

# SYRA Install Guide for Raspberry Pi 5

Full installation process for running the SYRA system on a Raspberry Pi 5 (8GB) with optional NVMe SSD boot.

## 1. Flash OS to microSD Card

Use Raspberry Pi Imager to flash Raspberry Pi OS Lite (64-bit) to a microSD card.

- 1 Open Raspberry Pi Imager
- 2 Select OS: Raspberry Pi OS (64-bit) Lite
- 3 Choose your SD card as the storage target
- 4 Use the gear icon to set hostname, enable SSH, set user/password, configure Wi-Fi and locale
- 5 Click Write and wait for flashing to complete

Insert the card and boot the Pi. Login using the credentials set during flashing.

## 2. First Boot & System Setup

Run `sudo raspi-config` and configure:

- Set hostname (e.g. syra-pi5)
- Configure locale, timezone, keyboard
- Enable interfaces: I2C, SPI, Serial, Camera
- Optional: Adjust GPU memory (e.g., 128MB for OpenCV/vision)

Update system packages:

```
sudo apt update && sudo apt full-upgrade -y
sudo reboot
```

## 3. Flash Raspberry Pi OS to NVMe SSD (From Pi)

- 1 Boot the Pi from microSD card
- 2 Connect NVMe SSD using the official PCIe HAT
- 3 Install Raspberry Pi Imager: `sudo apt install rpi-imager`
- 4 Run `rpi-imager` and flash Raspberry Pi OS Lite (64-bit) to the SSD
- 5 Power off the Pi, remove the SD card, and reboot — it should now boot from the SSD

## 4. Install System Dependencies

Run this to install core development packages:

```
sudo apt install -y \
git curl wget unzip neofetch htop tmux zsh vim \
build-essential cmake pkg-config \
libatlas-base-dev libssl-dev libffi-dev \
python3 python3-pip python3-venv python3-dev \
libopenblas-dev liblapack-dev libhdf5-dev \
libjpeg-dev libpng-dev libtiff-dev libavcodec-dev libavformat-dev libswscale-dev \
libgl1-mesa-glx libqt5gui5 libqt5webkit5 libqt5test5 \
i2c-tools
```

## 5. Set Up Python Virtual Environment

```
mkdir ~/syra && cd ~/syra
python3 -m venv venv
source venv/bin/activate
pip install --upgrade pip setuptools wheel
```

Install base Python packages:

```
pip install numpy scipy matplotlib opencv-python-headless pillow
```

## 6. Voice, Vision, and Hardware Support

- **\*\*TTS/STT\*\***: Coqui TTS, Vosk, Whisper (optional)
- **\*\*Vision\*\***: OpenCV, MediaPipe, libcamera
- **\*\*Hardware\*\***: RPi.GPIO, gpiozero, smbus2, spidev

## 7. Optional Dev Tools & Monitoring

Install if needed:

```
sudo apt install -y ncd u iftop iotop lm-sensors net-tools
```

For thermal monitoring:

```
sudo sensors-detect
```

```
watch -n 1 vcgencmd measure_temp
```

## 8. Set Up SYRA to Auto-Start with systemd

Create launcher script `syra-launch.sh`:

Content:

```
#!/bin/bash
cd /home/pi/syra
source venv/bin/activate
export $(cat .env | xargs)
python3 main.py
```

Make it executable:

```
chmod +x syra-launch.sh
```

Create a systemd unit file at `/etc/systemd/system/syra.service`:

```
[Unit]
Description=SYRA AI System
After=network-online.target
Wants=network-online.target
[Service]
User=pi
WorkingDirectory=/home/pi/syra
ExecStart=/home/pi/syra/syra-launch.sh
Restart=always
Environment=PYTHONUNBUFFERED=1
[Install]
WantedBy=multi-user.target
```

Enable and start the service:

```
sudo systemctl daemon-reload && sudo systemctl enable syra && sudo systemctl start syra
```