Setting up raspberry pi's

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change # Overview * Set up raspberry pi (`<pi><number>`) and get it connected to wifi hotspot * Connect to device using ssh * Update the system * Manage ssh connection to the device using ssh keys * Install editing, streaming, and networking tools (vim, libcamera, motion, tailscale) * Set up motion for streaming over internet

1. Get connected to wifi

1. Set up the connection to wifi hotspot when burning the image and enable ssh
2. Start the pi and check on hotspot that more devices are connected
3. run `arp -a` in gitbash to find the ip address into the device

2. Access the raspberry pi device

1. `ssh <name>@<ip-address>`
2. Input your password

3. Update the system

```
sudo apt update
sudo apt upgrade
```

4. Setup access through ssh keys

NOTE: Log out of the remote raspberry pi and work on your computer command line

Generate the keys on your machine

```
ssh-keygen -t rsa -b 4096 -f <pc>-for-<pi><number>
cp  <pc>-for-<pi><number>* .ssh/
ssh-copy-id -i <pc>-for-<pi><number>.pub <pi-ip>
```

Create/Add connection to this pi on given network

Open `/.ssh/config`

```
sudo vim ~/.ssh/config
```

Edit the file

```
# On S75 hotspot network
Host <pi><number>_s75
        HostName <pi-ip>
        User <user>
        IdentityFile ~/.ssh/<pc>-for-<pi><number>
```

Test connection

```
ssh <pi-ip>
```

5. Install tools

Tools: 1. noefetch to get info about the system 2. vim for editing 3. motion for streaming video 4. libcamera to make motion work with raspberry pi camera

Install

```
sudo apt install neofetch -y && \
sudo apt install vim -y && \
sudo apt install motion -y && \
sudo apt install libcamera-tools -y && \
sudo apt install libcamera-dev -y && \
sudo apt install libcamera-v4l2 -y && \
sudo sed -i 's/stream_localhost on/stream_localhost off/g' /etc/motion/motion.conf && \
echo "done"
```

Verify it runs

Test by running

```
sudo libcamerify motion -n
```

Access in browser at an address: `<pi-ip>:8081`

Shut down `<Ctrl>+<C>`

Start so that ssh logout will keep it running

```
sudo nohup libcamerify motion -n &
```

After pressing `<Enter>` you can work in the shell

NOTES: * To close the stream get back to background process `fg` and then `<Ctrl>+<C>` * If it is not in the background process of this shell `sudo pkill motion` to terminate the process

6. Install tailscale for remote access

Tailscale is a networking tool (like vpn) to access your devices over internet link

Install using commands and activate:

```
curl -fsSL https://pkgs.tailscale.com/stable/debian/bookworm.noarmor.gpg | sudo tee /usr/share/keyrings/tails
curl -fsSL https://pkgs.tailscale.com/stable/debian/bookworm.tailscale-keyring.list | sudo tee /etc/apt/sourc
sudo apt-get update -y
sudo apt-get install tailscale -y
sudo tailscale up
```

Resource

Detailed instruction how to install tailscale on Debian bookworm (on which the raspberry pi OS is based): link

7. Verify the streaming works over tailscale

In browser: `<tailscale-pi-name>:8081`

8. Put the link online to website

NOTE: works for hugo static website Create a file `webcam.md` in the `content/` folder and copy inside this text with updated link and instructions:

```
[webcam link](http://<tilscale-pi-name>:8081)
Activate the stream from camera over ssh:
`nohup sudo libcamerify motion -n &`
```

9. Tweaks

Set alias for streaming

```
sudo echo 'alias start-stream="sudo nohup libcamerify motion -n &" # alias to start streaming' >> ~/.bashrc
source ~/.bashrc
```

Now typing `start-stream` starts the stream in the background

Rotate the camera image

Adding `rotate <number-in-degrees>` into `motion.conf` rotates the image clockwise

```
# if the camera is upside down
sudo echo "rotate 180" >> /etc/motion/motion.conf
```

Restart the stream after the modification for it to take place

10. Motion config files

The default config file for motion is in `/etc/motion/motion.conf`.
To run a different configuration: 1. Make a copy of this file 2. Adjust it 3. Call it using `sudo libcamerify motion -n -c <path-to-config-file>`

Example config files

- **Snapshots:** Take a 2592x1944pxs image every 10 seconds saved in `/home/vld/Pictures` Download
- To be filled in...

Parameters to set

- `width 1296`
- `height 972`
- to be filled in...

11. Installing samba for shared folder

For easier transfer of files from the raspberry pi to the pc you can mount a shared folder on the pi as a network disk.
Samba project link.
Instructions for raspberry pi setup: link.

Install samba from repository

```
sudo apt update
sudo apt install samba samba-common-bin smbclient cifs-utils -y
```

Create a shared folder with the proper rights

```
cd ~
mkdir shared
chmod 0740 shared
```

Create the user who will be connecting

Think about user name and a password and write it on a piece of paper or use the same as you use to access rapsberry pi

```
sudo smbpasswd -a <username>
```

Configure samba

Open the config file

```
sudo vim /etc/samba/smb.conf
```

Add following at the end

```
[<share-name>]
    path = /home/<username>/shared
    read only = no
    public = yes
    writable = yes
```

NOTE: The text inside the brackets is how the folder will be called when you are connecting from outside (mapping the network disk)

Check it is working

```
sudo systemctl status smbd
```

NOTE: in case you use `sudo systemctl status samba` gives a `condition failed` message which does not mean the share is not working

Conect to the folder from a Win11 machine

1. Right click `This Computer`
2. Select the letter for a disk
3. Put \\<pi-ip>\<share-name>
4. Fill in the user name and a password (for samba)

NOTE: instead of `<pi-ip>` also the `<pi-name>` can be used but initially, the `<pi-ip>` is safer

12. Use USB cable for ssh connection

in /boot/firmware/config.txt

```
dtoverlay=dwc2
```

in /boot/firmware/cmdline.txt

```
rootwait modules-load=dwc,g_ether
```

reboot and connect

check if the usb0 is up

```
ip a show usb0
```

if it is dowb bring it up

```
sudo ip link set usb0 up
```

in `etc/dhcpcd.conf` should set it automatically

```
interface usb0
static ip_address=192.168.7.2/24
nolink
```

sudo reboot

Is not recognized from windows side, need insatllaiton of rndis drivers, downloaded from here emm2a post link

System

The above works for following systems

Camera(s)

Raspberry Pi camera V1.3

Raspberry Pi Zero W

Firmware

```
vld@pi0D:~ $ vcgencmd version
Apr 30 2025 13:35:18
Copyright (c) 2012 Broadcom
version 5560078dcc8591a00f57b9068d13e5544aeef3aa (clean) (release) (start)
```

OS

```
vld@pi0D:~ $ neofetch --off --color_blocks off
ld@pi0D
--------
OS: Raspbian GNU/Linux 12 (bookworm) armv6l
Host: Raspberry Pi Zero W Rev 1.1
Kernel: 6.12.34+rpt-rpi-v6
Uptime: 2 hours, 33 mins
Packages: 1595 (dpkg)
Shell: bash 5.2.15
Terminal: /dev/pts/2
CPU: BCM2835 (1) @ 1.000GHz
Memory: 130MiB / 427MiB
```

Camera

```
vld@pi0D:~ $ rpicam-hello --list-cameras
Available cameras
-----------------
0 : ov5647 [2592x1944 10-bit GBRG] (/base/soc/i2c0mux/i2c@1/ov5647@36)
    Modes: 'SGBRG10_CSI2P' : 640x480 [30.00 fps - (65535, 65535)/65535x65535 crop]
```

```
                              1296x972 [30.00 fps - (65535, 65535)/65535x65535 crop]
                              1920x1080 [30.00 fps - (65535, 65535)/65535x65535 crop]
                              2592x1944 [30.00 fps - (65535, 65535)/65535x65535 crop]
```

Raspberry Pi 4

Firmware

```
vld@pi4:~ $ vcgencmd version
Aug 30 2024 19:17:39
Copyright (c) 2012 Broadcom
version 2808975b80149bbfe86844655fe45c7de66fc078 (clean) (release) (start)
```

OS

```
vld@pi4:~ $ neofetch --off --color_blocks off
vld@pi4
-------
OS: Debian GNU/Linux 12 (bookworm) aarch64
Host: Raspberry Pi 4 Model B Rev 1.4
Kernel: 6.6.51+rpt-rpi-v8
Uptime: 2 hours, 46 mins
Packages: 1610 (dpkg)
Shell: bash 5.2.15
Terminal: /dev/pts/2
CPU: (4) @ 1.800GHz
Memory: 405MiB / 7809MiB
```

Camera

```
vld@pi4:~ $ rpicam-hello --list-cameras
Available cameras
-----------------
0 : ov5647 [2592x1944 10-bit GBRG] (/base/soc/i2c0mux/i2c@1/ov5647@36)
    Modes: 'SGBRG10_CSI2P' : 640x480 [30.00 fps - (65535, 65535)/65535x65535 crop]
                              1296x972 [30.00 fps - (65535, 65535)/65535x65535 crop]
                              1920x1080 [30.00 fps - (65535, 65535)/65535x65535 crop]
                              2592x1944 [30.00 fps - (65535, 65535)/65535x65535 crop]
```