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xMacscrope v2 - Exhibit Documentation

xMacroscope hardware components

Signup kiosk

Touchscreen kiosk where visitors sign up for the experience and start their Run.

Computer

[Intel® NUC Kit NUC8i3BEK](#)

The Intel NUC was selected for its small form factor, ease of mounting, and availability. Any modest Windows PC with WiFi, Ethernet, and Bluetooth could be used as a substitute.

Operating System

Windows 10 Pro

The xMacroscope system has only been tested on Windows 10 Pro. An OEM license can be used with the computer purchase.

Network switch

[NETGEAR 5-Port Gigabit Ethernet Unmanaged Switch](#)

A 5-Port switch allows each client unit (Finish Display and Make a Viz kiosk) to connect to the Signup kiosk which acts as a server for the overall experience. Any 5-port unmanaged network switch could be substituted.

Ethernet cables

- 3 x 1' Ethernet cable - Any brand patch cable can be used
    - Computer to network switch
    - Switch to cabinet port for Make a Viz connection
    - Switch to cabinet port for Finish Line Display connection
- 2 x 75' Ethernet cables - Any CAT 5e cable can be used. Shorter lengths could be used depending on the distance from the signup to the Make a Vis unit.
    - Signup cabinet to Make a Viz
    - Signup cabinet to Finish Line Display

Touchscreen

ELO 3243L Open Frame Touchscreen

32" (diagonal) touchscreen. Any 32" touchscreen that can emulate a mouse pointer could be substituted, but only ELO touchscreen and ELO drivers have been tested with the xMacroscope and Stele application browser.

Monitor Arm

Ergotron LX Desk Monitor Arm, Tall Pole

Ergotron monitor arm was selected to allow users to customize monitor height. Some adjustments on the monitor arm have been locked down in fabrication for safety reasons.

Powered speaker

Fostex 6301 NB
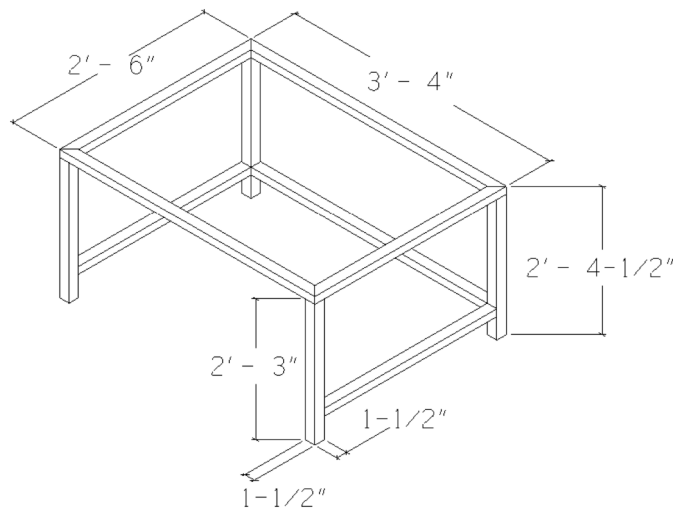
A powered speaker eliminates the need for an amp. Fostex speakers are robust and can be used in visitor facing experiences. Any powered speaker can be substituted.

Furniture
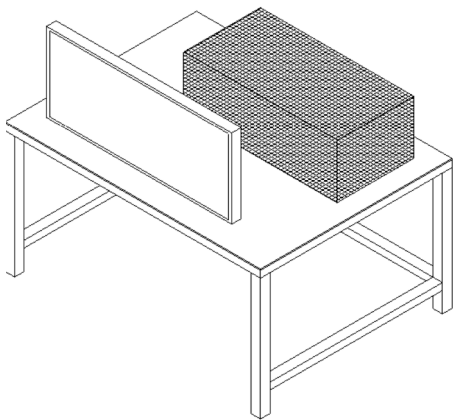
The Signup kiosk is a portable desk made from welded tube steel and anodized aluminum desktops. Octonorm and acrylic computer boxes, speaker brackets, monitor arms are drilled directly into the aluminum desktops.

Make a Vis kiosk

The touchscreen kiosk where visitors can visualize their Run data.
This desk kiosk is nearly identical to the Signup kiosk, except it is lacking a speaker (this experience does not have audio) and a network switch (this system acts as a client to the Signup computer's server).

Computer
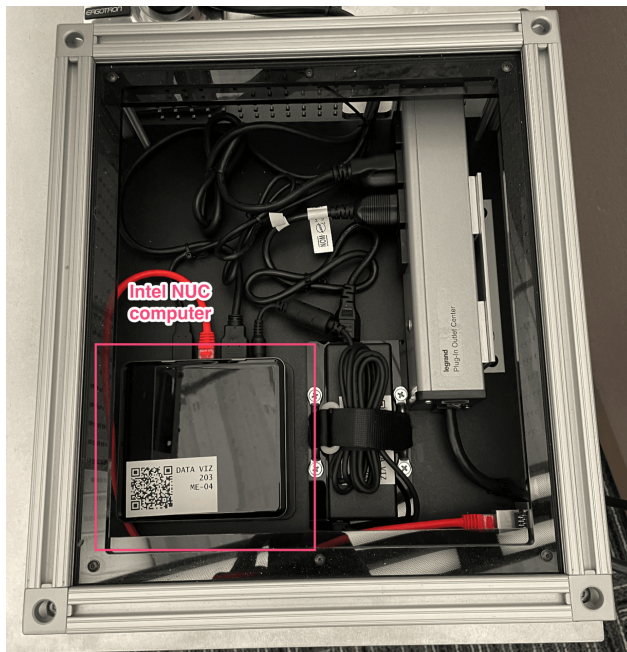
Intel® NUC Kit NUC8i3BEK

The Intel NUC that is used in the Make a Vis kiosk is identical to the Signup kiosk.

Touchscreen

ELO 3243L Open Frame Touchscreen

The ELO 32" (diagonal) touchscreen used in the Make a Vis kiosk is identical to the Signup kiosk.

Monitor Arm

Ergotron LX Desk Monitor Arm, Tall Pole

The Ergotron monitor arm used in the Make a Vis kiosk is identical to the Signup kiosk.

Furniture

The furniture for the Make A Vis kiosk is identical to the Signup kiosk

Finish display

Passive display for prompting the visitor and displaying timer.

The Finish Line display is a simple Raspberry Pi that acts as a web browser client displaying the finish line display from the Signup kiosk server.

Touchscreen

[ELO 3243L Open Frame Touchscreen](#)

The ELO 32" (diagonal) touchscreen used in the Finish Line Display is identical to the Signup kiosk. This device is used for consistency, even though the finish line display is not interactive and does not support touch input.

Computer

[Element14 Raspberry Pi 3 B+ Motherboard](#)

A Raspberry Pi 3 B+ was used at the time of fabrication, but any simple board computer that can support a full screen web application could be substituted.

Furniture

[ERGOTRON 24-190-085 Neo-Flex Mobile MediaCenter LD](#)

The monitor and computer are mounted to a Ergotron portable display. This monitor stand is easy to move to the right location for the finish line and is stable enough to be used in the experience safely.

Finish line sensor

The Finish Line Sensor is a microcontroller with a Bluetooth chip and a motion sensor that detects visitors crossing the finish line. The Bluetooth keyboard is wirelessly connected to the Signup computer application as a standard system keyboard. When a visitor triggers the motion sensor the Bluetooth keyboard activates an "A" keyboard press, telling the software application that the Run has finished.

Microcontroller

The Microcontroller that powers the sensor is a [Adafruit Feather nRF52 Bluefruit LE-nRF52832 Microcontroller](#)

Sensor

The sensor that detects the runner crossing the finish line is a [Sharp GP2Y0A02YK long range distance sensor](#).

Code

The Arduino sketch for the Finish Line Sensor can be found at:
https://github.com/scimusmn/Data-Viz-Bluetooth-Finish-Line

Operations

The microcontroller is configured to appear as a Bluetooth keyboard to other devices. When someone passes the finish line sensor, a letter "a" keypress is transmitted. The keypress is only sent once. A subsequent keypress only happens when someone has moved-off the sensor and then crosses it again. Though the max range of the Sharp distance sensor is 5 ft. (150 cm), the operating range has been attenuated to work reliably in a 4 ft. (121 cm) wide lane.

Ideally, the sensor unit should be placed so that it is aimed somewhere between the lower waist and upper torso of the runners. The sensor unit should also be perpendicular to the run lane. Make sure the run lane is well defined. Use a tape-line and make sure the run lane is no wider than 4 ft. It is suggested that a sport cone be placed just outside of the run lane (1-2 ft.) directly across from the sensor, so spectators don't accidently trigger the sensor.

The sensor unit can be powered via USB connection to a computer, USB power adaptor, or with the provided USB battery pack. When fully charged, the provided USB battery pack will allow the sensor unit to operate for several hours.

If it is necessary to reprogram the microcontroller, use the Arduino IDE, and install the nRF52 library following the instructions here:

https://learn.adafruit.com/bluefruit-nrf52-feather-learning-guide/arduino-bsp-setup

Prior to installing the library, it may be necessary to temporarily disable antivirus software when using Windows. Lastly, make sure to select the correct board before uploading the code.

xMacroscope Software

Computer setup

BIOS setup

Boot the machine into the BIOS setup by powering the machine on and then tapping the F2 key when the Intel NUC logo appears.

Enable Power on after Power Failure

In almost all exhibit setups we want the machine to automatically power on after the end of a power failure.

Navigate to Advanced > Power

Under After Power Failure set the selection to Power On

Disable Wake on LAN

When using these machines with a battery backup, you can see a problem where the machine won't stay shutdown after being shutdown. To fix this, we disable wake on LAN in the BIOS power settings.

Navigate to Advanced > Power

Under Wake on LAN from S4/S5 set the selection to Stay Off.

Update to the latest BIOS

This step is more important when installing Linux on the computer.

Find your Intel NUC in the list of kits. Follow the link to that page and look for the BIOS Update.

For example, here's the page for the Intel Nuc NUC6i5SYK.

Download the latest file. This should be a file like SY0054.bio

Place this file on a USB drive and plug it in to your NUC.

Restart the NUC and press F7 once the Intel logo appears.

On the first screen you should see a string of characters representing your USB drive. Use the arrow keys to select it and hit enter.

On the next screen you will see a list of files. Select the BIOS update file, which should look like SY0054.bio.

Select the file name from the screen and press enter to update the BIOS.

It will take a few minutes. Once the update is complete, the system will restart.

Windows setup

Disable voice

Windows will probably start into the Cortana voice-enabled setup assistant. Click on the microphone to disable this.

Select region and keyboard

Select US and English language and keyboard settings.

Initial network setup for install

The install setup will ask you to connect to the wifi for updates. During this phase of the setup, connect the computer to your WiFi network. Let it do any updates it wants during this phase of the setup.

License

Agree to the Windows license.

Setup for personal use

At some point in the install it will ask you whether you want to set it up for personal or organization use. Make sure to set it up for personal use. We don't exhibit computers to any domain.

First user

When you install Windows it will ask you to create a user. This first user will be the admin user and should be called *exhibits*.

The install process may prompt you to create a Microsoft account. Don't do this. To skip this select, skip or Offline account. It may prompt you multiple times. Keeping skipping the options to create a Microsoft account.

When it asks you for a user account type all lowercase exhibits.

Don't set a password

At this phase leave the password field blank. This will prevent the system from asking you to set up security questions. We don't want the user to have security questions and they aren't possible to remove once they are created.

We will set the password after the initial login.

Services

Cortana

The install process will ask you if you want to use Cortana. Make sure to say No

Privacy

When the install process asks about privacy settings, make sure to disable all options.

Restart

The computer will restart and automatically log in.

Set user password

Now that the computer is set up, we should create a password for the exhibits user.

Navigate to Start menu > Settings > Accounts > Sign-in options

Under Password, click Add. and use your selected password.

Turn off notifications

Navigate to Settings > Notifications & actions

Turn off notifications and uncheck "Show me the Windows welcome experience..." and "Get tips, tricks..." boxes.

Install updates

Click the start bar and search for updates. Click Check for updates. Run all the updates and restart the computer. Repeat this process until it says there are no more updates to install.

Make Chrome your default browser

Click the Start menu, search Default and select the Choose default apps option.

Select Web browser and change it to Google Chrome and then select Switch anyway.

Power settings

Disable hibernation

Hibernation doesn't work well with our shutdown and restart strategy. Disable it via the admin command line prompt.

Right click on the Start menu.

Select Command Prompt (Admin). This won't work if you try to do it via the normal command prompt.

Type `powercfg.exe /hibernate off`

Don't go to sleep

System Settings > Power & sleep

Set both settings to Never.

Don't require password to wake from sleep

The computer shouldn't ever go to sleep, but if it does, don't require a password.

Settings > Accounts > Sign-in options. Under "Require sign-in," choose Never from the drop-down menu to complete the task.

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Network setup

The xMacroscope computers are connected together in a local network where the Make a Vis kiosk and FInish Line computer are connected to the Signup kiosk as a server.

On each Windows machine:

Open Control panel > Network and Internet > Network and Sharing Center

Change adapter settings

Right click on the ethernet adapter and select properties

IPV4 > Properties

Set static IP address to 172.17.68.*. The last digit should be 1 on the Signup kiosk computer and 2 on the Make A Vis computer.

Kiosk browser setup

The Make a Vis application runs in a kiosk browser called Stele. On each device, download the Stele .exe from https://github.com/scimusmn/stele/releases/tag/v2.1.6

Once you have downloaded the latest version, start the application and configure the URL for each kiosk.

- Signup kiosk - 192.172.17.86.1/start
- MAV kiosk - 192.172.17.86.1/mav

Install xMacroscope

Open Git Bash

Clone the repo and checkout the appropriate branch

cd ~/Documents
git clone https://github.com/cns-iu/xmacroscope.git

Install the node modules and set up the application.
cd ~/Documents/xmacroscope

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npm install
npm run setup
npm run build

Before running the application, you need to manually add a SQLite file. The application should be able to create the file itself, but there is an active bug preventing this in Windows.

Run the same steps on a Mac or Linux machine and start the application. Copy the packages/server-graphql/private/data.sqlite file over to the Windows machine in the same path.

Then start the application.

npm run start

The first time you run this Windows will ask you if you want to give Node.js permission to modify the Firewall. Check the public box and click *Allow access*.