HASviolet

Build Guide

Hudson Valley Digital Network

5 March 2020

v1.0

Introduction

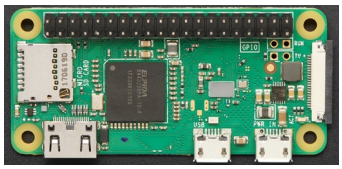
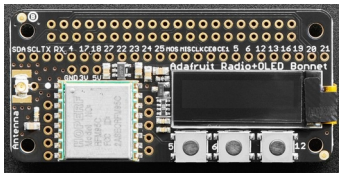
This build guide will walk you through the required hardware and software installation for HASviolet to function. HASviolet will require Internet connectivity via its onboard WiFi for update of the Raspbian Lite OS as well as use future use as a possible LoRaWAN gateway.

While the production of this guide and steps is focused on Linux users, references to installation on Mac OSX and Windows platforms are called out within the text

All reference to “RPi” in this guide are an abbreviation for the Raspberry Pi Zero WH hardware.

Hardware

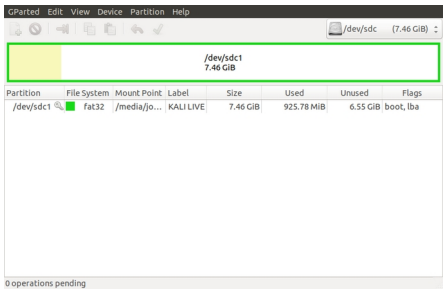
HASviolet consists of the following hardware:

Raspberry Pi Zero WH (Wireless with Headers) • You will need to solder the 20-pin header to the board.	
Adafruit LoRa Radio Bonnet with OLED – RFM95W @915Mhz • Antenna is via a male U.FL connector	
SanDisk Ultra 16GB RAM Class 10 MicroSD • RPI require quality microSD cards at least Class 10	
Power Source 5V @ 2.5A minimum • The hardware can be powered via USB to PC as part of setup but for operation it needs to be on a standalone power source	
900 MHz Antenna with U.FL IPEX to SMA Connector • We will use a simple omnidirectional antenna to get started. Permanent installations should use antennas with greater gain	

Preparing Media

Media installation and preparation for operating systems other than Linux can be found in the [Raspberry Pi Documentation Section on Installing images](#).

- From your PC insert an SD Card
- Run **sudo gparted** partitioning software
- From Gparted menu select **Devices** and SD card inserted
- Unmount the SD card **Delete** any existing parititons
- Right click on **unallocated**, select **new**, select **FAT32** as file system. Click **add**
- Click **check mark** to apply all operations



- Download Raspbian and Extract from ZIP file
- Install Raspbian on freshly formatted SD card

```
wget --max-redirect=3 https://downloads.raspberrypi.org/raspbian_lite_latest

unzip raspbian_lite_latest

sudo dd bs=4M if=2020-02-05-raspbian-buster-lite.img of=/dev/sdg conv=fsync
```

Pi Connectivity

Via connected keyboard, monitor and mouse

- Change to your home directory, run **sync** as sudo, and unmount the SD card
- Remove the SD card

```
cd ~
sudo sync
umount /media/sd-card/root
umount /media/sd-card/boot
```

- You will rerquire a mini HDMI adapter to your monitor (HDMI, VGA, mDP, etc)
- You will require a USB OTG cable to attach a keybaord

Via IP through Wireless Connection

- You can use this method if you wish to access the RPi via an existing WiFi network
- Change to the **boot** directory on the SD card
- Enable **ssh** access by creating a blank file named **ssh**

```
cd /media/sd-card/boot
touch ssh
```

- Within the boot directory, create a file called **wpa_supplicant.conf** and edit

```
vi wpa_supplicant.conf
```

- When you have opened the new file**,** add the configuration at right and save
- Be sure to replace **SSID** with your local wireless network SSID

```
country=US
ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev
update_config=1
network={
        ssid="MyWiFiNetwork"
        psk="aVeryStrongPassword"
        key_mgmt=WPA-PSK
}
```

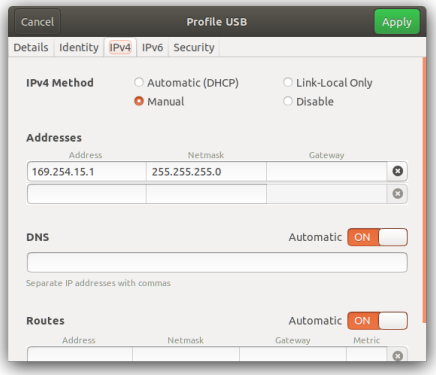
- Change to your home directory, run **sync** as sudo, and unmount the SD card
- Remove the SD card

```
cd ~
sudo sync
umount /media/sd-card/root
umount /media/sd-card/boot
```

Via IP through USB connection

If WiFi is not available is is possible for the Pi to be IP accessible via USB from a desktop/laptop that runs zero-configuration networking, namely BonJour Services developed by Apple. method is for when access to a network is not possible for the Rpi but network access is possible from a laptop or PC.

- For Linux add a USB Network Interface and a network with the Pi on the USB interface. Give it a static address (ie 169.254.15.1)



- Change to the **boot** directory on the SD card
- Edit the **config.txt** file

```
cd /media/sd-card/boot

vi config,txt

          Append the following line:

          dtoverlay=dwc2

          Then save the file.
```

- While in the boot directory, edit the **cmdline.txt** file, replace a line, then save file.

```
vi cmdline,txt

Replace with the following all as one continuous line:

          dwc_otg.lpm_enable=0 console=serial0,115200 console=tty1
          root=/dev/mmcblk0p2 rootfstype=ext4 elevator=deadline fsck.repair=yes
          rootwait modules-load=dwc2,g_ether quiet
          init=/usr/lib/raspi-config/init_resize.sh

Than save the file.
```

- Remaining in the boot directory, enable **ssh** access by creating a blank file named **ssh**

```
touch ssh
```

- Change to the **rootfs** directory
- Edit the **interfaces** file

```
cd /media/sd-card/rootfs/etc/network
vi interfaces

          Append the following lines:

         allow-hotplug usb0
         iface usb0 inet static
                 address 169.254.15.2
                 netmask 255.255.255.0
                 network 169.254.15.0
                 broadcast 169.254.15.255
                 gateway 169.254.15.1

          Then save the file
```

- Change to your home directory, run **sync** as sudo, and unmount the SD card
- Remove the SD card

```
cd ~
sudo sync
umount /media/sd-card/root
umount /media/sd-card/b
```

Pi Setup

- Install Adafruit Radio Bonnet and Antenna
- Insert SD card
- Connect RPI and Power on
- Log in with default pi:raspberry

If accessing via IP over USB, connect PC USB port to RPi USB Data port (next to mini-HDMI port)

ssh -l pi <yourpi>

If connecting via SSH for first time click **yes** to **accept fingerprint**

• Run Configuration tool	`sudo raspi-config`

• Navigate through each menu making selections as noted then exit tool	`1. Change User Password to <something>`
	`2. Network options`
	`N1 Change hostname to your call + number [1-15]`
	`yourcall-5`
	`3. Boot Options`
	`B1 Desktop/CLI`
	`choose B1 Console`
	`4. Localization`
	`I1 Change Local to en_US.UTF-8`
	`I2 Change Timezone`
	`I4 Set to US`
	`5. Interfacing options`
	`P2 Enable SSH`
	`P4 Enable SPI`
	`P5 Enable I2C`
	`7. Advanced Options`
	`A3 memory Split`
	`Reduce GPU from 64 to 16`
	`8. Update`

• Run **sync** as sudo, and **reboot**	`sudo sync ; sudo sync ; sudo sync` `sudo reboot`

HASviolet Install

Copy Report and Run Install	

• Ensure you are in the home directory
• Install Git
• Clone the Github HASviolet repo locally
• Go into the build directory and run the install shell script
	`cd ~`
	`sudo apt-get install -y git`
	`mkdir hvdn-repo ; cd hvdn-repo`
	`git clone https://github.com/hudsonvalleydigitalnetwork/hasviolet.git`
	`cd hasviolet/build`
	`./hvdn_hasviolet_install.sh`

• Installation is complete. Apps are run from **/home/pi/hvdn**	`Installed Directories include` ◦ **/home/pi/hvdn** where the programs and their config files are to be run from ◦ **/home/pi/hvdn-repo** is local repo of hvdn apps are ◦ **/home/pi/hvdn-repo/hasviolet** is local repo of HASviolet

Using HASviolet

HVDN Communicator is data only currently designed to be used on local LoRa networks. It is installed in ***/home/pi/hvdn-comm***

HVDN Communicator is built with Python. Applications include;

- **hvdn_lora-beacon.py** sends a repeating broadcast message
- **hvdn_lora-chat.py** is a half-duplex messaging app
- **hvdn_lora-tx.py** sends a message to another LoRa station
- **hvdn_lora-rx.py** listens for messages from other LoRa stations

Three files dependend by all applications are;

- **hvdn-comm.ini** is a configuration file
- **rf95.py** is a Python Library for the HOPE RFM95 modules on the Raspberry Radio Bonnet
- **font5x8.bin** used by the OLED on the Adafruit Radio Bonnet

hvdn_lora-beacon.py

Beacon a LoRa message

```
Usage: hvdn_lora-beacon.py -c COUNT -t DELAY "message"

OPTIONS
    -c Number of times to repeat MESSAGE
    -t NUmber of seconds before repeat MESSAGE
    MESSAGE is message to be send within double quotes
```

hvdn_lora-chat.py

Half-duplex LoRa messaging app

```
Usage: ./hvdn_lora-chat [-r] [-s]

OPTIONS
  -h, --help      show this help message and exit
  -r, --raw_data  Receive raw data
  -s, --signal    Signal Strength
```

- Starts and loops in Listening Mode
- CTRL-Z to send a message, CTRL-C to exit program
- When in send mode
    - Recipient is node id (255 = broadcast address)
    - Message is whatever message followed by enter
    - Message is sent, return to listening mode

hvdn_lora-tx.py

Send a LoRa message

```
Usage: hvdn_lora-tx.py -d DESTINATION "message"

OPTIONS
        -d Destination ID
        MESSAGE is message to be send within double quotes
```

hvdn_lora-rx.py

Listens for messages from other LoRa stations

```
Usage: ./hvdn_lora-rx.py -r -s

OPTIONS
    -h, --help      show this help message and exit
    -r, --raw_data  Receive raw data
    -s, --signal    Signal Strength
```

HASviolet Manual Install

The build script (**hvdn_hasviolet_install.sh**) automates the following steps.

Install Raspbian Packages	

• Log back into the RPi.
• Ensure you are in the home directory
• Install the following packages
  ○ pip3 – Python Package Index
  ○ Git – For cloning repositories
	cd ~
	sudo apt-get install python3-pip
	sudo apt-get install git

Install Python Libraries	

• Install the following Python libraries
  ○ Python Image Library
  ○ APRS and APRSlib
  ○ Adafruit Radio Bonnet Libraries
	sudo apt-get install python3-pil
	sudo pip3 install aprs
	sudo pip3 install aprslib
	sudo pip3 install adafruit-circuitpython-rfm69
	sudo pip3 install adafruit-circuitpython-rfm9x
	sudo pip3 install adafruit-circuitpython-ssd1306
	sudo pip3 install adafruit-circuitpython-framebuf

Install HVDN Repository	
• Ensure you are in the home directory • Make two new directories called **hvdn** and **hvdn-repo** • Change directory to hvdn-repo and clone the HASViolet repo from Github • Copy the HASviolet stable directory to **hvdn**	cd ~ mkdir hvdn-comm mkdir hvdn-repo cd hvdn-repo git clone https://github.com/hudsonvalleydigitalnetwork/hasviolet.git cp -R /home/pi/hvdn-repo/hasviolet/stable/* /home/pi/hvdn

• Installation is complete. Apps are run from **/home/pi/hvdn**	Installed Directories include
	  ○ **/home/pi/hvdn** where the programs and their config files are to be run from
	  ○ **/home/pi/hvdn-repo** is local repo of hvdn apps are
	  ○ **/home/pi/hvdn-repo/hasviolet** is local repo of HASviolet