

Animating and Coding with the Sense HAT

Drop-In Activity Plan



World Maker Faire New York, 2015

This activity is an opportunity for people of all ages experiment with Raspberry Pi and the Sense HAT using just the mouse or by typing code and executing it. It's meant as a self-guided, drop-in activity for events, but can be used in other environments as well.

The Sense HAT is a Raspberry Pi add-on board which has a matrix of LEDs, a joystick input, and a few sensors for measuring temperature, pressure, humidity, orientation, and movement. It's the very same hardware that's on the International Space Station right now as part of the [Astro Pi program](#).

For younger participants, there's a point-and-click interface for creating drawings and animations with the LEDs on the Sense HAT. Participants who can type code are guided in

writing a few lines of Python code in order to access the board's sensors and to use the LED matrix.

Participants may simply want to explore the capabilities Raspberry Pi without guidance. We absolutely encourage people to hack, experiment, and play with it.

For each workstation, you'll need:

- Raspberry Pi (Pi 1 Model B+, Pi 2, or Pi 3)
- 8GB or larger microSD card, formatted with the latest version of Raspbian
- Power supply, 5 volts, 2000mA (2A) or greater output
- Sense HAT. To attach it securely to the Raspberry Pi, you'll optionally need:
 - 4x M2.5 12mm length standoffs
 - 8x M2.5 5mm length machine screws
 - Philips head screwdriver
- USB keyboard
- USB mouse
- HDMI cable
- HDMI monitor
- Instruction card (see end of document)

You'll also need:

- Internet connection, for initial setup (WiFi dongle or Ethernet cable are required for Pi 1 & 2)
- microSD card reader/writer

Equipment recommendations:

- Be sure to have spare prepared SD cards handy in case someone wreaks havoc with the filesystem. This way you'll be able to quickly swap the SD cards and get the Pi back to its starting state.
- We recommend a full-size keyboard and mouse as opposed to keyboard/trackpad combos or travel-size peripherals. It can be difficult for some participants to use trackpads or mini keyboards.
- Provide two low stools for each workstation. Events often provide folding chairs, but they can be too large and kids sometimes have difficulty sitting in them. Stools can help with this a lot. Ikea sells really inexpensive stools.
- We had 6 workstations at our 10'x20' booth at Maker Faire New York, an event with 75,000-100,000 attendees over two days. During peak times, there was a small wait for a workstation to open up, but 6 workstations were enough to accommodate the crowd.
- We had 12 workstations at a 20'x20' booth at USA Science and Engineering Festival in DC with 330,000 attendees over three days. On the weekend days, all workstations were fully occupied for most of the event.

Setup:

1. Connect the Sense HAT to the Raspberry Pi with the standoffs and screws.

2. Connect the monitor via HDMI cable and make sure the monitor is turned on.
3. Connect the USB keyboard and mouse.
4. Insert the microSD card. It should already have the latest version of [Raspbian](#) installed. If not, you can either create a bootable Raspbian microSD card or use NOOBS to install Raspbian:
 - a. [Guide to creating a new Raspbian microSD card.](#)
 - b. [Guide to creating a new NOOBS microSD card.](#)
5. Connect Ethernet cable or USB WiFi dongle
6. Connect power and let the Raspberry Pi boot to the desktop environment.
7. If you're using WiFi, connect to your network by clicking on the network symbol on the right side of the taskbar along the top of the screen.
8. You may need to set the following options within Raspberry Pi Configuration (Click Menu → Preferences → Raspberry Pi Configuration):
 - a. Disable overscan if the desktop doesn't fill the whole screen
 - b. Set the keyboard to the appropriate layout (default is set to UK, so the " and @ keys are swapped compared to USA keyboard layout.)
9. Click the Terminal icon in the taskbar. It looks like a monitor.
10. At the terminal prompt, type the following commands to install the Sense HAT Grid Editor software and setup desktop icons:

```
cd ↵  
curl -L bit.ly/1PQeM7a | sh ↵
```

Note: The | symbol above is above the enter key on most US keyboards. However, since Raspbian defaults to British settings, you may need to try holding the the right side Alt key while pressing the ~ key in order to generate the | character. You can also change the keyboard layout by clicking Menu → Preferences → Raspberry Pi Configuration. Click the "Localisation" tab and then "Set Keyboard..."

If you'd like to review or improve the code for this project, it's available here:
https://github.com/mrichardson23/RPi_8x8GridDraw

Note: The Sense HAT Grid Editor program won't launch if there's no Sense HAT attached to the Raspberry Pi.

11. Print copies of the activity card for participants (at end of this document).

Setup Recommendations

- If setting up multiple workstations, it's best to fully set up a single workstation and then duplicate that microSD card for each of the rest of the workstations.
 - [Duplicating a microSD card with Windows](#)
 - [Duplicating a microSD card with Macintosh](#)

- Be sure to test the activity with the light level you're expecting during the event. Direct sunlight or even bright daylight will make the Sense HAT's LEDs difficult to see.
- We've found that many young participants will discover that Minecraft is installed and want to use it instead of the Sense HAT activity. This tends to attract many other kids that just want to play Minecraft and do nothing else. If you want to prevent this, consider removing the Minecraft shortcut from the menu by going to Menu → Preferences → Main Menu Editor. Click on "Games" and then untick Minecraft Pi.



SX Create 2016 in Austin, TX

Running the activity:

- Invite participants to experiment with Raspberry Pi by creating an animation or writing a few lines of code.
- The animation activity is usually self-explanatory, but the card should help guide participants.
- If someone is working on the coding activity, remind them that the code is case-sensitive.
- Have them experiment with the `get_temperature()` function and `get_humidity()` function. Can they figure out how to make the numbers go up?

- If there's an internet connection, encourage the to explore the [Sense HAT library's documentation](#) to learn how to change the speed and color of the text or to read other sensors. You may even want to have a printed copy of the library's API functions.
- The activity cards instruct users to enter code on the Python interpreter's interactive mode command line ("`>>>`"). Commands are executed immediately after the user presses enter. If the participant wants to write a full script and then execute it, they can click File -> New File to write the code into a file and then execute that file.
- If the Sense HAT Grid Editor program has an animation running on the Sense HAT, then the Python code won't run as expected. Make sure participants close the Sense HAT Grid Editor window before executing any Python code.
- Allow participants to explore beyond the instruction card.
- Encourage participants to collaborate together and share a workstation during peak times.
- After someone finishes the activity, close all their windows so that the next person can start from the beginning of the activity.
- Mention that the hardware that the Sense HAT is the same hardware that's on the International Space Station. Read more about this at <https://astro-pi.org/>.

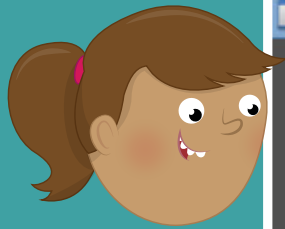


2016 USA Science and Engineering Festival in Washington, DC

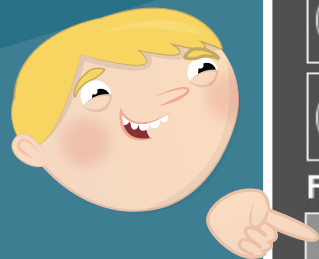
Draw and Animate with **LEDs**



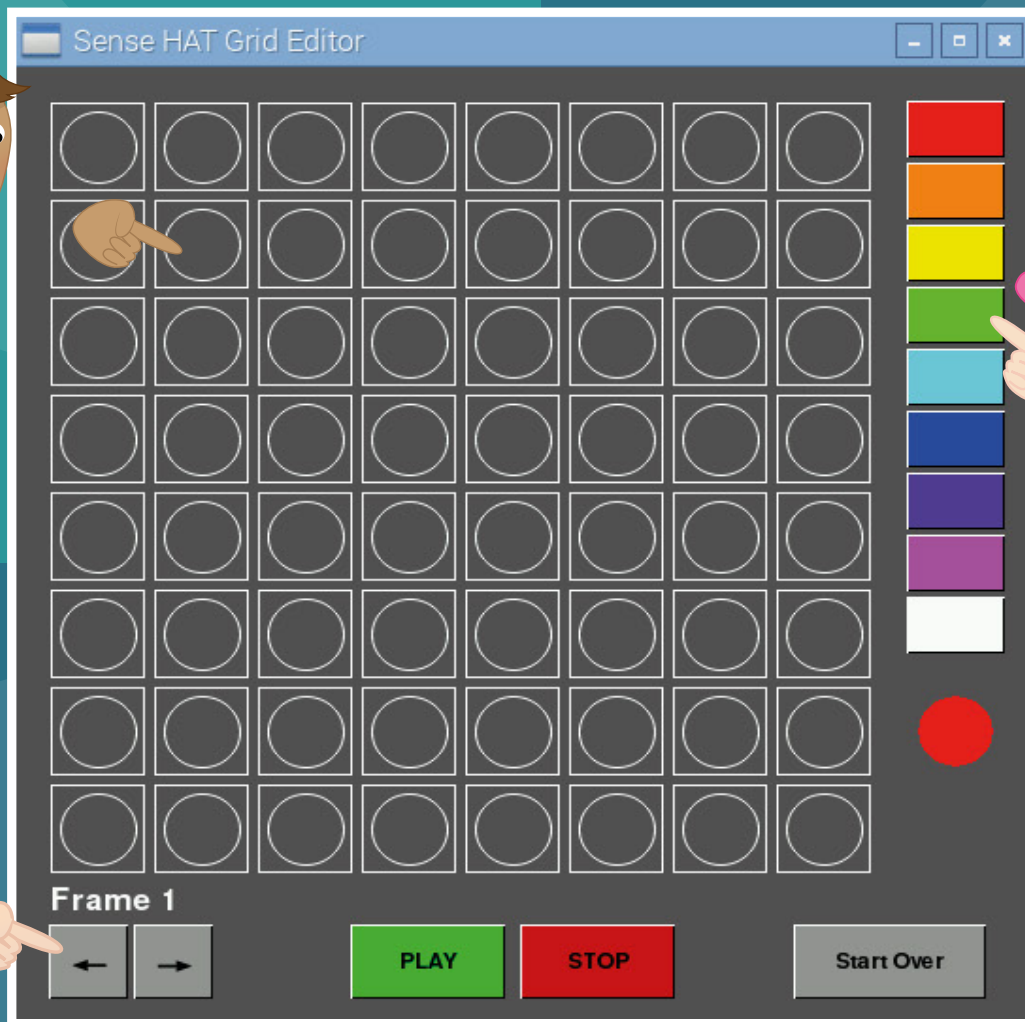
Double-click here to begin



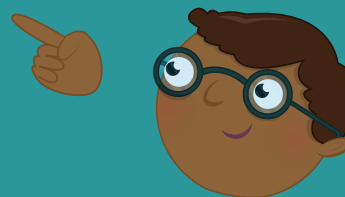
Click to select pixels



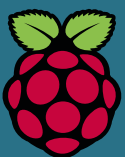
Next / previous frame



Choose a color



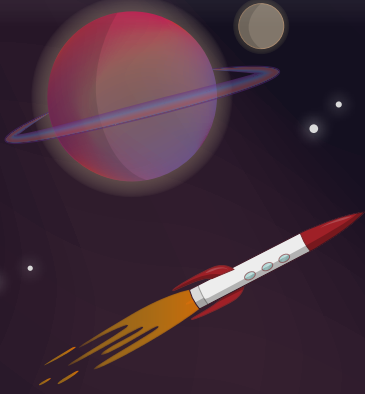
Display on LEDs



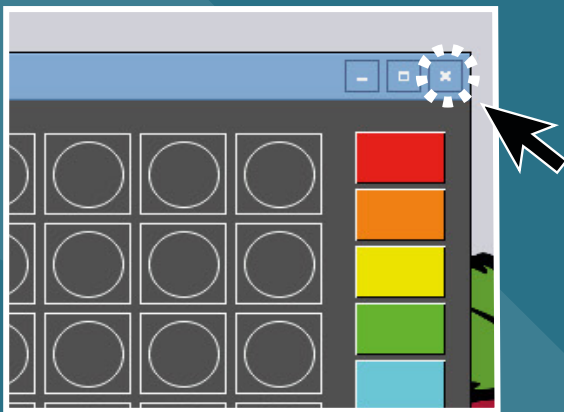
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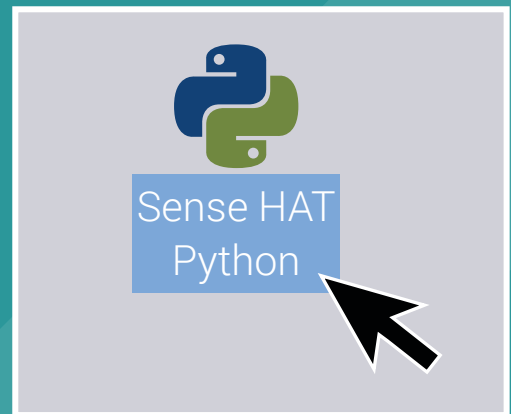
Programming



1 Close the Sense HAT Grid editor



2 Double-click here to open Python



3 Type at the >>> prompt

```
sense.show_message("Hello, Earth!") ↵
```



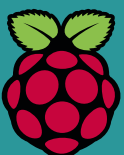
After you hit enter, watch your message scroll on the LED matrix!

4 Also try:

```
sense.get_temperature() ↵  
sense.get_humidity() ↵
```

```
red = (255, 0, 0) ↵  
sense.set_pixel(0, 0, red) ↵
```

Type Alt+p to repeat the last command.



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