and gaining personal satisfaction from creating a working project.

This prior research study led to the researcher developing a collection of technical guides to give other librarians and library staff the inspiration and knowledge to implement the most popular of these projects in their libraries. Appendices A and B include examples of two of these technical guides, which are oriented towards novice technologists.

The work presented in this paper builds on this prior research by taking a case study approach, in which these guides are used to implement maker projects within an academic library, to test and improve the projects for wider use. Thus, the research questions explored here are*: How feasible is it for libraries to implement such projects using the technical guides created? And what successes and barriers may be encountered?*

BACKGROUND

Low-cost single-board computers and microcontrollers popular with tinkerers and educators, such as the Raspberry Pi and Arduino, have a myriad of potential uses and are a common supply found in makerspaces.[2] Due to their inherent flexibility and accessibility to both technical and nontechnical users, these devices have been creatively employed in implementing library-based projects. These library projects largely fall into three categories: 1) inexpensive desktop computer replacement, 2) facilitating data collection and analysis, and 3) a means to increase patron engagement with library services and materials.

In the first category of use, the Raspberry Pi has been extensively used in library scenarios that require cheap, portable computers. Common library uses in this realm include: hosting information displays and kiosks, running online public access catalog (OPAC) terminals, and self-checkout stations.[3] The ease of connecting various sensors and actuators (for example, to drive wheels or motors), allowed for further experimental and data-driven projects using Raspberry Pi and/or Arduino. Robotic projects have included a wheeled robot to automate the monitoring of book locations and one to guide patrons to book locations within the library.[4]

Sensors were used in novel ways, such as to collect and visualize library noise levels and to gauge library seat occupancy levels.[5] Sensors were also employed to enhance traditional data collection and assessment within an RFID-based Tap In/Tap Out tool which facilitated voluntary collection of visitors' demographic data useful to assessment efforts and to aid in reference statistics collection, and gate counting.[6] Aiming to bring together numerous data sources, Jason Griffey's Measure the Future project sought to create a data collection, analysis, and visualization platform for library metrics, running on a Raspberry Pi.[7]

Other Raspberry Pi and Arduino projects have aimed to bring visibility to library initiatives and enhance patron engagement with materials and exhibits. Such projects include the interactive poemBot project, a Raspberry Pi–based system that printed poetry onto receipts, intended to raise awareness of physical computing and the public poetry initiative at the University of Idaho Library.[8] Gallant and Denzer used Arduino devices to create a digital manuscript exhibit that played prerecorded audio when touched by the viewer.[9] And during reference interviews, Kubat employed dual screens driven by a Raspberry Pi to allow patrons to more easily view and engage with the information presented during the reference interaction.[10]

To provide library digital resources in areas without internet, the LibraryBox project originally used a Raspberry Pi as the basis for a portable, anonymous file sharing device which allows users to wirelessly connect.[11] Similarly, LaRochelle and Dobbins-Bucklad deployed offline Wi-Fi educational servers, which consisted of Raspberry Pi devices preloaded with educational websites' content, in geographic areas lacking internet access.[12]

RESEARCH STUDY DESIGN

The case study took place at Pratt Institute Libraries, the academic library system of Pratt Institute. One librarian served as the main point of contact for the study and was asked to select and implement one or more of the common projects documented in the GitHub repository employing maker technologies identified from prior research.[13] Further details regarding the choice of projects implemented will be covered in the subsequent Results section. The researcher provided all necessary hardware to complete the selected projects, with the exception of large display screens, which were already in the library's possession. Initial data at the start of the case study was collected through a combination of methods including a beginning survey and an interview to gauge the participant's knowledge, skills, attitudes towards, and experience with maker technologies.

The librarian participant was asked to implement and operate the projects for a period of approximately eight weeks, all of which took place during the institution's spring semester. Within that timeframe, periodic interviews took place, with the first being approximately four weeks after implementation of the maker projects and the last being upon conclusion of the study period at the eight-week mark. While operating the projects, the participant was asked to document any interactions and time spent on the projects in a Google Sheets diary that was accessible to both the participant and researcher. Data collected through the survey, interviews, and diary keeping was analyzed using qualitative methods, employing a thematic analysis approach.

RESULTS

The primary participant in the case study held the role of User Experience Librarian at the main branch of the academic library. The participant was between 18 and 40 years old and held MSIS and MFA degrees. The initial demographic survey and interview questioned the participant's interests and prior experiences with maker technologies, as well as their broader thoughts on the role, benefits, and challenges of such technologies in wider librarianship.

Though the participant was aware of a range of maker-related technologies and techniques, they were most familiar on a hands-on level with scripting languages and single-board computers. The participant had become interested in the Raspberry Pi specifically during their undergraduate study and had a long-standing interest in microcontrollers and single-board computers, derived from their personal projects in gaming, digital arts, and makerspaces. The participant had gained the necessary skills and knowledge to work with such technologies through reading forums and documentation online, particularly from the Raspberry Pi foundation, and using user-generated guides.

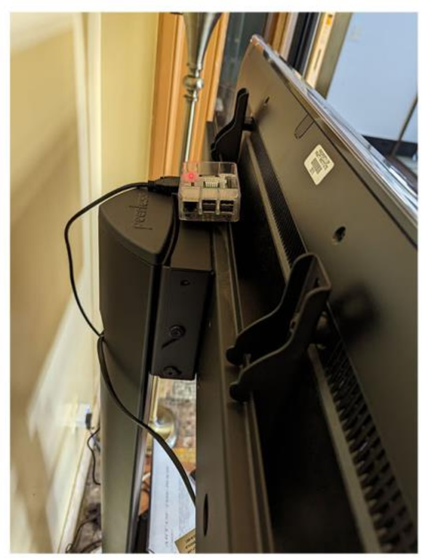
Though the participant's library system did not have a makerspace, they believed that such technologies offer benefits within broader library work, stating that "They [creators] fully understand what they're doing and they have full control over it. And as a result, they can create a more custom solution to the problem." However, they acknowledged that a lack of technical literacy, especially around the Linux operating system and command line, could pose barriers to librarians seeking to work with such technologies.

Project Selection

The academic library in this case study has two locations able to host the projects being tested: the main campus library and a second, smaller library on another campus. The participant reported that they had chosen two projects to implement using multiple Raspberry Pi devices. First, two devices using the Anthias digital signage platform for Raspberry Pi software would be placed in both library locations. Second, two devices with OPAC stations would be set up in the main campus library.[14] The Anthias digital signage platform was formerly known as Screenly, and the interface continues to be branded as such in older versions and was referred to as Screenly by the participant throughout the study data.[15] The participant chose the digital display project as a possible replacement for an existing display system in use at the library. The OPAC station project was chosen to add more public access machines to existing public spaces in the library.

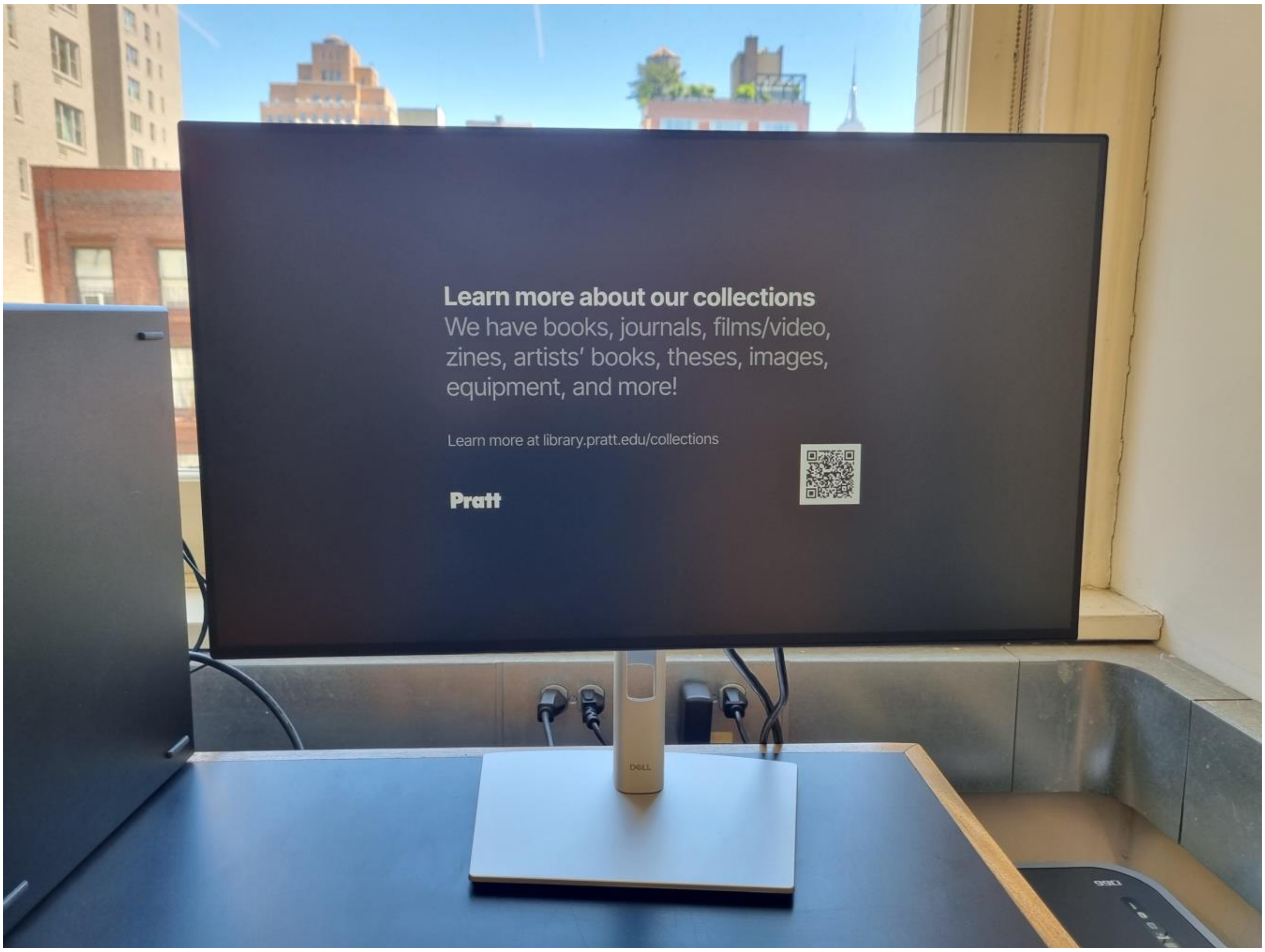
On the main campus library, the digital signage project was implemented using a Raspberry Pi connected to a large HD television on the second floor near the reading room. It displayed a slideshow of evergreen slides, developed by the participant, that highlighted core services and includes links and contact information in QR codes (see fig. 1). The two OPAC stations were set up in an existing location used for patron desktop computer usage and included Raspberry Pi devices, monitors, keyboards, and mice.

Figure 1. One of the implemented digital displays at the main campus library (left) and a close-up of the Raspberry Pi device running the display (right).



In the second location, the digital signage Raspberry Pi project was placed in a conference room of the library (see fig. 2). It was connected to a smaller monitor and displayed content managed by the access services coordinator at this location. The primary participant provided support as needed.

Figure 2. The implemented digital display at the second library location.



The participant stated there was immediate administrative support and enthusiasm for these projects, stating that "the director was excited to experiment with these tools and encouraged me to set them up." The library director followed projects with interest during the study and reported a technical issue in the early weeks of their operation.

Interviews were conducted with the participant at in the fourth and eighth weeks. All interviews used a similar semistructured series of questions to record the participant's experience, thoughts, and comments on implementing and running the projects. The participant was also asked to note each time they interacted with the project(s) with an entry in a Google Sheets diary log with the approximate time taken for each interaction and a brief description of the interaction.

Week Four Interview

At the four-week point, the participant had found both projects to be generally easy to set up and get online and provided a few suggestions as to how to helpfully expand on the documentation in the GitHub repository. The participant was impressed with the Screenly software used, praising its user interface and ability to be used by nontechnical colleagues, as well as the possibility for the device to serve as a Wi-Fi access point. The participant had run into challenges with the newest version of the digital display software failing to run on the Raspberry Pi and had been forced to roll back to a prior functional version. The participant also noted an intermittent problem with the digital displays losing the HDMI output, which would resolve upon restarting the Raspberry Pi.

Technical issues had also emerged early in the OPAC station project. The Raspberry Pi 3B+ device was likely underpowered for the role, and the browser it ran was observed to be sometimes unresponsive to user interactions. The participant also identified a need to investigate browser plugins to ensure that the machines were restricted to the library's catalog and website. Because of these problems, and because supply chain issues prevented replacing the devices with higher-powered Raspberry Pi 4 models, the participant chose to take the OPAC devices offline and to run the two digital displays only through the remainder of the study.

After four weeks, the diary log showed that the bulk of the participant's time was spent on the initial device setup and troubleshooting. The participant provided support to others operating the Raspberry Pi–based systems and trained one additional staff member to add content to the display screen using the web-based interface. Additionally, the participant advocated for these systems in conversations with administrators, interested faculty librarians, and other nontechnical staff. The participant spent just over four hours on the project in the first month; however, the participant stated that these early time estimates were likely too low, and may have been closer to five to six hours of work.

Final Week 8 Interview

The diary log for the second half of the project documented that smaller amounts of time had been spent monitoring the function of running devices, troubleshooting issues, and providing support to the librarian at the second campus library. As the study progressed, much less time had been spent on the project. Generally, all that was required were quick checks to ensure the system was running smoothly. "At least three days a week, I will glance at the device and mentally note that it's still running."

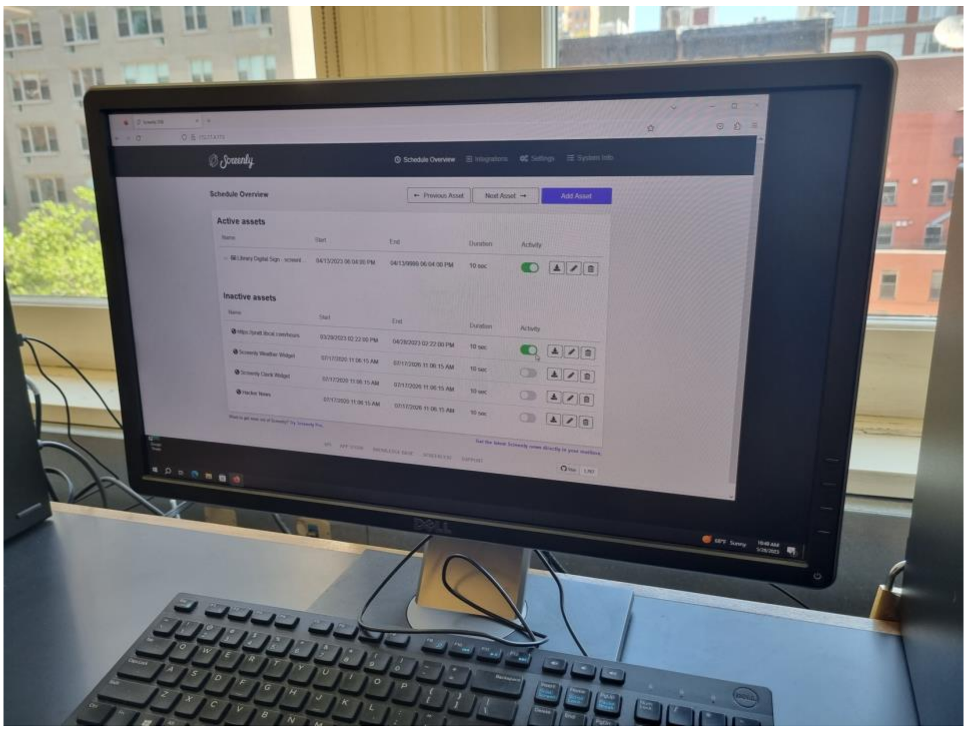
The participant reported that in the final four weeks of the projects, several successes in the projects had been fully realized, including improved content management, a better user experience, and stable operation of the devices. The digital signage software provided a user-friendly interface (see fig. 3) that the participant and other staff considered to be much more efficient and easier to use than the tool used by the wider organization. The participant reported that tasks such as updating content and integrating live web content, in particular, were easy to implement with a few clicks. The technical issues reported by the participant in the first interview had been largely resolved, and the devices were reported to be stable and running continuously for extended periods of time.

When asked about the overall challenges that had emerged during the study period, the participant referred again to several technical issues that had emerged throughout the course of the project, the OPAC station performance issues, as well as problems running the most recent version of Screenly. Though the participant investigated both issues in depth, they did not have enough time available to come to a resolution on either outstanding issue. They did feel that given more time to investigate the issues and the higher-powered Raspberry Pi models, the OPAC station project could still be of interest and use to the library.

Lastly, the participant was asked whether they anticipated running the digital display projects past the end of the study period, responding:

> "Absolutely.... In particular, this software, I think, is very easy to get up and running, and the content is still good and relevant. So I'm happy to just let it roll, you know. And hopefully, a student will pass by and see some relevant information."

Figure 3. The Screenly web interface, used by the access services coordinator to add content to the digital display at the second library location.



In total, twelve diary log entries were created during the study, with the estimated total time spent interacting with the projects being five hours and 50 minutes. Per the earlier interview, however, this is likely an undercount of the earlier setup/troubleshooting time by several hours. The total time spent on the projects was likely closer to eight hours.

DISCUSSION

The goals of this study were to improve understanding of the use and feasibility of Raspberry Pi and maker technologies by librarians in an academic library setting, and to identify best practices and challenges in the implementation and use of Raspberry Pi technology in libraries outside of the makerspace. The research questions were 1) How feasible is it for libraries to implement such projects using the technical guides created? and 2) What benefits and barriers may be encountered?

It is clear, from both this study and prior research on similar projects, that popular projects such as the digital display are both useful and feasible for libraries to implement.[16] As the participant emphasized, the open-source digital display software was relatively easy to implement and required little maintenance. During the second month of operation of the digital display, the participant noted that the amount of time taken up by the projects was “no more than 30 minutes, I would say, and mostly it's just been checking in order to make sure that it was still running and being pleased that it was okay.”

Both digital displays and OPAC stations are commonly found in libraries of all types and sizes, thus replacing or expanding these with an inexpensive, available device is a straightforward option that may be easily advocated for with library administration. The digital display project is likely the most novice friendly of such projects. Some of the more creative and technically challenging projects may be harder for novice users to plan and execute on. Even for the digital display project, the technical guides need revision to make the installation and maintenance of the system easier.

For tech-savvy users, technical issues may be overcome eventually if given enough time. The reality, however, is that a sufficient amount of time may not be dedicated to such projects, particularly when they are perceived as “additional” to one’s main responsibilities. When a roadblock is encountered, for example the bugs in a new version of the display-hosting software in this case study, the project may need to be abandoned, temporarily or longer term. This is a downside common with, but not exclusive to, open-source software development. It may be the case that despite a library enthusiastically implementing and using the devices, technical issues can lead to projects being abandoned entirely.

Both projects emphasize the interest in and feasibility of using maker devices as a low-cost, flexible way to replace or augment existing library technology. At the conclusion of this research study, the digital displays were still running at the main library location. Though these displays ultimately did not replace the commercial products in use, they allowed the library to add new displays in areas of the space that would otherwise be lacking.

To lower this technical and inspirational barrier, this work also sought to create and improve educational materials in this realm, for use by the librarian audience. Several suggestions for the GitHub guides, such as more background information on the Raspberry Pi setup, will be included in subsequent versions of the guides. There is a clear need for community work and collaboration on such education materials. Horton’s 2019 survey of librarians and library staff working in makerspaces or with maker technologies found a strong desire for makerspace-related training and education. Of particular relevance to this research study is the finding that approximately 17% percent of respondents did not work directly in a makerspace, but worked with typical maker technologies, such as 3-D printers, Arduino, Raspberry Pi, and others.[17] This finding, along with the many creative and useful projects discussed earlier, provides clear evidence that such maker technologies are not and need not be limited to or useful only within a makerspace context. Horton emphasizes that “There is a lot of opportunity in creating training and professional development in the area of makerspaces and their technologies.”[18]

This case study indicates a path forward in creating educational opportunities focused on library maker projects that integrate seamlessly and obviously into current library technical offerings. As familiarity and technical competency with these maker devices develops over time, the more complex projects may become feasible for a wider swath of libraries and a greater number of practitioners will be involved in innovating other useful applications for such tools within libraries. Future research in this area will continue to develop a shared repository for these projects' code and instructions, as well as widen knowledge of such resources' availability.

Limitations

As this case study took place in an academic library setting, it may not be entirely generalizable to other types of libraries or library settings. The case study focused on only one participant, who served as a liaison with other librarians interacting directly or indirectly with the projects. As discussed earlier, the participant came into the study with a pre-existing interest and baseline skill set in these technologies. However, this tends to mirror the typical real-life scenario (as documented in the prior research study) where there may be a sole librarian advocating for and running such projects within any given organization, turning to external web-based resources and forums for assistance when needed.[19] The difficulties with the OPAC project, in particular, make it clear that some of these projects may simply not be feasible for true novices to implement.

CONCLUSION

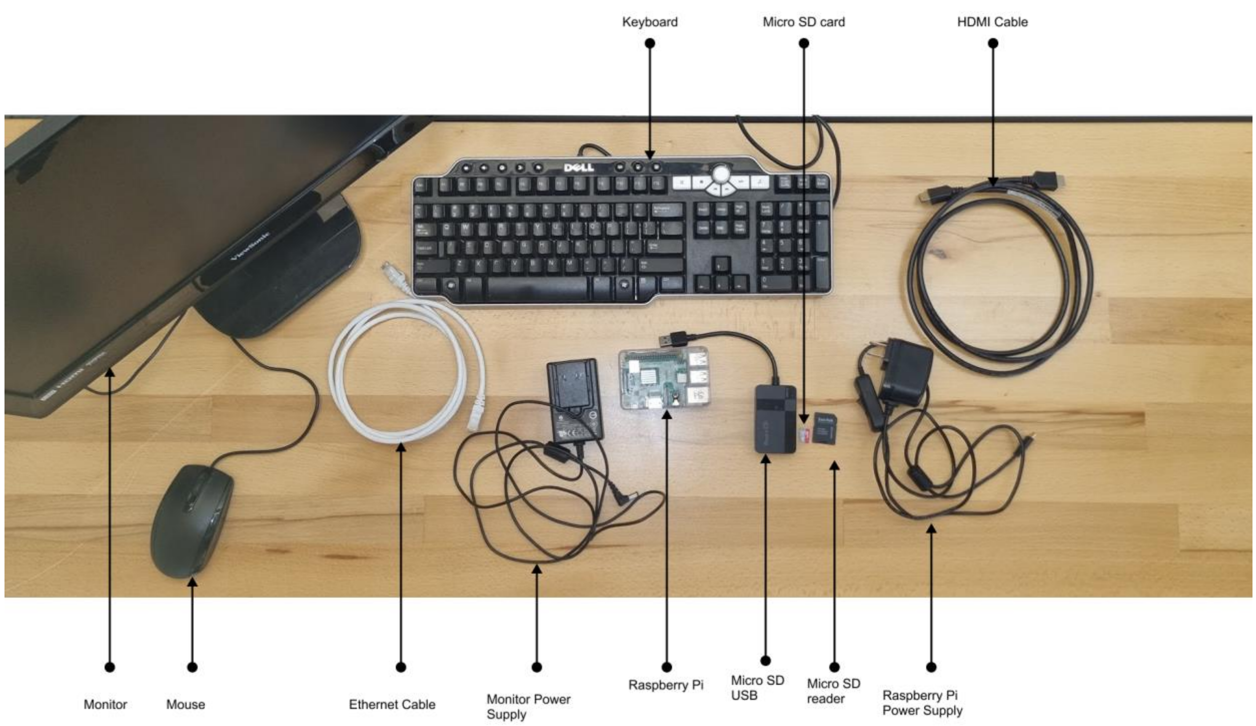
Prior research work collected and documented popular maker technology projects that have been implemented in libraries, in applications outside of the makerspace. The aim of this follow-up case study was to explore the feasibility of implementing such projects by librarians in an academic library environment. This was achieved by introducing these projects into a new library setting and evaluating the accompanying code and educational materials created by the researcher. The study presents the results of this investigation, in which digital displays and OPAC stations were implemented using the Raspberry Pi single-board computer, a common makerspace device. This work demonstrated the interest and applicability of these projects within libraries, though technical issues and challenges emerged. Future work will continue to improve the educational materials provided based on participant feedback. That will include expanding the tutorial to include more basic information about the Raspberry Pi and its setup, as well as revisions to correct the technical issues encountered by the participant, such as the poor performance of the Chromium browser. Lastly, future publications and presentations by the researcher will endeavor to broaden awareness of the potential applications of such devices in libraries.

APPENDIX A: DIGITAL SIGNAGE WITH RASPBERRY PI

Screenly Open Source Edition (OSE) is a free digital signage software that runs on the Raspberry Pi. These instructions are also available on GitHub at https://github.com/prattpi/piprojects4libraries and may include updates from after this article was published.

Equipment

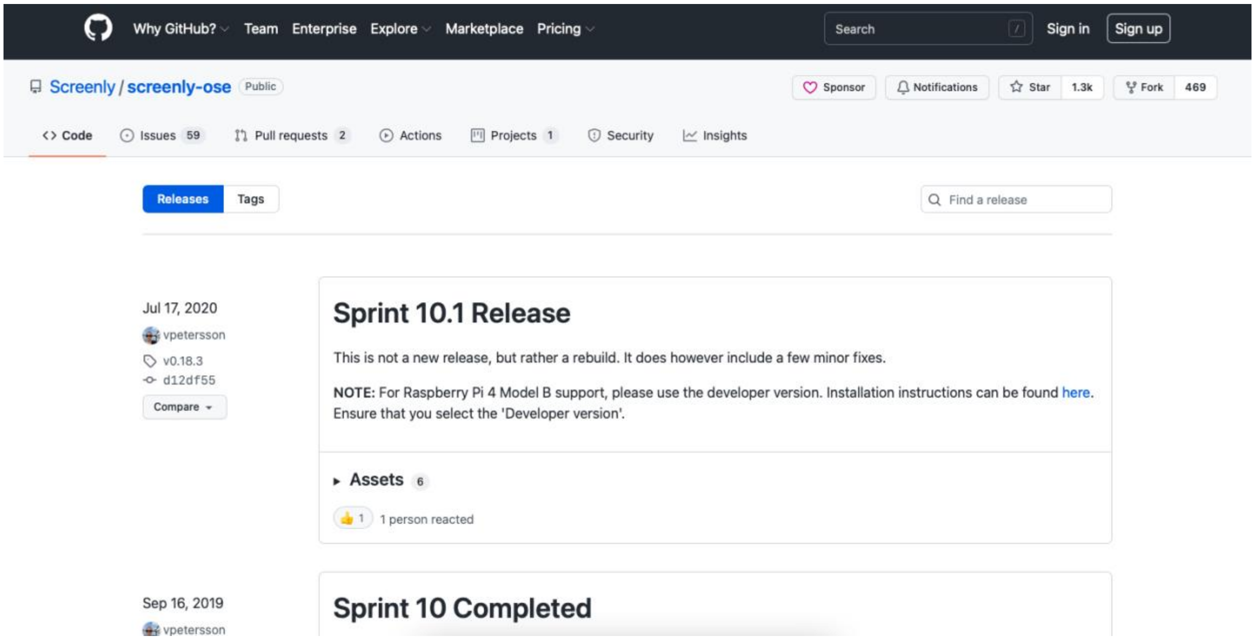
- Raspberry Pi
- Raspberry Pi power supply
- Raspberry Pi Imager
- Secondary computer
- SD card
- SD card reader
- HDMI cable
- Ethernet cable
- Monitor
- Mouse
- Keyboard



Labeled equipment necessary to create the digital signage project.

Setting Up Screenly OSE

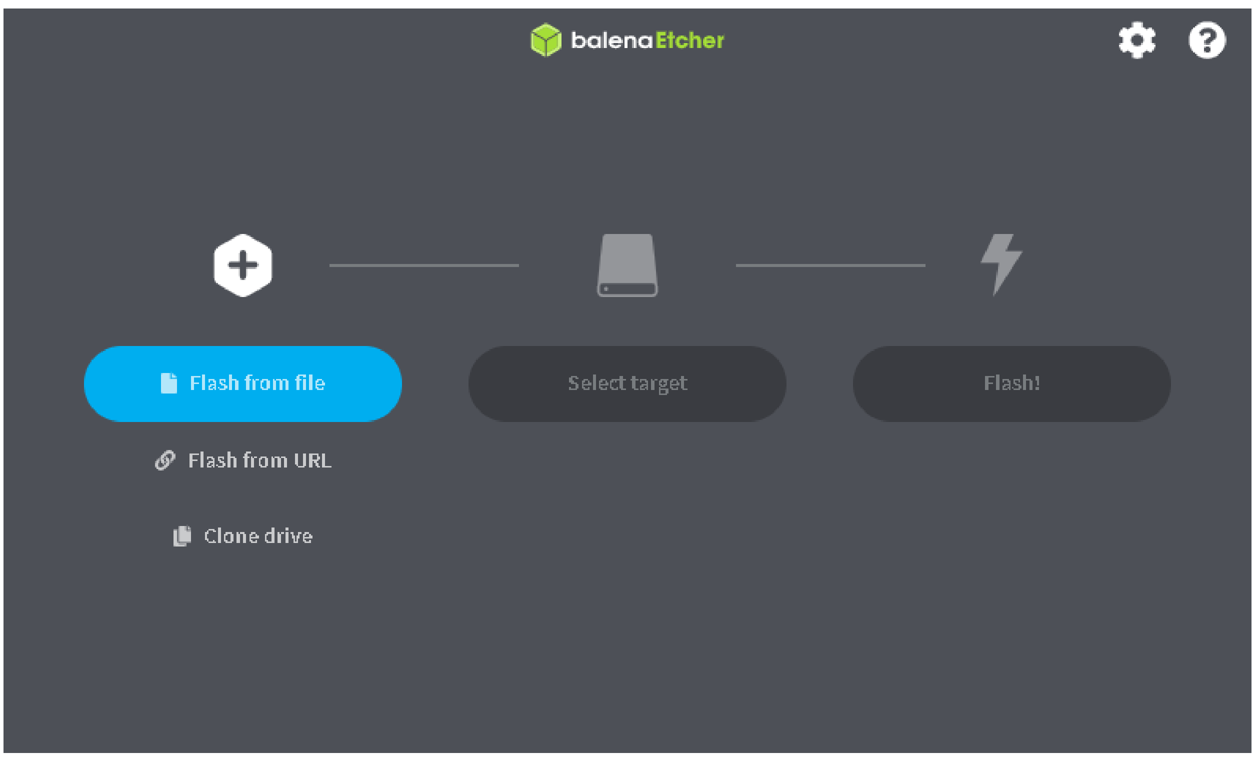
Download the Screenly OSE zip file (the disk image) of the latest sprint release from Screenly's Github releases page.



Download Etcher from balena's website.

Insert the micro SD card into a card reader, and connect to a computer.

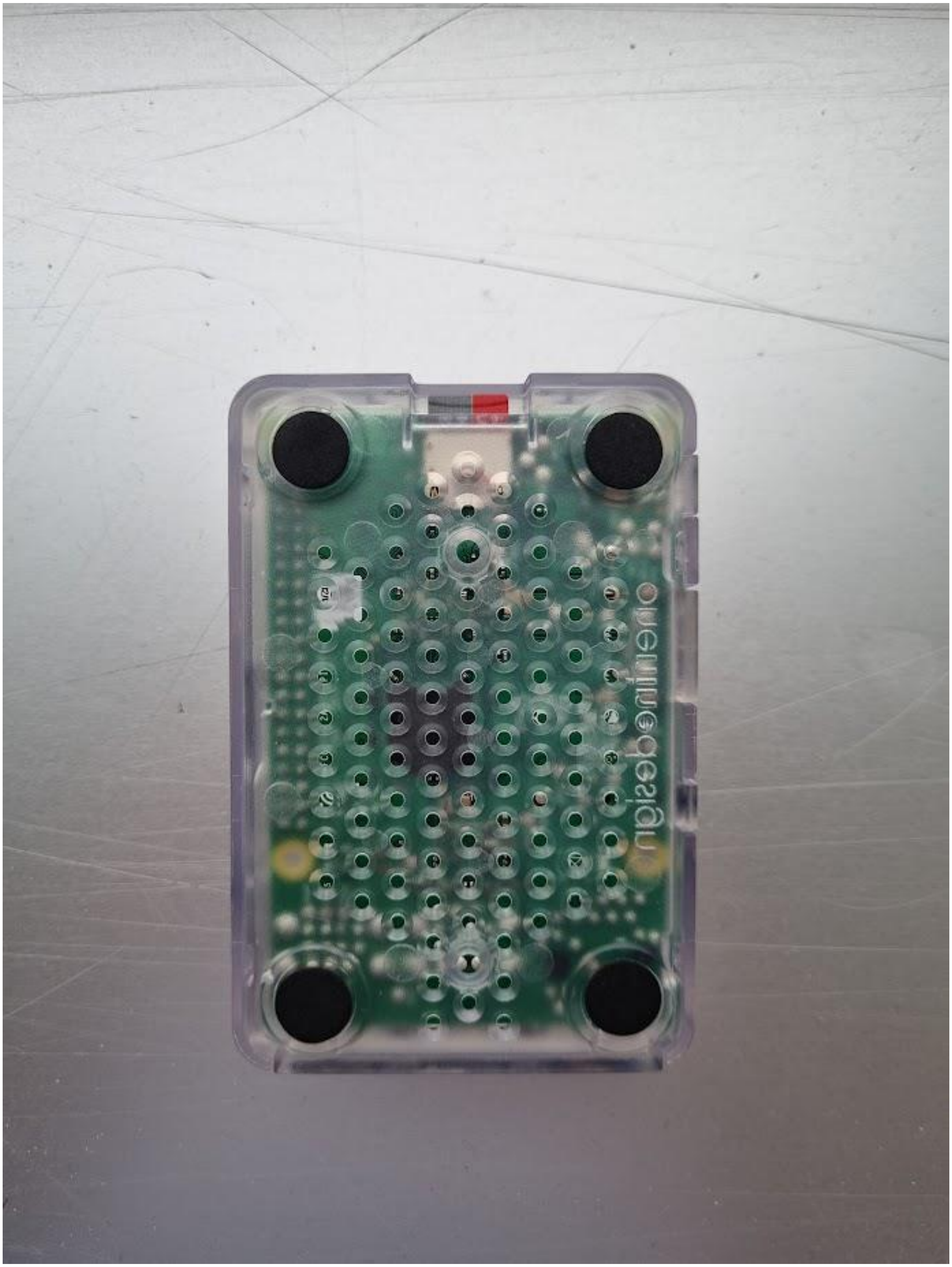
Using balena Etcher, flash the disk image onto the micro SD card.



Setting Up Your Raspberry Pi

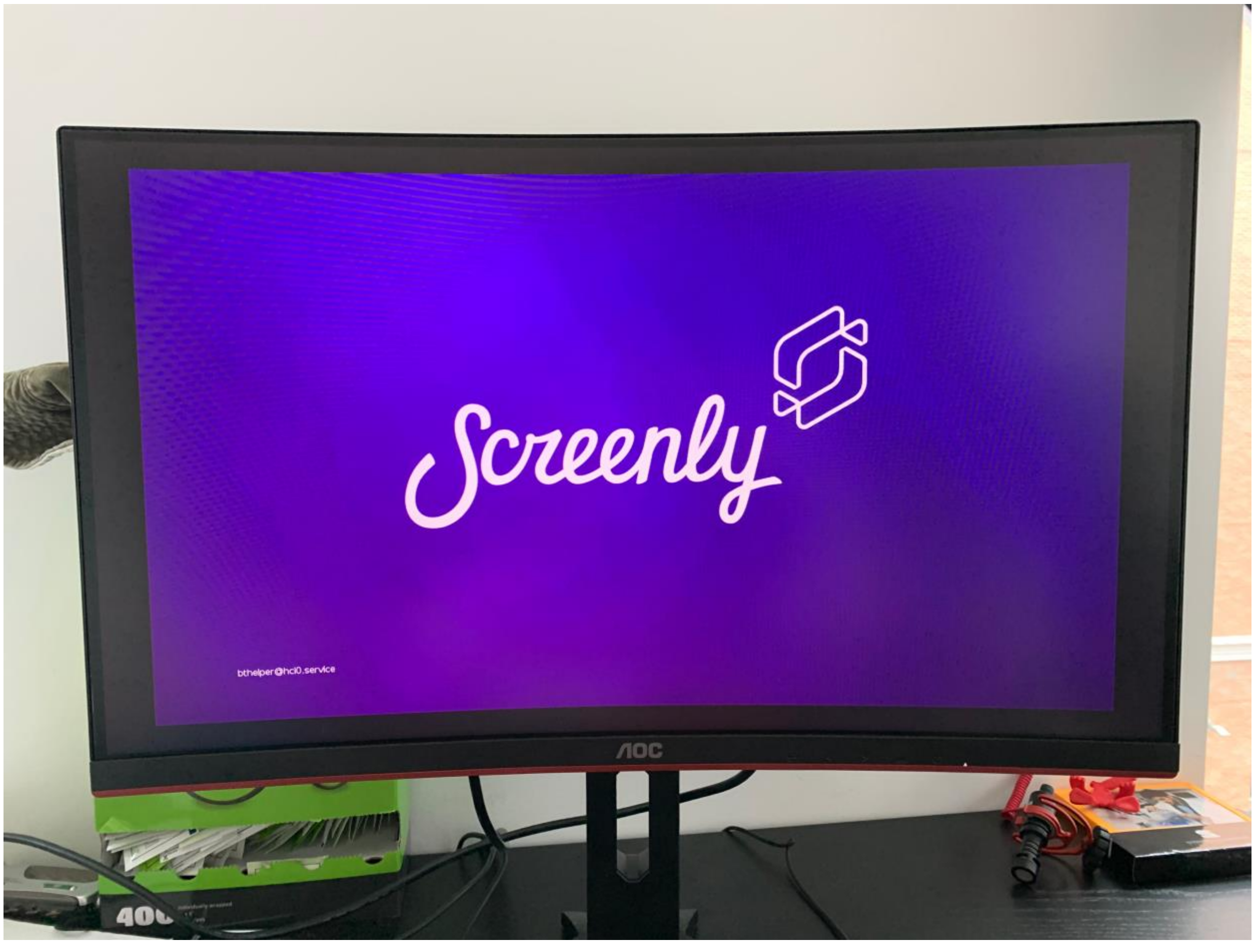
Once you are done imaging your SD card with the Raspberry Pi OS, it is time to start up the Pi. Connect the Raspberry Pi power supply to the Pi and insert the SD card. Connect the Pi with the monitor using the HDMI cable. Connect the mouse and keyboard to the Pi. Plug in the Ethernet cable to a working port and connect it to the Pi to access the internet.

Check for a blinking red light on your Pi to ensure it is being supplied with power. To check for a working internet connection, look for a yellow blinking light inside the port for the Ethernet cable.

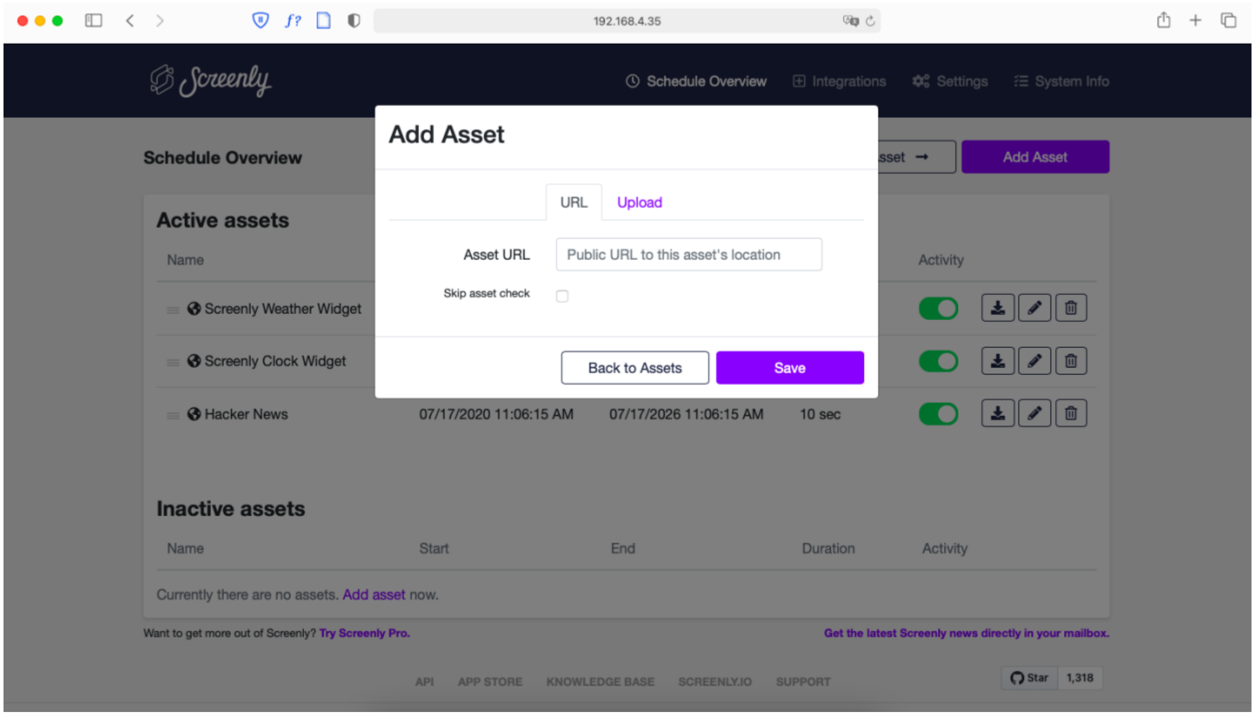


Using Screenly OSE

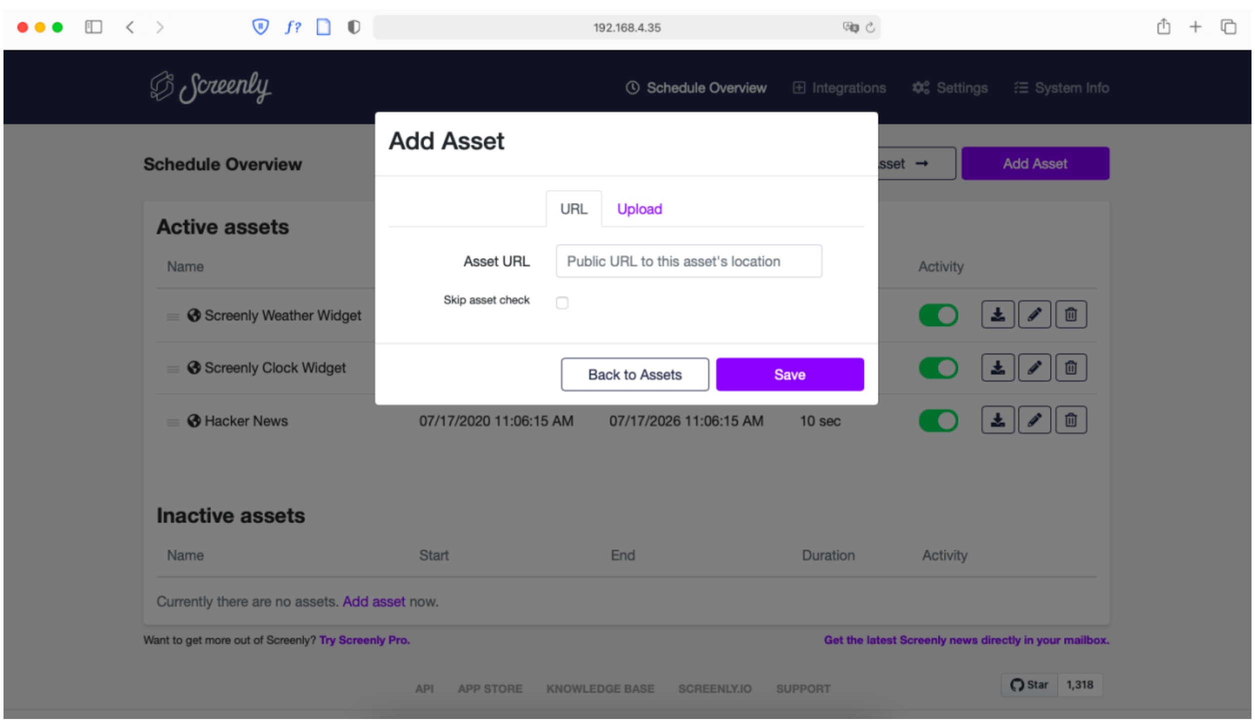
On your secondary laptop, computer, or phone, navigate to the IP address displayed on the screen when Screenly boots up.



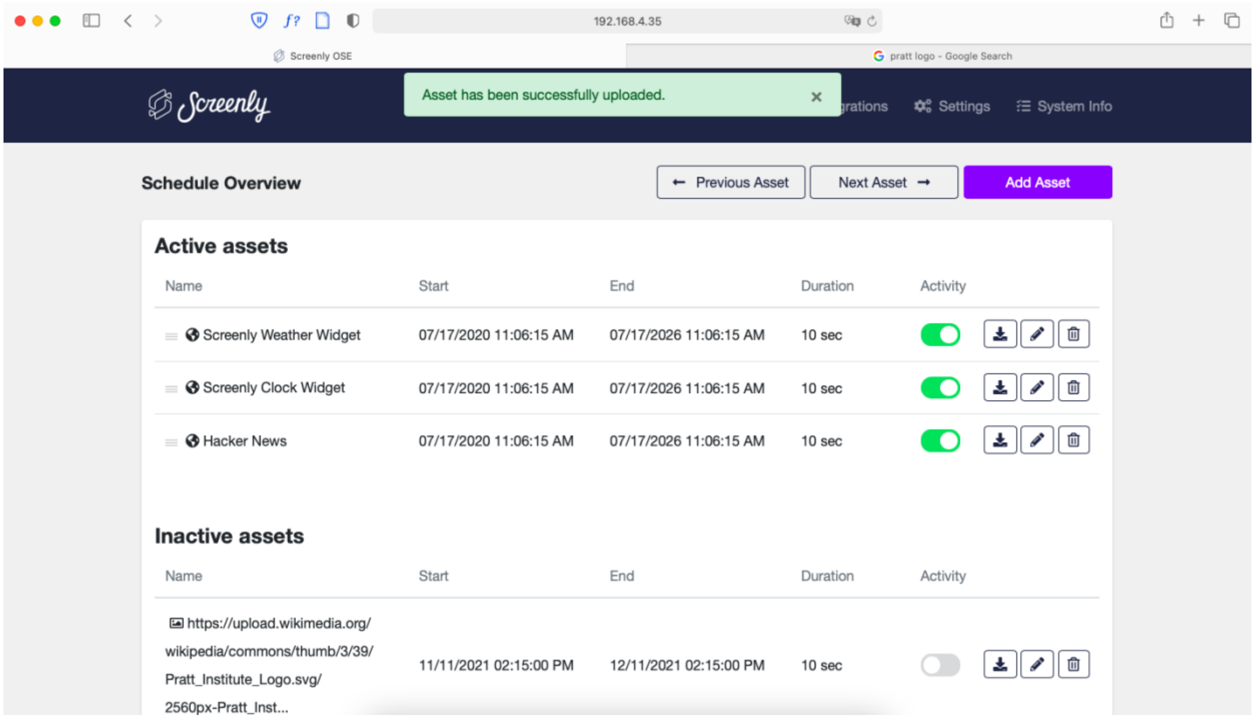
Click Add Asset on the Screenly asset management page to add an asset.



Add an asset by pasting the URL or uploading a file.



After toggling the Activity slider, the uploaded image should now appear on your Screenly monitor.



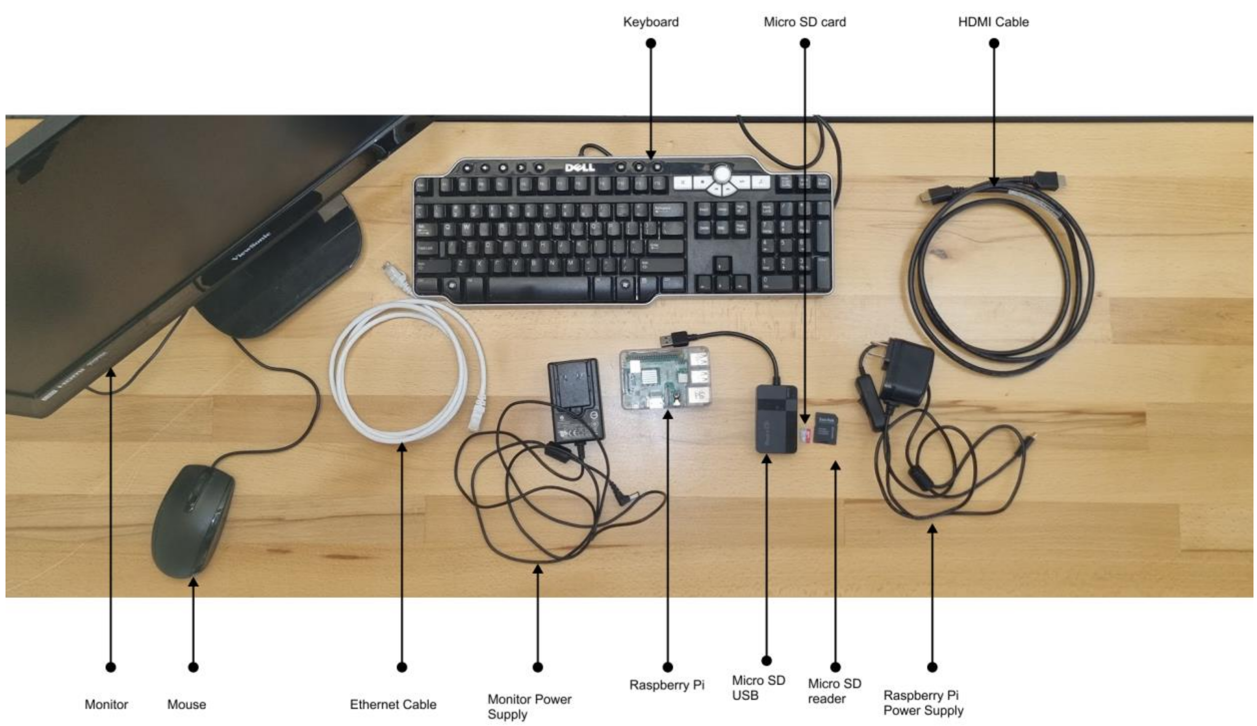
This is what a typical setup of Screenly with Raspberry Pi looks like.

APPENDIX B: OPAC KIOSK WITH RASPBERRY PI

This tutorial will teach you how to set your library catalog website as the homepage of your browser on Raspberry Pi, as well as how to set up a kiosk browser. These instructions are also available on GitHub at https://github.com/prattpi/piprojects4libraries and may include updates from after this article was published.

Equipment

- Raspberry Pi
- Raspberry Pi power supply
- Raspberry Pi Imager
- Secondary computer
- SD card
- SD card reader
- HDMI cable
- Ethernet cable
- Monitor
- Mouse
- Keyboard



Labeled equipment necessary to create the OPAC kiosk project.

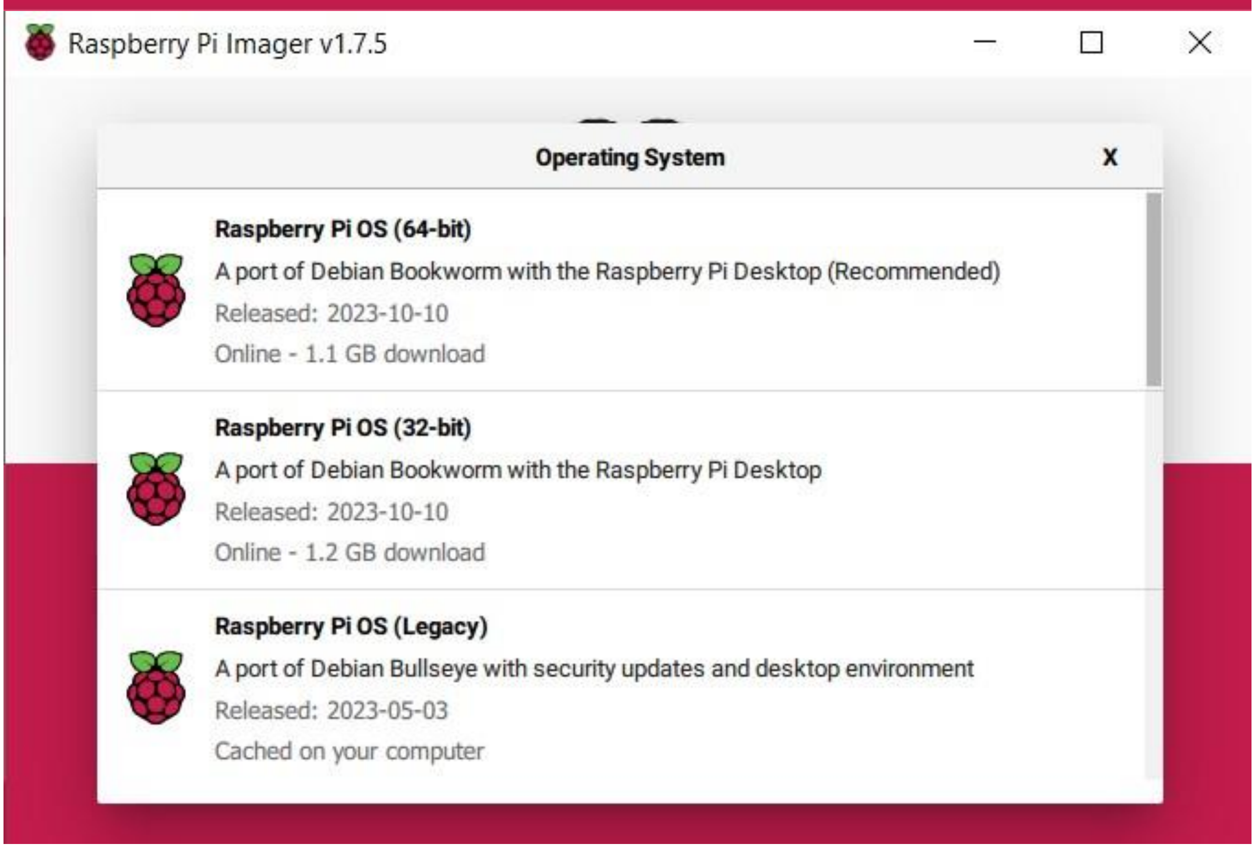
Imaging the Pi

Insert your SD card into the SD card reader. Plug the SD card reader into your secondary computer. Using your secondary computer open the Raspberry Pi Imager and install the recommended version. In this case, we are using the Raspberry Pi OS 64-bit version.

Choose the storage; in this case, it should be the SD card you use. Click on Write and wait for your SD card to be reimaged with Raspberry Pi OS.

Note: For this project, it is recommended to work with Firefox Browser; although Chromium is preinstalled, it is rather slow when run in Kiosk mode.

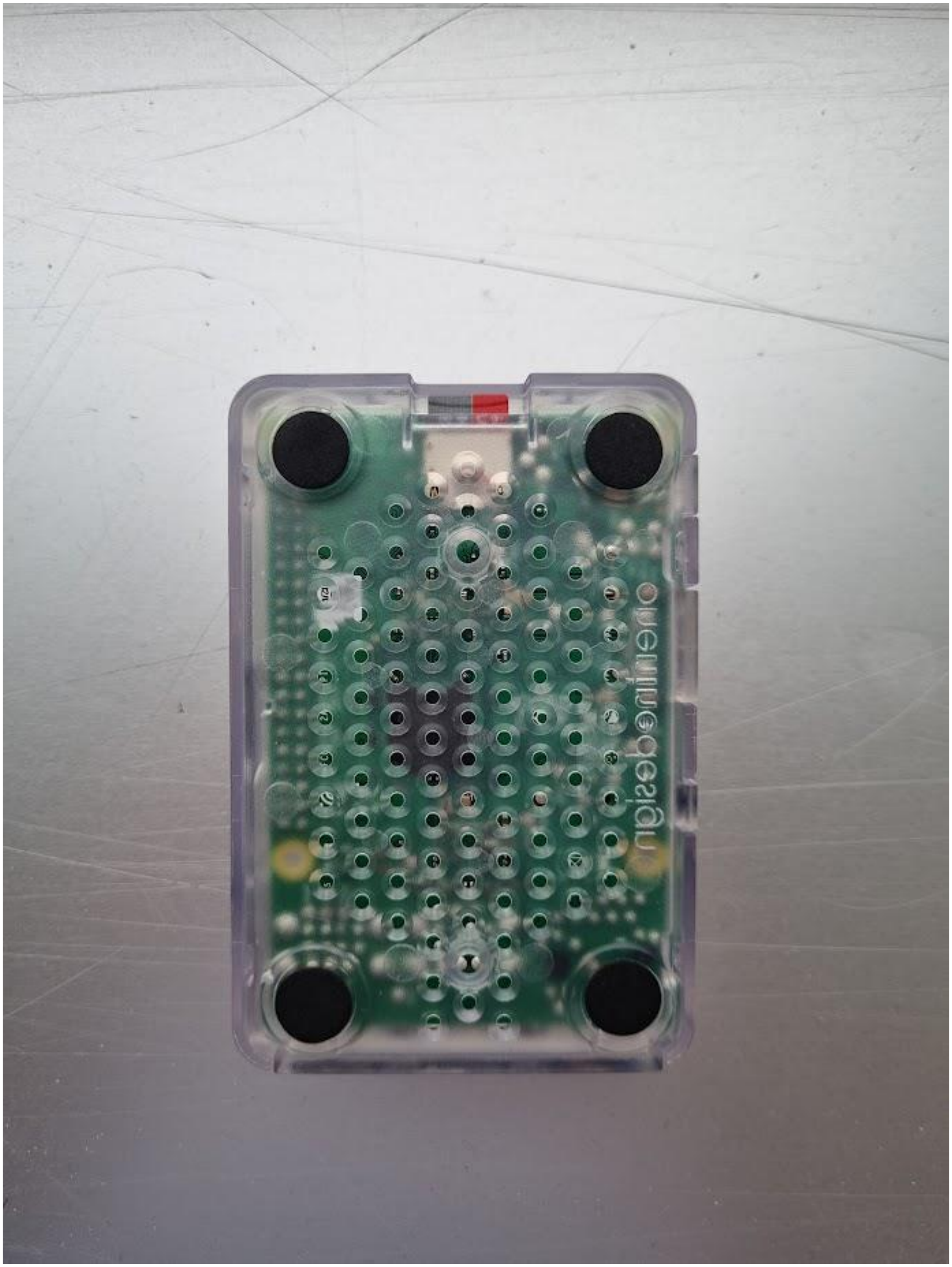

Raspberry Pi Imager v1.7.5
Raspberry Pi
Operating System
CHOOSE OS
Storage
CHOOSE STORAGE
WRITE


Raspberry Pi Imager v1.7.5
Operating System
X
Raspberry Pi OS (64-bit)
A port of Debian Bookworm with the Raspberry Pi Desktop (Recommended)
Released: 2023-10-10
Online - 1.1 GB download
Raspberry Pi OS (32-bit)
A port of Debian Bookworm with the Raspberry Pi Desktop
Released: 2023-10-10
Online - 1.2 GB download
Raspberry Pi OS (Legacy)
A port of Debian Bullseye with security updates and desktop environment
Released: 2023-05-03
Cached on your computer

Setting Up Your Raspberry Pi

Once you are done imaging your SD card with the Raspberry Pi OS, it is time to start up the Pi. Connect the Raspberry Pi power supply to the Pi, and insert the SD card. Connect the Pi with the monitor using the HDMI cable. Connect the mouse and keyboard to the Pi. Plug in the Ethernet cable to a working port and connect it to the Pi to access the internet.

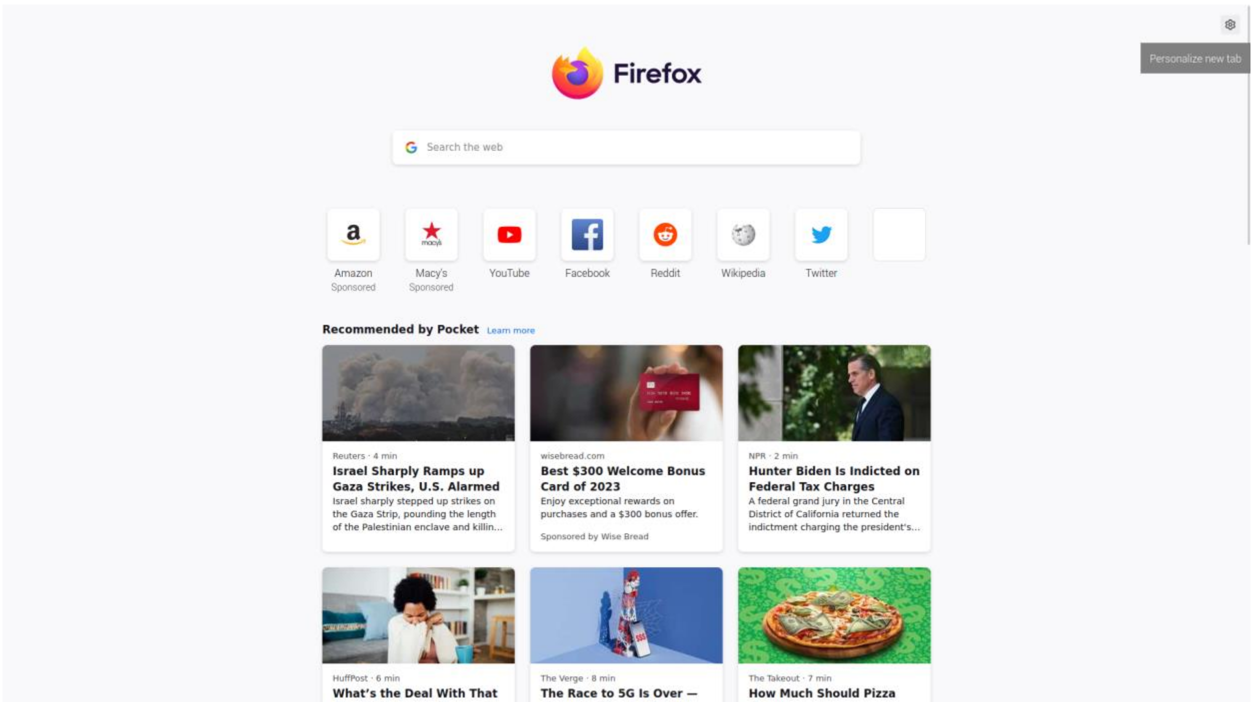
Check for a blinking red light on your Pi to ensure it is being supplied with power. To check for a working internet connection, look for a yellow blinking light inside the port for the Ethernet cable.



Starting Up the Browser

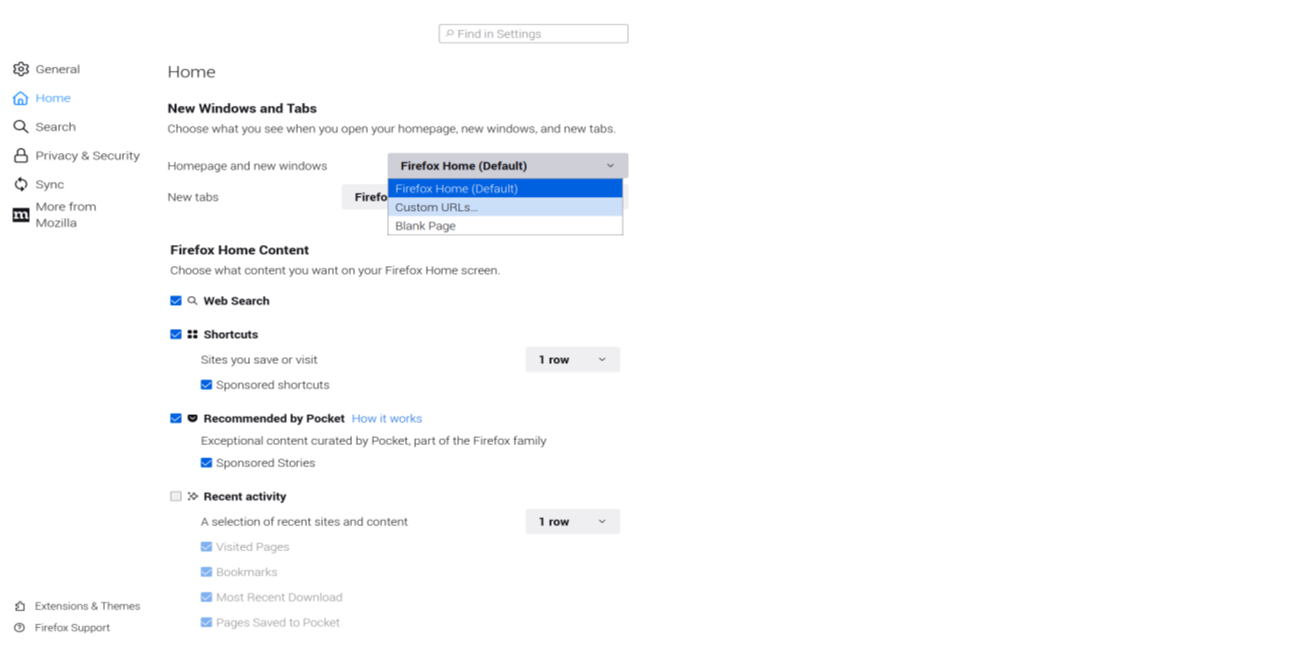
Once you have successfully booted your Raspberry Pi, you will be given the option to choose your browser of choice. Raspberry Pi comes with two in-built options: Chromium and Firefox. Choose Firefox as your choice of the default browser.

Go to the Settings menu in Firefox as displayed here.

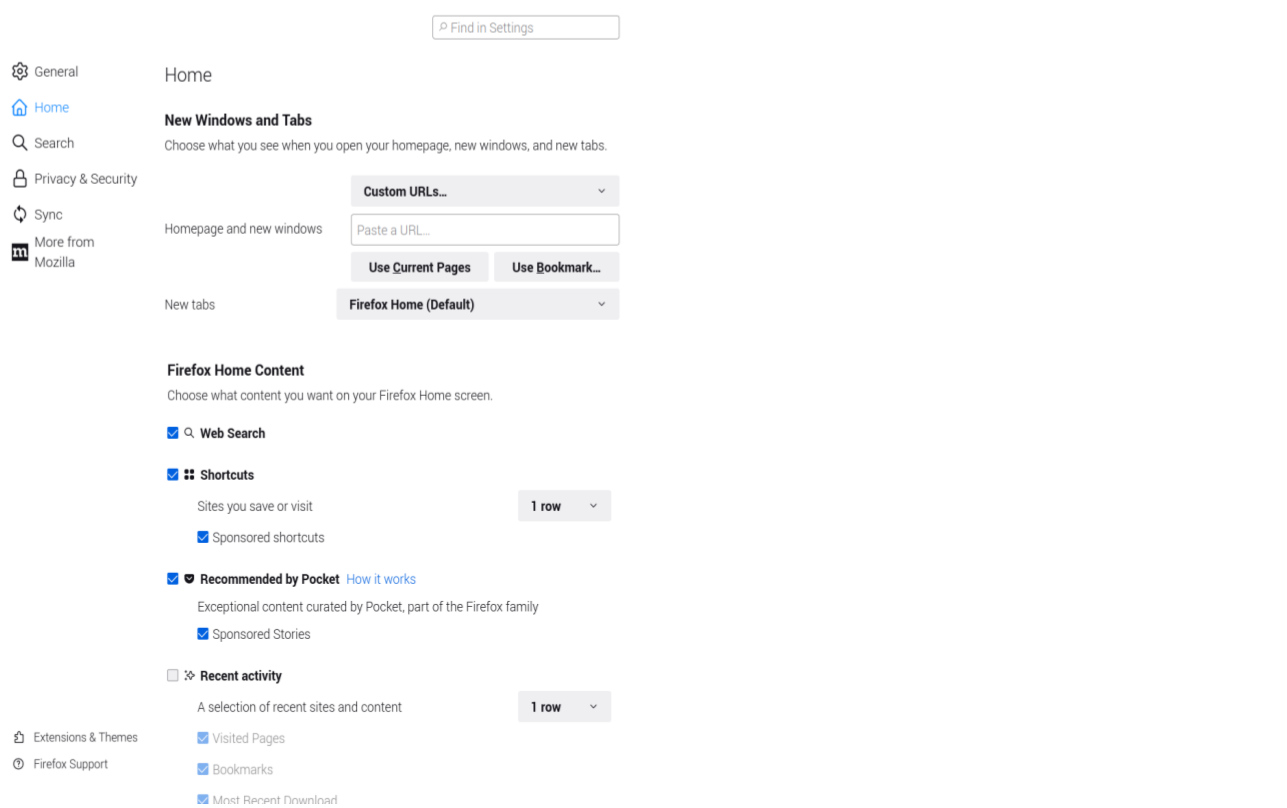


Click on "Manage more settings."

Navigate to the Home option.



Choose Custom URL here and add the address of your desired webpage.



Set Up Kiosk Mode in Firefox

Kiosk mode refers to having your website locked onto the screen, so that the user will not be able to access anything but your website of choice.

For the following steps, you will be using the terminal to type in (or copy in) text commands. Press Ctrl+Alt+F1 to access the terminal or click on the terminal icon on the navigation bar at the top. From there, type the following command to install updates:

```
sudo apt-get update && sudo apt-get upgrade -y
```

Using Firefox ESR: When to Install Firefox ESR?

Firefox ESR is available for lower versions of Raspberry Pi OS. These versions are not compatible with the Firefox browser that comes with the newer 64-bit version. If you are using the legacy version of Raspberry Pi, it is recommended to install Firefox ESR.

Simply input this command into the terminal:

```
sudo apt-get install firefox-esr
```

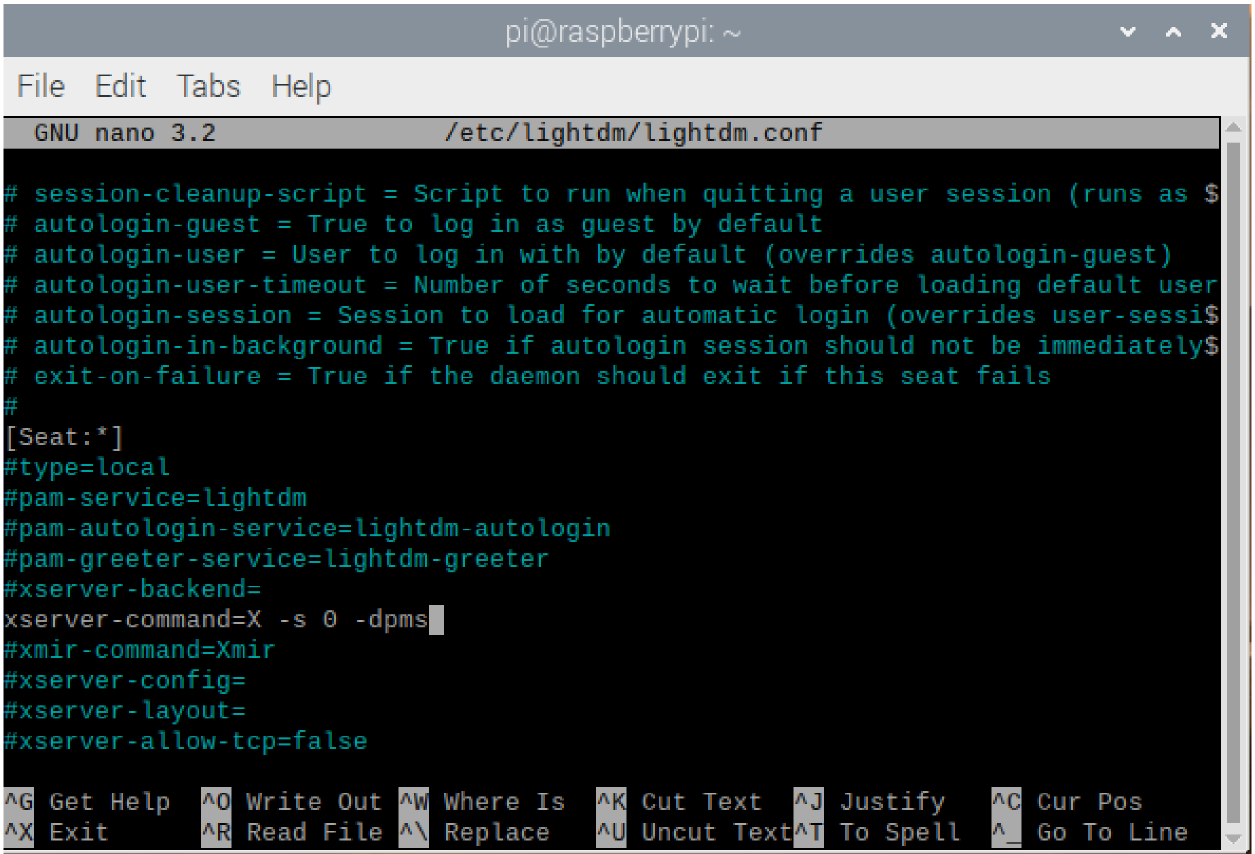
Next, edit the lightdm.conf file by typing the following command:

```
sudo nano /etc/lightdm/lightdm.conf
```

In the lightdm.conf file, use the arrow keys to go to [Seat:*]. You should find #xserver-command=X six lines below it. Change this line to:

```
xserver-command=X -s 0 -dpms
```

The image below shows the lightdm.conf file with the changed command.



Press Ctrl+X, press Y, and press Enter to save the file.

Next, type the following command:

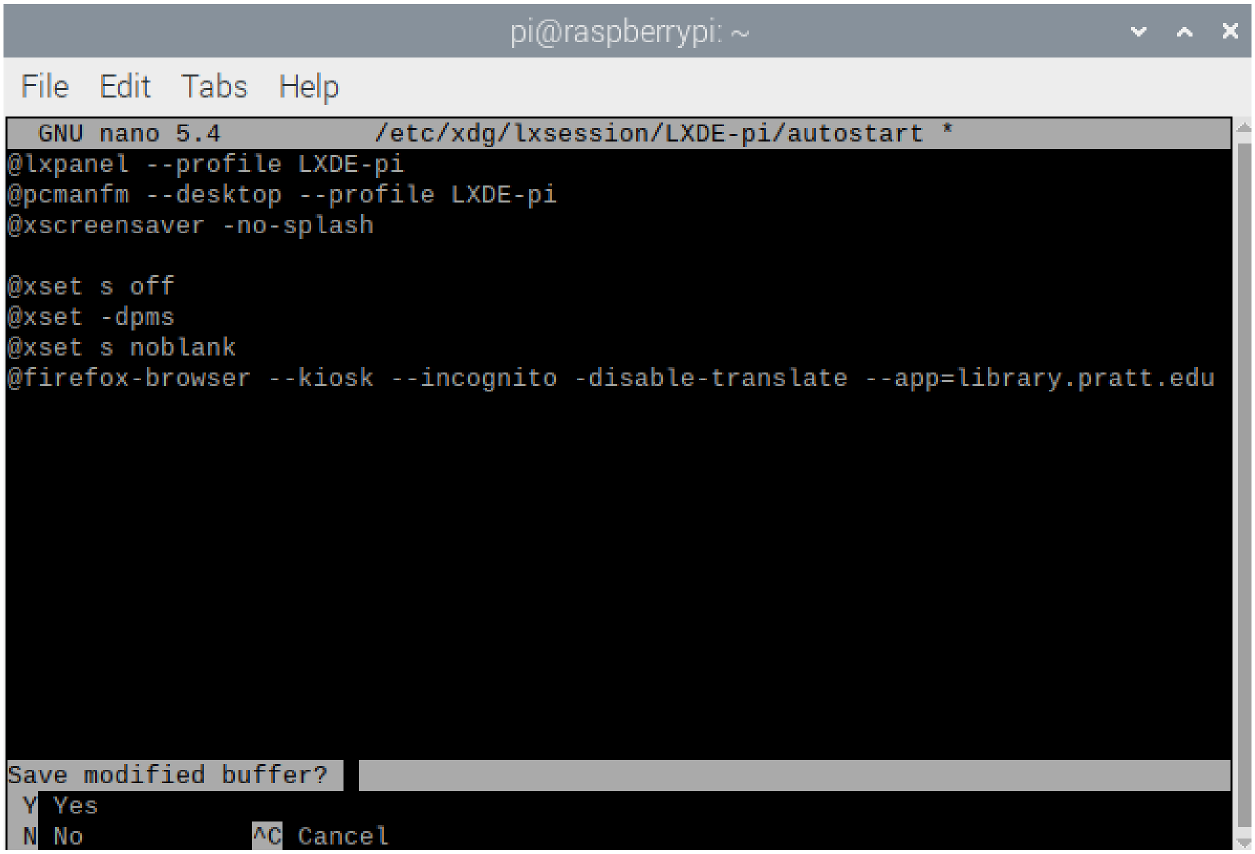
Please note that the following command is used to hide the mouse pointer on the screen. If you do not want your mouse pointer to blink upon movement, feel free to skip this command.

```
sudo apt-get install unclutter
```

After, type the following command:

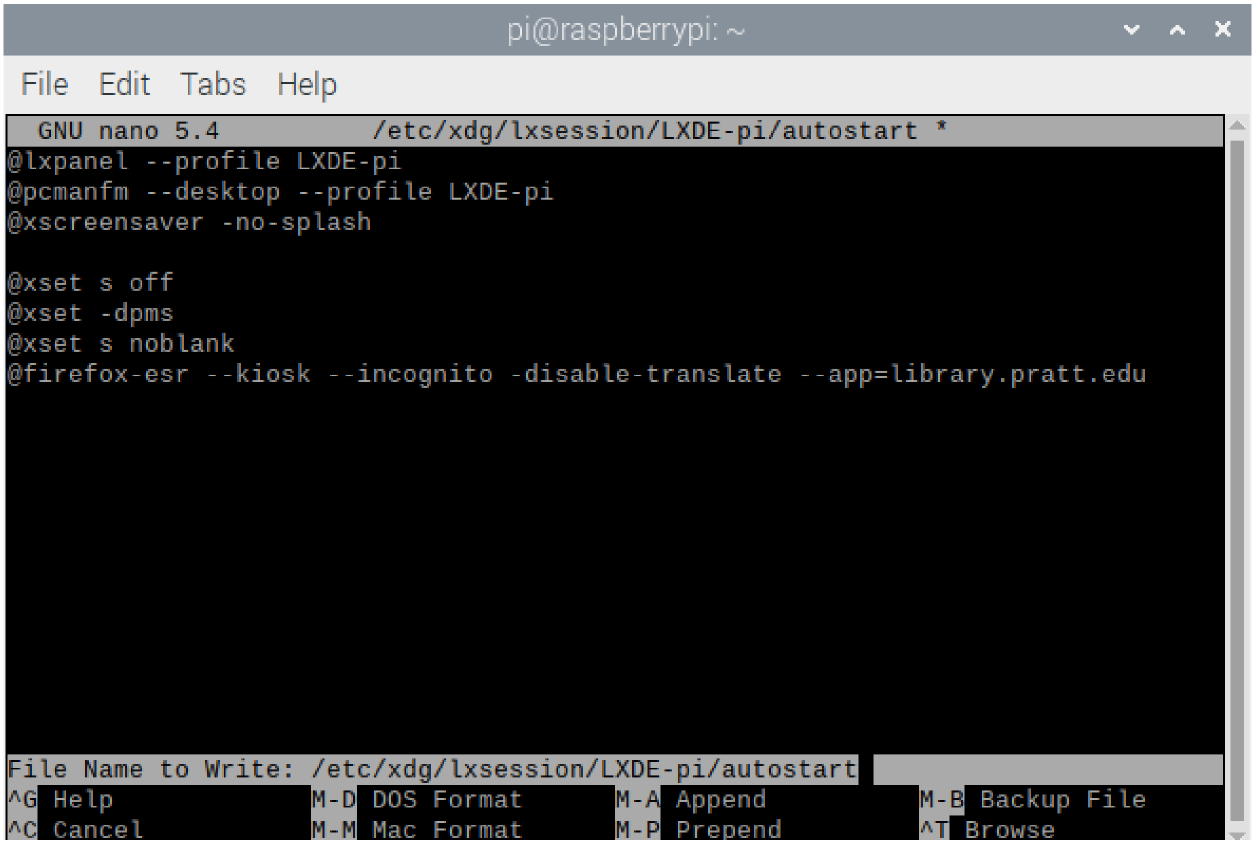
```
sudo nano /etc/xdg/lxsession/LXDE-pi/autostart
```

Add the following lines to the file (refer to the image below).




```
@xset s off
@xset -dpms
@xset s noblank
@firefox-browser --kiosk --incognito -disable-translate --app=YOUR URL HERE
@unclutter -idle 0
```

For Firefox ESR users, copy and paste this code instead.

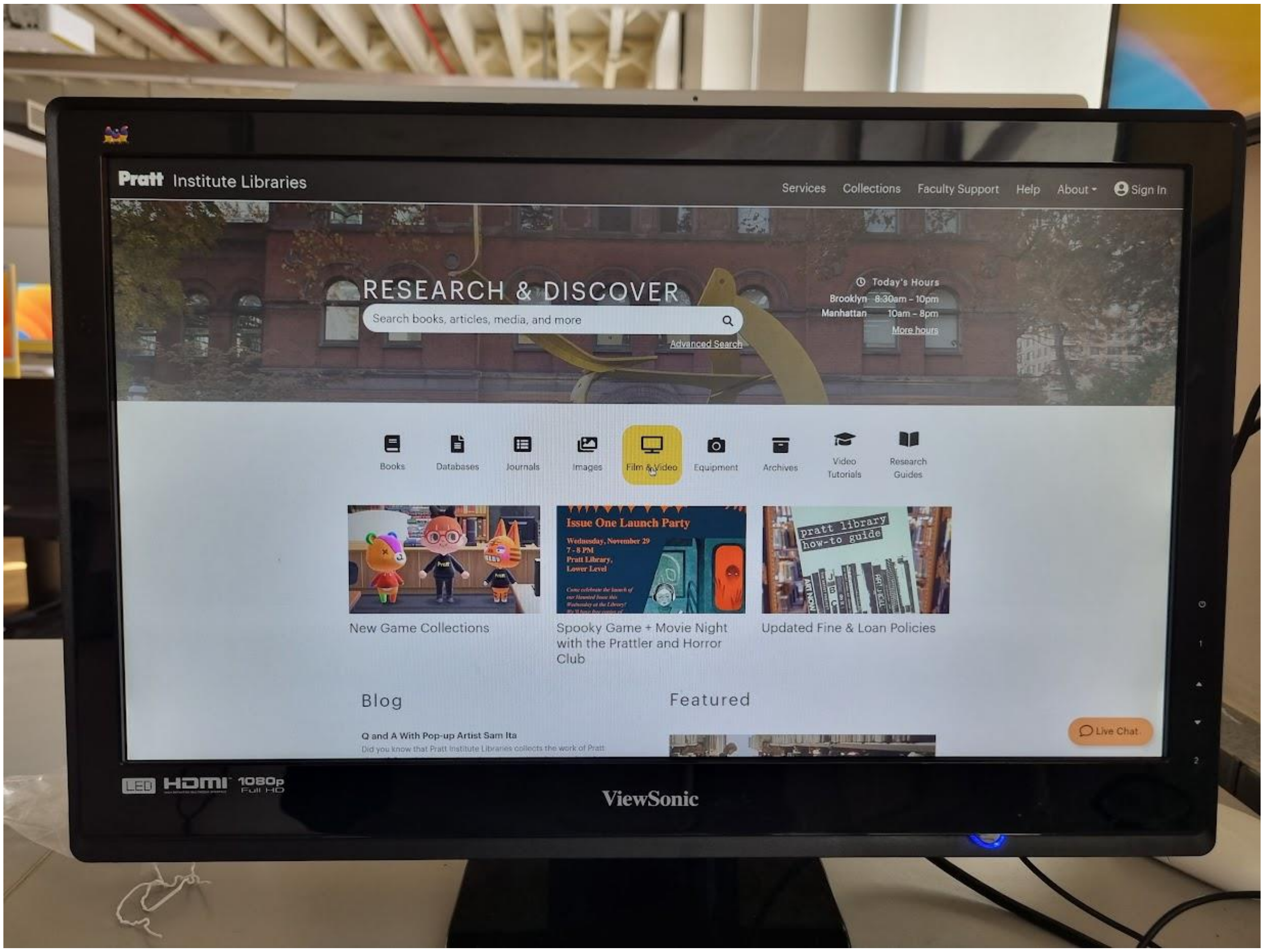



```
@xset s off
@xset -dpms
@xset s noblank
@firefox-esr --kiosk --incognito -disable-translate --app=YOUR URL HERE
@unclutter -idle 0
```

Again, note that the last line `@unclutter -idle 0` is optional and up to you.

Press Ctrl+X, press Y, and press Enter to save the file.

Type `sudo reboot` to restart your Pi. After a few moments, the monitor should display the URL you inputted.



Returning to the Raspberry Pi Interface

Follow the steps below to access the Raspberry Pi interface by exiting kiosk mode.

Press Ctrl+Alt+F1 to access the terminal. From there, type the following command:

```
sudo killall /usr/lib/firefox-browser-v7
```

Afterwards, press Ctrl+Alt+F7 to access the Raspberry Pi interface.

Stopping Kiosk Mode on Boot

If you would like to stop booting up in kiosk mode, access the terminal and type the following:

```
sudo nano /etc/xdg/lxsession/LXDE-pi/autostart
```

This will take you back to the autostart file.

From there, comment out the five lines that were added by adding a pound sign (#) in front of each line that you added.

```
#@xset s off
#@xset -dpms
#@xset s noblank
#@firefox-browser --kiosk --incognito -disable-translate --app=YOUR URL HERE
#@unclutter -idle 0
```

For Firefox ESR users, this is how it should look:

```
#@xset s off
#@xset -dpms
#@xset s noblank
#@firefox-esr --kiosk --incognito -disable-translate --app=YOUR URL HERE
#@unclutter -idle 0
```

Press Ctrl+X, press Y, and press Enter to save the file.

Afterwards, type `sudo reboot` to reboot the Pi. The regular Raspberry Pi interface should now appear after the Pi has booted up.

ENDNOTES

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