Nybble: Basic Assembly and Serial Connections

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- A simplified instruction set, developed directly from Petoi instructions, designed to be a simple step-by-step set of instructions to build your own Nybble cat! This guide is aimed at those who find that they struggle with direction in establishing the fundamentals of playing with Nybble. All Nybble related information in this guide is available in more detail from Petoi. I also highly recommend the Petoi Forum for ideas, inspiration and additional assistance. It is full of great content and a good way to learn how to make your Nybble stand out from the crowd!

1 Assembly and Setting up the Raspberry Pi Interface

1. Upload firmwire to the Nyboard using the Petoi Desktop app. Be sure to zero the IMU (gyro sensor) on a flat bench-top or Nybble will not balance well. See Petoi firmware uploader for additional information.
2. Carry out the assembly process, following the process outlined by Petoi: Petoi Nybble Instructions. Joint calibration can be carried out via USB as per the instructions guide or with the serial input after step 6.
3. To use a Raspberry Pi for controlling Nybble, download the OpenCat repository to the Raspberry Pi. With a Github account, the repository can be set up on your Pi using the Pi terminal:

   ```
   sudo apt-get update
   ```

   ```
   sudo apt-get install git
   ```

   Optionally, to link your own GitHub account:

   ```
   git config –global user.email ”Your@email.com”
   ```

   ```
   git config – global user.name ”Your GITHUB username”
   ```

4. To clone the OpenCat repository to your device, then use:

   ```
   git clone https://github.com/PetoiCamp/OpenCat.git
   ```

   Alternatively, using the same link, download and install manually. All Git repositories can be downloaded by simply replacing the URL with the URL of the desired repository.
5. Follow the Petoi guide to set up the serial port of the Raspberry Pi to interface with the Nybble.
6. ArdSerial.py is used to issue serial commands from the Raspberry Pi to the Nyboard. Serial commands can be found here: Petoi Serial Protocol.

2 Issuing commands to the Raspberry Pi via Wi-Fi and a remote terminal

1. Connect the Raspberry Pi to the same WiFi network as the control device.
2. Using ifconfig in the Raspberry Pi terminal, find IP address of the Raspberry Pi.

   ```
   ifconfig
   ```

3. Download the latest PuTTY client to the control device. A remote connection to the Raspberry Pi can be established by following simple guide.

4. After establishing the connection, use the PuTTY terminal as per steps 1.5 and 1.6 to issue commands to Nybble!

3 Using the OpenCatWeb Interface

1. Download or clone the OpenCatWeb repository to your device
2. Follow the setup instructions in the read-me either from the cloned repository or here. Stop when you reach the section called ”First Start”, changes must be made to enable the connection to be made.
3. Enable SSH in the Raspberry Pi terminal and configuration settings and acquire the IP address of the Raspberry Pi on the network using ifconfig.

   ```
   sudo raspi-config
   ```

   ```
   ifconfig
   ```

4. html.escape supersedes cgi.escape from Python 3.2 onwards (issues arise in OpenCatWeb scripts as a result of this) and additional compatability issues may occur. A workaround is to install Python 2.7 and alter app.py to run on the older version. Begin by installing Python 2.7, using the Raspberry Py terminal.

   ```
   sudo apt-get update
   ```

   ```
   sudo apt-get install python2.7
   ```

   ```
   reboot
   ```

5. Open app.py from the OpenCatWeb directy with a text or Python editor. Alterations are made to use the known IP address and to reconfigure the script to use Python 2.7. Observe the following sections of code:

   `!/usr/bin/python` at line 1

   `HOST = ’0.0.0.0’` at line 8

   The first line must be altered to run Python 2.7, and new lines added directly beneath to reconfigure the default location of packages, as these will not be installed in the standard Python 2.7 location. Replace line 1 with the following 3 lines:

   ```
   !/usr/bin/python2.7
   ```

   ```
   import sys
   ```

   ```
   sys.path.append(‘/usr/lib/python3/dist-packages‘)
   ```

   Now simply input the IP address of your Raspberry Pi into the HOST line and save the code. For example:

   ```
   HOST = ’192.168.0.32’
   ```

6. Next, bus.py must be altered to suit the correct serial configuration. Code lines 9 to 18 are responsible for setting up the serial connection. Note in particular, the following 2 lines:

   ```
   port = ’/dev/ttyAMA0’,
   ```

   ```
   baudrate = 57600,
   ```

   To allow OpenCatWeb to function, these must be re-defined to suit the ttyS0 serial port. Changing the lines as follows:

   ```
   port = ’/dev/ttyS0’,
   ```

   ```
   baudrate = 115200,
   ```

7. Ensure that Flask and serial are installed:

   ```
   pip install Flask
   ```

   ```
   pip install serial
   ```

8. You should now be able to resume following the read-me for OpenCatWeb from the ”First Start” section.

4 Arduino Serial Output

1. The Arduino serial monitor can be used with both Bluetooth or a USB cable as an interface. Connect the desired adaptor to the Nyboard and either connect the USB cable to your control device or confirm that Nyble is visible over Bluetooth.
2. Open the Arduino IDE, choose an Arduino UNO as the board and choose the correct COM port. If using a USB cable, you should be able to view which COM port is connected to Nybble, and alternatively determine the COM port of your Bluetooth connection. Open the serial monitor and ensure that the settings of the serial monitor is set to ”No line ending” and ”115200 baud”.
3. If a succesful connection is made, Nybble will begin by relaying some data back to the serial monitor. If you can clearly see information from the Nybble, you are ready to go! Issue commands to Nybble observed in the Serial Protocol documentation to control her!

5 Raspberry Pi with Ubuntu Via PuTTY

1. Install Ubuntu via the Raspberry Pi imager. The server version can be used for simplicity, performs much better on older Raspberry Pi hardware. It is necessary to open the advanced options section on the main page, and enable SSH and enter desired log-in details of the Raspberry Pi, to allow access over a network connection. For additional information, follow the Ubuntu Installation Guide.
2. Download the latest PuTTY client to the control device. A remote connection to the Raspberry Pi can be established by following simple guide.You can use the host name given during the installation setup to connect to the Raspberry Pi, or the IP address.
3. Ubuntu lacks some essential Python packages required to use ardSerial.py. It is useful to install the Python pip package as well as tkinster.

   ```
   sudo apt-get update
   ```

   ```
   sudo apt install python3-pip
   ```

   ```
   sudo apt install python3.8-tk
   ```

   sudo dmesg | grep tty [check that ttyS0 is enabled or see what it is about!?]

   Can install a desktop UI if needed: sudo apt install xubuntu-desktop sudo apt install lubuntu-desktop

6 Kinematic Model- Skill Creation

Kinematic Model pip3 install –upgrade numpy sudo apt-get install libatlas-base-dev

7 Flinders University Customisations

This section introduces adaptations made during the assembly and testing of the Nybble project.

1. Customised Battery Holder:
   A replacement battery holder was developed to suit a 7.4 850mAh LiPo battery featuring a JST connector, using an inline switch. The mounting was designed to retain Nybble's sliding battery mechanism, to allow for adjustments to her centre of gravity. The current itteration of the design is entirely 3D printed, and is ready to use after installation to the lower frame of Nybble. Due to tolerancing from the print, drilling of the base may be required to fit the original locating collars, however heating the collars with a soldering iron is also effective.

2. Petoi/Raspberry Pi Camera Holder:
   As Nybble does not have the facilities to equip a camera, as Bittle would, a clip on camera mount was designed. It sits over the head of Nybble, and clips around the ultrasonic sensor. The camera design has 2 versions, one to suit the Petoi camera and one to suit a Raspberry Pi camera, to better facilitate projects requiring additional functionality. Details about setting up the camera can be found here.

3. Raspberry Pi 3B spaced mounts:
   As Nybble was designed around a Raspberry Pi 3A, with a smaller footprint than later models, the design of the body inhibits the use of full scale Pi models, with issues accessing most of the USB ports. Spacers have been designed, that use the Nyboard mounting screws to secure them to the body, and allows self-tapping screws to be fitted to support the Raspberry Pi. Additional requirements are a 2x5 pin spacer and some self-tapping screws.

8 Acknowledgments

Here will be acknowledgements to the Cat man himself, leukipp and other sources