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INDIA

Did Ya'

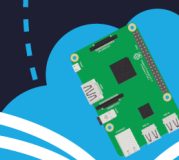
# BREAK YOUR PI AGAIN!



V 2.0



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## Raspberry PI

Get Started

Useful Commands  
Tips & Tricks

[WWW.PIBOX.IN](http://WWW.PIBOX.IN)

## Welcome!

Congratulations on the purchase of your PiBOX India kit containing Raspberry Pi and peripherals.

## Warranty!

Your PiBOX India purchase is covered under warranty from the manufacturer. Please register your order at the below link within 7 days of your purchase to avail the extended warranty benefits [www.pibox.in/register](http://www.pibox.in/register)

## Support!

We are a customer focused startup. Please inspect the contents of the kit and contact us if you have any queries. You may contact us at

**Whatsapp:** +91 8072238441

**Email:** support@pibox.in

This book is an extension of our vision to create value to our customers. Our sincere thanks and best wishes to you. Good Luck with your Pi Ventures!

## Notes/Worksheet

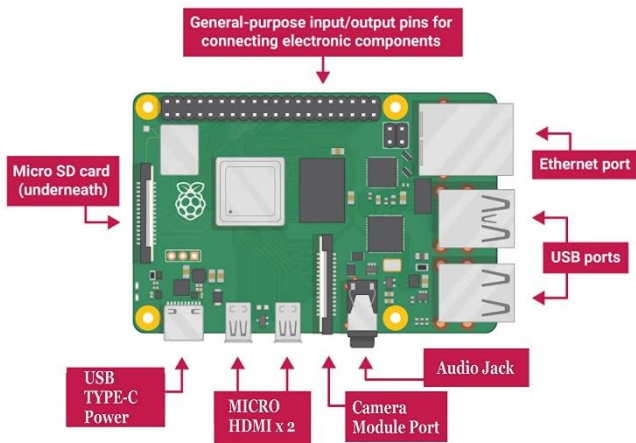
PiBOX India

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## Know Your Pi4 [For other versions: [www.pibox.in/myrpi](http://www.pibox.in/myrpi)]

Let's take a quick look at the Raspberry Pi4 and make sure that you get a thorough understanding of the updated features of Pi4.



**Faster Processor:** Raspberry Pi 4 sports a faster 1.5GHz clock speed processor (up from the 1.4GHz found on Raspberry Pi 3B+).

**Choice of RAM:** Raspberry Pi4 comes in 4 different RAM configurations to choose from – 1GB / 2GB / 4GB

**Connectivity:** Raspberry Pi4 has a modern implementation of most of the connections.

- Bluetooth 5.0 with improved speed, range, and capacity
- Faster USB 3.0 ports - 2 x USB 3.0 ports
- Unconstrained Gigabit Ethernet
- 2 micro HDMI ports - capable of running 4K video at 60 frames-per-second
- 5V DC via USB-C connector

Raspberry Pi4 is a clear winner when it comes to pure specifications and hardware grunt.

## Getting Started with your PiBOX India Kit

[Note: Refer “*Headless Raspberry Pi setup*” section if you don’t have a monitor, mouse and keyboard]

You will need the following peripherals to setup the Pi.

### 16GB microSD card – Class 10

The microSD card is a key component, as the Pi boots into the OS from the microSD card and also to store games, programs, and photo files. You’ll need a card with a capacity of 8GB or greater and a card reader to connect to a PC/Mac. The PiBOX India combo kit comes with a microSD card with pre-loaded NOOBS.



### USB mouse

A tethered mouse that physically attaches to your Raspberry Pi via a USB port is the simplest input device to navigate the Pi Desktop.

## Mac / PC /Laptop

A Windows or Linux PC/ Mac computer is required to format the micro SDcard and download NOOBS.



## Power supply – 5V 3 Amps

The PiBOX India kit comes with a BIS certified charger adapter. Raspberry Pi uses the same type of USB power supply as your average smartphone. So you can use your USB to micro USB cable (or USB Type-C for Raspberry Pi 4) and a smartphone power supply.

## USB keyboard

Like any computer, you need a means to enter web addresses, type commands, and otherwise control Raspberry Pi. You can use a Bluetooth keyboard, but the initial setup process is much easier with a wired keyboard.



## Monitor / TV Display and Micro HDMI Cable (Included)



A standard PC monitor with HDMI port is ideal. Raspberry Pi 3B+ uses regular HDMI cables. Raspberry Pi 4 can power two HDMI displays, but requires a less common micro-HDMI to HDMI cable (or adapter). The PiBOX India kit contains a premium micro HDMI cable.

## Hardware Setup

The Raspberry Pi has plenty of ports to connect peripherals.

**01**

### Hook up the keyboard

Connect a regular wired keyboard to one of the four USB ports. You can connect a Bluetooth keyboard, but it is better to use a wired keyboard for initial setup.

**02**

### Connect a mouse

Connect a wired mouse to another USB A socket. As with the keyboard, it is possible to use a Bluetooth wireless mouse, but setup is easier with wired mouse.

**03**

### Connect Display

Connect the Pi to your display using a HDMI cable. This connects to one of the micro-HDMI ports of a Raspberry Pi 4, or full-size HDMI socket on a Raspberry Pi 3/3B+. For monitors with VGA, you would need a HDMI to VGA adapter.

## Software Setup and OS Installation

A micro SD card stores the Operating System for the Raspberry Pi to boot, as the Pi does not have any in-built memory for OS. The PiBOX India Raspberry Pi combo kit includes a microSD card loaded with the latest version of NOOBS (New Out Of Box Software). You may skip the next step and proceed to the installation of the OS.

To copy NOOBS to a new SD card, follow below steps.  
For step by step description, visit [www.pibox.in/sdcard](http://www.pibox.in/sdcard)



**01****Prepare to format**

Download the [SD Card Formatter Tool](#) and launch the program. Insert the micro SD card to PC or Mac and choose the Quick Format option. This tool deletes all the existing partitions and erases all data in the SD card.

**02****Download NOOBS**

Download the latest NOOBS ver 3.3.1 or above. Download the ZIP file and extract the ZIP file to a destination NOOBS folder in the local storage of your PC/Mac.

**03****Copy NOOBS to the SD card**

You need to copy all the files from the NOOBS folder to your SD card. Press CTRL+A (⌘+A on a Mac) to select all the files, then drag all the files to the SD card folder. Please make sure to copy the files inside the NOOBS folder to the microSD card (not the NOOBS folder itself).

The Raspberry Pi hardware and software setup is complete. After inserting the microSD card with NOOBS into the micro SD card slot of the Pi4, it is now ready to be powered ON. Raspberry Pi does not have a power switch and will turn on as soon as it is connected to a live power supply. Connecting the Raspberry Pi to a power supply is the very last step in the Pi setup process.

**Installing OS from NOOBS**

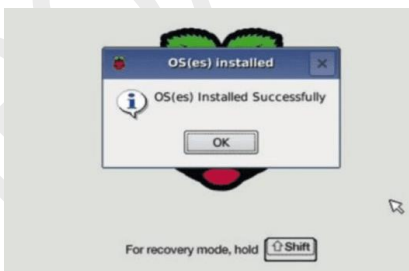
For detailed procedure, please visit [www.pibox.in/NOOBS](http://www.pibox.in/NOOBS)

NOOBS, the New Out-Of-Box Software, allows to choose from several different operating systems and install them.

automatically. Once the Pi is powered ON for the first time with fresh NOOBS, you have to choose the OS to install, from the NOOBS menu. If the Pi is connected to the network, you can also download and install other operating systems. The two OS included with the NOOBS are

- Raspbian, a version of the Debian Linux operating system tailored specifically for the Raspberry Pi
- LibreELEC, a version of the Kodi Entertainment Centre software

Select your choice of OS and 'Install'. Raspbian OS is the recommended OS for first time users. A warning message appears stating that installing the operating system will overwrite any data currently stored on the microSD. Click 'Yes' and the installation process will begin. The installation process can take 10 to 30 minutes, depending on the speed of your microSD card. When the operating system is fully installed, the setup wizard appears.



The Raspberry Pi now displays the Graphical Desktop. This process completes the one-time setup of the software for Pi. Upon successful completion of the OS installation process, Raspberry Pi boots directly to this Pi desktop every time it is powered ON with this micro SD



## Recovery Mode

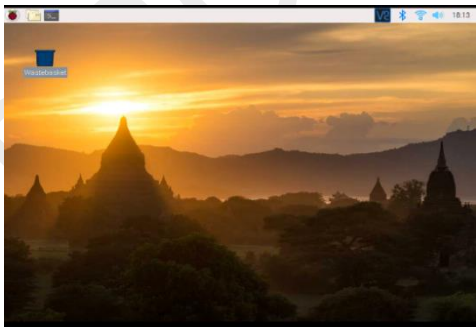
In case, you want the Pi to go to the NOOBS menu, even after successful OS installation, then hold down the SHIFT key on the keyboard as you connect the Raspberry Pi to its power supply. This is known as recovery mode, and is a great way to restore a Pi whose OS has been corrupted. It also allows you to enter the NOOBS menu to reinstall the operating system, or install one of the other operating systems. You can also edit the *config.txt* file from this menu.

## Welcome Wizard

The Welcome wizard appears on the Pi Desktop, when the Pi starts for the first time after the OS installation. This helpful tool is used to change some settings in Raspbian.

1. Selecting a Country, language, Time Zone and similar options
2. Setting a new password
3. Choosing a wireless network
4. Checking for updates
5. Rebooting the Raspberry Pi

After all the configuration settings, you will be able to see the Raspberry Pi Graphical Desktop. This brings us to the end of the one-time setup of the Raspberry Pi. In the future, every time the Raspberry Pi is powered ON with this micro SD card, the Pi starts from the Graphical Desktop as shown below.



## Setup your Raspberry Pi without Display [HEADLESS]

The method of setting up the Pi without ever connecting it to a monitor or keyboard is known as running the Pi “headless”. As it requires certain changes to the root directory files and other configuration settings of Pi, it is not recommended for beginners. The users are requested to exercise caution during the setup.

For a detailed description of the Headless setup with step by step images, please visit [www.pibox.in/headless](http://www.pibox.in/headless)

### 1. Choose the OS image:

You can choose any OS image and download the .zip file.

<https://www.raspberrypi.org/downloads/raspbian/>

### 2. Choose an SD card Imager:

Download Raspberry Pi Imager (or tools like Etcher) for PC/Mac and burn the OS image to micro SD card. Please be sure to format the SD card using SD card formatter tool, before starting.

<https://www.raspberrypi.org/downloads/>

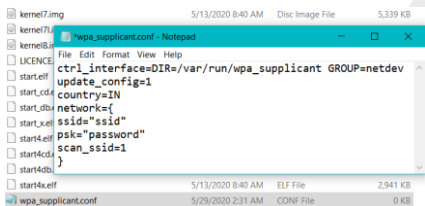
### 3. Enable SSH during boot:

Write an empty text file named "ssh" (no file extension) to the root of the directory of the card. Power ON the Raspberry Pi using Ethernet cable, micro SD card.

### 4. Enable Wi-Fi during boot:

Create a text file called “wpa\_supplicant.conf”, and place it in the root directory of the microSD card. Edit the file to include the below text. Please use

your real-time SSID and password: ssid = your Wi-Fi SSID and password = your Wi-Fi Password. You may skip this step, if you can connect Pi to the network using Ethernet LAN port.



## 5. Find the IP address of the Pi:

You can login to the router as admin or use software tools like Advanced IP scanner to get the IP address of the Pi.

## 6. Connect to the Pi using SSH client:

You can use Putty or other SSH client software tool to login to the Raspberry Pi using SSH. Use **pi** as username and **raspberrypi** as password for the SSH login credentials.

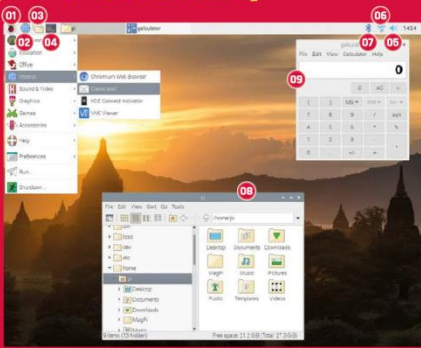
Now the Pi is ready to be Powered ON anywhere and anytime using the micro SD card alone. Once, you have connected to the Pi via SSH, you can use **sudo raspi-config** to edit various settings.

<https://hackernoon.com/raspberry-pi-headless-install-462ccabd75d0>

<https://www.tomshardware.com/reviews/raspberry-pi-headless-setup-how-to,6028.html>

## Using the Pi – Raspbian Graphical Desktop

### Meet Raspbian with Desktop



**01** Click the Raspberry Pi logo to open the applications menu. This is where you'll find the software that's pre-installed in Raspbian, and anything else you add later.

**02** Click the globe for quick access to the Chromium web browser.

**03** Click the folders to open the File Manager. You can use it to find, move, copy, and delete files on your storage devices. Why not explore the Linux file system?

**04** Find the Terminal here. It gives you powerful tools for managing your files and devices, and the command line is often the quickest way to get things done.

**05** Volume control. Right-click to select audio output.

**06** WiFi options. Turn WiFi on and off, and switch networks here. If the icon is blue like this, you're connected. You can also

hover the mouse pointer over the icon to see your Raspberry Pi's IP address.

**07** Manage Bluetooth connections. You can use Bluetooth devices such as keyboards and mice to

wirelessly control your Raspberry Pi device.

**08** File Manager. Use the hierarchical browser on the left or the Go menu to find devices connected to Raspberry Pi. You should

store your files in the `/home/pi` folder.

**09** With basic, scientific, and paper modes, this calculator is handy. Find it in the Accessories section of the applications menu.

## Raspberry Pi Configuration Tool

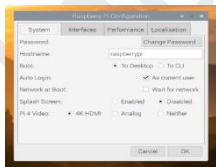
The Raspberry Pi Configuration Tool is a powerful package for adjusting numerous settings on your Raspberry Pi, from the interfaces available - to programs - to controlling it over a network. You can load the Raspberry Pi Configuration

Tool from the Preferences category under the Raspberry icon menu. It can also be run from the command-line interface or Terminal using the command `sudo raspi-config`. The layouts for the command-line version and the graphical version are different, with options appearing in different categories, depending on which version you use.

### System tab

The System tab holds options to control various Raspbian settings.

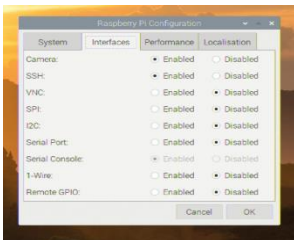
- Password
- Hostname
- Boot
- Auto Login
- Network at Boot
- Splash Screen
- Pi4 Video



### Interfaces tab

The Interfaces tab holds settings which control the hardware interfaces available on the Pi.

- Camera
- SSH
- VNC
- SPI
- I2C
- Serial Port
- Serial Console
- 1-Wire
- Remote GPIO

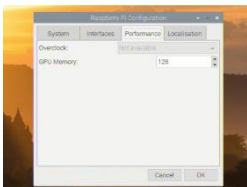




## Performance tab

The Performance tab holds settings which control how much memory is available and how fast the Raspberry Pi processor runs.

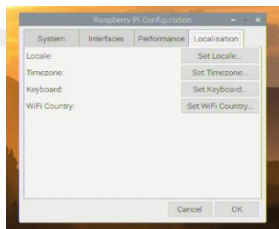
- Overclock
- GPU Memory



## Localisation tab

The Localisation tab holds settings which control which region the Raspberry Pi is designed to operate in, including keyboard layout settings.

- Locale
- Timezone
- Keyboard
- WiFi Country



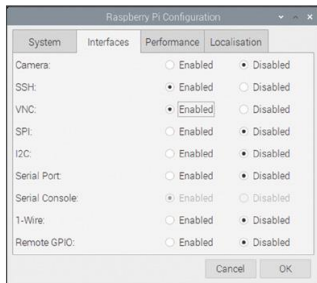
## Remote Connection to Pi

There are two methods of connecting remotely to the Pi, after the installation of the OS is complete.

- Secure Shell (SSH)
- Virtual Network Computing (VNC)

The first step is to enable the VNC or SSH from the Interface tab of the Configuration tool.

Enable SSH and VNC in the Raspberry Pi Configuration tool.



The next step is to get the IP address of the Raspberry Pi. To find out, click the Terminal icon on the taskbar, and enter *ifconfig* at the prompt. You'll find it beside '*inet*', in the details for *wlan0* if you're using WiFi or in the *eth0* summary if you're plugged in to the network.

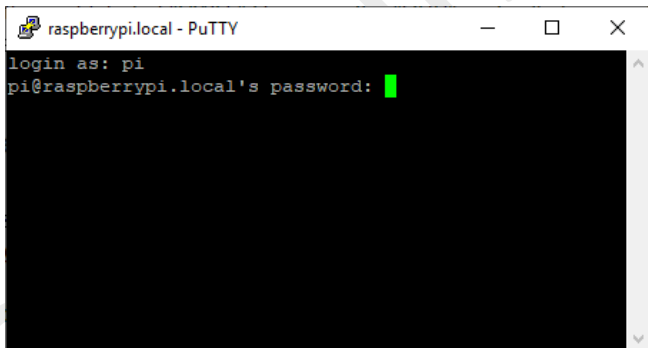
[ifconfig](#): To check the status of the network connection of the Pi. The IP address of this example is 192.168.1.5 via Wi-Fi.

```
root@PiBOX:~# ifconfig
wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.1.5 netmask 255.255.255.0 broadcast 192.168.1.255
    inet6 fe80::9f20:ee70:89c9:1bd2 prefixlen 64 scopeid 0x20<link>
    ether b8:27:eb:91:53:47 txqueuelen 1000 (Ethernet)
    RX packets 9456 bytes 9762225 (9.3 MiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 8045 bytes 1054222 (1.0 MiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@PiBOX:~#
```

## Connect to the Command Line Through SSH:

You can connect to your Raspberry Pi's command line interface using SSH from any computer. While you won't get a graphic interface, you can run any type of command from the terminal application on another computer and it'll execute on the Raspberry Pi. If you're working on a project that doesn't require a screen, this is a great way to connect to your Raspberry Pi without a monitor, keyboard, or mouse. Use SSH tools like PuTTY, login to the Pi using the IP address, use the login credentials username – *pi*, password – *raspberrypi*. You will be able to execute the Pi by using commands.



<https://www.raspberrypi.org/documentation/remote-access/ssh/>

To access the device without a password:

<https://www.raspberrypi.org/documentation/remote-access/ssh/passwordless.md>

## **Connect to Pi as remote screen through VNC:**

To access the Raspberry Pi Graphical Desktop Interface, you can use VNC (Virtual Network Computing). You'll see the desktop of the Raspberry Pi in a window on your desktop computer and you can control it as if you're sitting in front of the Pi itself.

In your PC you will need to download and install VNC Viewer or similar applications to remotely access Raspberry Pi Desktop. VNC Viewer is available for Windows, macOS, and Linux. There are also Android and iOS apps, so you can use VNC to control Raspberry Pi from a mobile device.

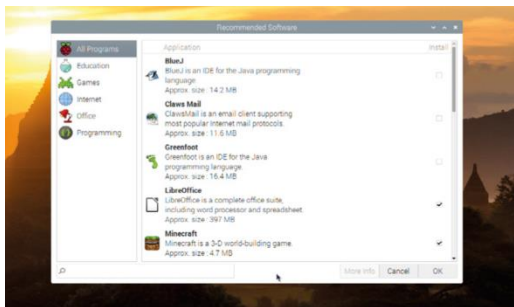
<https://www.raspberrypi.org/documentation/remote-access/vnc/>

Remotely connecting to and controlling your Raspberry Pi is a pretty useful feature, so you'll want to familiarize yourself with both of these remote connection methods at some point.

## **The Recommended Software tool**

Although Raspbian comes preloaded with a wide range of software, it's compatible with even more. A selection of the best of this software can be found in the Recommended Software tool.

Note that this tool needs a connection to the internet. If your Raspberry Pi is connected, go to Preferences tab and select Recommended Software. A list of compatible software packages will appear under various categories. You can check or uncheck the Software for installation or uninstallation.

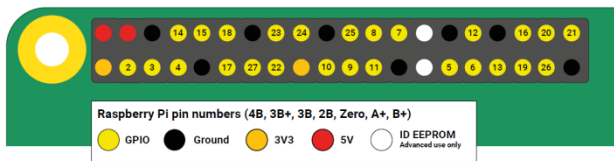


You can mark as many pieces of software as you like before installing/removing them all at once. After software selection, click the OK button to begin the installation or uninstallation process. The pi will start the downloading and installing/uninstalling of any new software.

An additional tool for installing or uninstalling software, the Add/Remove Software tool, can be found in the same Preferences category of the Raspbian menu. This offers a wider selection of software, but which has not been vetted by the Raspberry Pi Foundation.

## **GPIO**

A great way to kick start learning with Pi, is to start using physical input/output devices using the GPIO pins located on the Pi board. You can connect hardware like light-emitting diodes (LEDs) and switches to the Pi board for control under programs you create.



The pins are split into 4 main types

- 3.3V
- 5V
- GPIO
- Ground

### DPI (Display Parallel Interface)

This interface allows you to add VGA connection directly from the pins itself. Supported resolution ranges from 640 x 480 up to 1920 x 1024 @ 60fps. If you don't want to use HDMI connection – simply wire these pins accordingly and the video output will be sent to your display. You would be able to drive another desktop through the pins, but bear in mind you will use 22 pins to do so!

### I<sup>2</sup>C (Integrated Circuit)

4 of the pins are available as I2C connections, allowing to communicate with a range of other devices supporting this standard. This way you can save other GPIOs on your RPI, for other purposes and communicate with various microcontrollers via this bus. You would be able to connect expansion boards to overcome RPI limitations. Using these allow also to reduce the GPIO hungry expansions like LCD displays, GSM/GPS etc. So if you ever find yourself lacking inputs/outputs on your RPI – look into expanding this bus.

### SPI (Serial Peripheral Interface)

This is another standard that expands the connections of your RPi, using 11 pins allows chaining your compatible devices together and read out the output on separate pins. This interface allows linking several slave devices to a single master.

### JTAG (Joint Test Action Group)

The interface uses 11 pins and allows to test and debug circuits on your RPi. Chances are you will never need this.

### GPCLK (General Purpose Clock)

This interface allows you to output a specific hardware driven frequency. You will sacrifice 3 pins to use it. Available frequencies are predefined.









































### UART (Universal Asynchronous Receiver Transmitter)

One of the older interfaces that allow for interactions with a lot of controllers. The receiving end is required to have UART hardware on board and commands are issued as 8-bit transfers with 1st and the last bits marking the start and the end of the message. Voltage levels are ignored, so message can be coded using 3.3V, 5v or at even bigger current level.

### PCM (Pulse-Code Modulation)

If you are looking for another way of outputting high-quality audio – you can use 4 pins digital output that can be translated to DAC standard.

## Raspberry Pi Model B+ (J8 Header)

GPIO	BCM	NAME				NAME	BCM	GPIO
		3.3 VDC Power	1			2		5.0 VDC Power
8	2	GPIO 8 SDA1 (I2C)	3			4		5.0 VDC Power
9	3	GPIO 9 SCL1 (I2C)	5			6		Ground
7	4	GPIO 7 GPCLK0	7			8		GPIO 15 TxD (UART) 14 15
		Ground	9			10		GPIO 16 RxD (UART) 15 16
0	17	GPIO 0	11			12		GPIO 1 PCM_CLK/PWM0 18 1
2	27	GPIO 2	13			14		Ground
3	22	GPIO 3	15			16		GPIO 4 23 4
		3.3 VDC Power	17			18		GPIO 5 24 5
12	10	GPIO 12 MOSI (SPI)	19			20		Ground
13	9	GPIO 13 MISO (SPI)	21			22		GPIO 6 25 6
14	11	GPIO 14 SCLK (SPI)	23			24		GPIO 10 CE0 (SPI) 8 10
		Ground	25			26		GPIO 11 CE1 (SPI) 7 11
30	0	SDA0 (I2C ID EEPROM)	27			28		SCL0 (I2C ID EEPROM) 1 31
21	5	GPIO 21 GPCLK1	29			30		Ground
22	6	GPIO 22 GPCLK2	31			32		GPIO 26 PWM0 12 26
23	13	GPIO 23 PWM1	33			34		Ground
24	19	GPIO 24 PCM_FS/PWM1	35			36		GPIO 27 16 27
25	26	GPIO 25	37			38		GPIO 28 PCM_DIN 20 28
		Ground	39			40		GPIO 29 PCM_DOUT 21 29



## Remote Access

Sometimes you need to access a Raspberry Pi without connecting it to a monitor. Perhaps the Pi is embedded in something like a robot. You can find more information on accessing your Raspberry Pi remotely below:

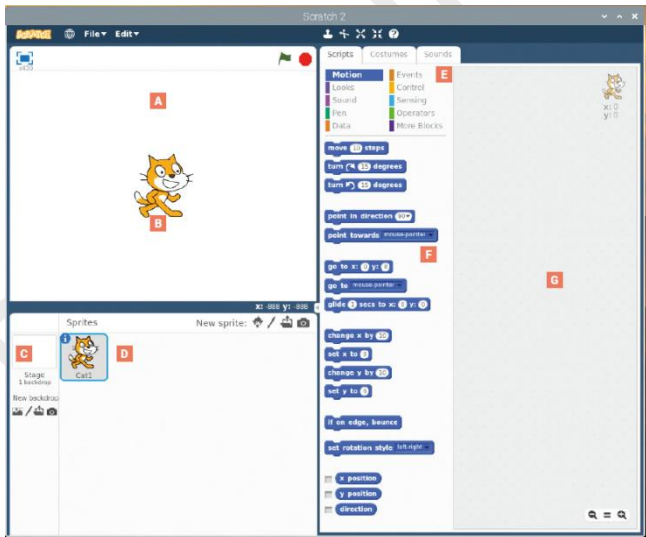
<https://www.raspberrypi.org/documentation/remote-access>

- **IP address:** To find your Raspberry Pi's IP address in order to connect to it
- **Access over Internet:** Remote access to the Pi over the internet using Weaved or Dataplicity
- **VNC:** Remote access to the Pi's graphical interface, viewed in a window on another computer
- **SSH:** Access the command line of the Pi from another computer
- **SFTP:** Copy files between your Pi and another PC using SFTP (Secure File Transfer Protocol)
- **SCP:** Copy files between your Pi and another computer using SCP (Secure Copy Protocol)
- **SSHFS:** Copy files between your Pi and another computer using SSHFS (Secure Shell File system)
- **rsync:** Synchronise folders between the Pi and another computer using rsync over SSH
- **FTP:** Copy files between your Pi and another computer using FTP (File Transfer Protocol)
- **Samba/CIFS:** Sharing folders from or to Windows-based devices
- **Web Server:** Set up a website or a web page to display any information, using a web browser on another machine, on the network or on the internet.

## Programming with Scratch

Scratch is a great first language for budding coders. You can build your program step-by-step using blocks, pre-written chunks of code hidden behind colour coded jigsaw pieces.

With friendly appearance, it's a powerful and fully functional programming environment for creating everything from simple games and animations through to complex interactive robotics projects, with a drag-and-drop interface. This visual programming tool can be used to control GPIO as well.



- A Stage Area** – Like actors in a play, your sprites move around the stage under the control of your program.
- B Sprite** – The characters or objects you control in a Scratch program are known as sprites, and sit on the stage.
- C Stage Controls** – Your stage can be changed, including adding your own pictures as backgrounds, using the stage controls.
- D Sprites List** – All the sprites you have created or loaded into Scratch will appear in this section of the window.
- E Blocks Palette** – All the blocks available for your program appear in the blocks palette, which features colour-coded categories.

## SCRATCH VERSIONS



At the time this book was written, Raspbian came with two versions of Scratch: the original Scratch and the updated Scratch 2, both included in the Programming section of the Raspbian menu. This chapter is written for Scratch 2. Make sure you don't load the original Scratch by mistake or you're likely to get very confused! Sadly, Scratch 2 won't run on the Pi Zero, Model A, A+, B, or B+.

- F Blocks** – Pre-written chunks of program code, blocks allow you to build your program step-by-step.
- G Scripts Area** – The scripts area is where your program is built by dragging-and-dropping blocks from the blocks palette.

## Useful Commands

The latest versions of Pi have sophisticated GUIs for executing actions and running applications. It is still important to know some basic and commonly used commands, as remote applications can run only Command Line Interface on the Pi.

- **apt-get install (RPM NAME):** To install a specific installation package.
- **apt-get update:** Synchronizes the list of packages on your system to the list in the repositories. Use it before

installing new packages to make sure you are installing the latest version.

```
root@PiBOX:~# apt-get update
Get:1 http://mirrordirector.raspbian.org/raspbian s
Get:2 http://archive.raspberrypi.org/debian stretch
Fetched 40.2 kB in 21s (1,904 B/s)
Reading package lists... Done
root@PiBOX:~#
```

- **apt-get upgrade:** Upgrades all of the software packages you have installed.

```
root@PiBOX:~# apt-get upgrade
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
```

- **clear:** Clears previously run commands and text from the terminal screen.
- **date:** Prints the current date.

```
root@PiBOX:~# date
Fri 23 Mar 11:30:09 UTC 2018
root@PiBOX:~#
```

- **find / -name PiBox.txt:** Searches for the file PiBox.txt and outputs a list of all directories that contain the file.

```
root@PiBOX:~# find / -name PiBOX.txt
/root/PiBOX.txt
```

- **nano PiBox.txt:** Opens the file PiBox.txt in the Linux text editor Nano.

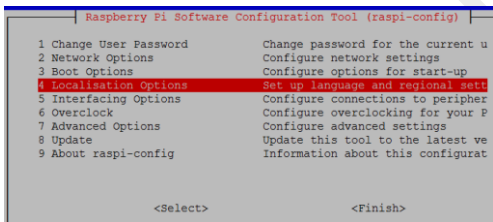
```

root@PiBOX:~# nano PiBOX.txt
Use "fg" to return to nano.

[1]+  Stopped                  nano PiBOX.txt
root@PiBOX:~# █

```

- **raspi-config:** Opens the configuration settings menu.



- **reboot:** To reboot immediately.
- **sudo:** This command allows you to run a command as a super user or another user. Simply type “sudo” to check what it can do.
- **shutdown-h now:** To shut down immediately.

```

root@PiBOX:~# sudo shutdown -h now
login as: pi

```

- **shutdown -h 01:22:** To shutdown at 1:22 AM.
- **poweroff:** To shut down immediately
- **startx:** Opens the GUI (Graphical User Interface). To be run from VNC if you are on shell only

## Shutdown device

*sudo shutdown -h now*

*sudo shutdown -r now*

## File and Directory Commands

- **cat example.txt:** Displays the contents of the file example.txt.
- **cd /abc/xyz:** Changes the current directory to the /abc/xyz directory.
- **cp XXX:** Copies the file or directory XXX and pastes it to a specified location; i.e.  
*cp examplefile.txt /home/pi/* copies *examplefile.txt* in the current directory and pastes it into the */home/pi/* directory. If the file is not in the current directory, add the path of the file's location; i.e.  
*cp /home/pi/documents/examplefile.txt /home/pi/office/* copies the file from the documents directory to the office directory.
- **ls -lrt:** Lists files in the current directory, along with file size, date modified, and permissions.

```
root@PiBOX:~# ls -lrt
total 32
-rw-r--r-- 1 root root    0 Mar 23 07:35 PiBOX.txt
drwxr-xr-x 2 root root 4096 Mar 23 11:42 Videos
drwxr-xr-x 2 root root 4096 Mar 23 11:42 Templates
drwxr-xr-x 2 root root 4096 Mar 23 11:42 Public
drwxr-xr-x 2 root root 4096 Mar 23 11:42 Pictures
drwxr-xr-x 2 root root 4096 Mar 23 11:42 Music
drwxr-xr-x 2 root root 4096 Mar 23 11:42 Downloads
drwxr-xr-x 2 root root 4096 Mar 23 11:42 Documents
drwxr-xr-x 2 root root 4096 Mar 23 11:42 Desktop
root@PiBOX:~#
```

- **mkdir example\_directory:** Creates a new directory named *example\_directory* inside the current directory.
- **mv XXX:** Moves the file or directory named XXX to a specified location.
- **PWD (Print Working Directory):** This tells you your current working directory.
- **rm example.txt:** Deletes the file *example.txt*.
- **rmdir example\_directory:** Deletes the directory *example\_directory* (only if it is empty).
- **scp user@10.0.0.32:/some/path/file.txt:** Copies a file over SSH. Can be used to download a file from a PC to the Raspberry Pi. *user@10.0.0.32* is the username and local IP address of the PC, and */some/path/file.txt* is the path and file name of the file on the PC.
- **touch example.txt:** Creates a new, empty file named *example.txt* in the current directory.

## Networking and Internet Commands

- **ifconfig:** To check the status of the wireless connection you are using (to see if wlan0 has acquired an IP address use `ifconfig wlan0`)

```
root@PiBOX:~# ifconfig
wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.1.5 netmask 255.255.255.0 broadcast 192.168.1.255
    inet6 fe80::9f20:ee70:89c9:1bd2 prefixlen 64 scopeid 0x20<link>
    ether b8:27:eb:91:53:47 txqueuelen 1000 (Ethernet)
    RX packets 9456 bytes 9762225 (9.3 MiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 8045 bytes 1054222 (1.0 MiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@PiBOX:~#
```

- **iwconfig:** To check which network the wireless adapter is using.

```
root@PiBOX:~# iwconfig
eth0      no wireless extensions.

wlan0     IEEE 802.11  ESSID:"sennet"
Mode:Managed  Frequency:2.462 GHz  Access Point: A4:2E:
Bit Rate=65 Mb/s   Tx-Power=31 dBm
Retry short limit:7   RTS thr:off   Fragment thr:off
Encryption key:off
Power Management:on
Link Quality=51/70  Signal level=-59 dBm
Rx invalid nwid:0  Rx invalid crypt:0  Rx invalid frag
Tx excessive retries:1 Invalid misc:0  Missed beacon
```

- **iwlist wlan0 scan:** Prints a list of the currently available wireless networks.
- **iwlist wlan0 scan | grep ESSID:** Use grep along with the name of a field to list only the fields you need (for example to just list the ESSIDs).
- **nmap:** Scans your network and lists connected devices, port number, protocol, state (open or closed) operating system, MAC addresses, and other information. You need to download nmap first

```
root@PiBOX:~# apt-get install nmap
root@PiBOX:~# nmap localhost

Starting Nmap 7.40 ( https://nmap.org ) at 2018-03-23 11:57 UTC
Nmap scan report for localhost (127.0.0.1)
Host is up (0.000050s latency).
Other addresses for localhost (not scanned): ::1
Not shown: 999 closed ports
PORT      STATE SERVICE
22/tcp    open  ssh

Nmap done: 1 IP address (1 host up) scanned in 3.22 seconds
root@PiBOX:~#
```



- **ping:** Tests connectivity between two devices connected on a network. Command: ping (ip)

```
root@PiBOX:~# ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=43 time=46.2 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=43 time=49.3 ms
```

- **wget** <http://www.website.com/example.txt>: Downloads the file example.txt from the web and saves it to the current directory.
- **hostname -I**: Shows the IP address of the Pi.

```
root@PiBOX:~# hostname -I
192.168.1.5
root@PiBOX:~#
```

## System Information Commands

- **cat /proc/meminfo**: Shows details about your memory.

```
root@PiBOX:~# cat /proc/meminfo
MemTotal:          945520 kB
MemFree:           194508 kB
MemAvailable:      765576 kB
Buffers:           11704 kB
```

- **cat /proc/version**: Shows the version of the Raspberry Pi being used.

```
root@PiBOX:~# cat /proc/version
Linux version 4.9.59-v7+ (dc4@dc4-XPS13-9333)
(gcc version 4.9.3 (crosstool-NG crosstool-ng-
1.22.0-88-g8460611) ) #1047 SMP Sun Oct 29 12:
19:23 GMT 2017
root@PiBOX:~#
```

- **cat /proc/partitions:** Shows the size and number of partitions on your SD card or hard drive.

```
root@PiBOX:~# cat /proc/partitions
major minor  #blocks  name
   1         9      4096  ram9
   1         8      4096  ram8
  179         7  13805056  mmcblk0p7
  179         6    67584  mmcblk0p6
  179         5   32767  mmcblk0p5
  179         2         1  mmcblk0p2
```

- **df -h:** Shows information about the available disk space.

```
root@PiBOX:~# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        13G   4.9G   7.4G  40% /
devtmpfs         458M    0   458M    0% /dev
tmpfs            462M    0   462M    0% /dev/shm
tmpfs            462M   13M   450M    3% /run
tmpfs            5.0M   4.0K   5.0M    1% /run/lock
tmpfs            462M    0   462M    0% /sys/fs/cgroup
/dev/mmcblk0p6   65M   21M   45M   33% /boot
tmpfs            93M    0   93M    0% /run/user/1000
/dev/mmcblk0p5   30M  454K   28M    2% /media/pi/SETTINGS
root@PiBOX:~#
```

- **df /:** Shows how much free disk space is available.

```
root@PiBOX:~# df /
Filesystem      1K-blocks    Used Available Use% Mounted on
/dev/root        13457240  5075956   7674648   40% /
root@PiBOX:~#
```

- **dpkg --get-selections | grep XXX:** Shows all of the installed packages that are related to XXX.
- **dpkg --get-selections:** Shows all of your installed packages.
- **free:** Shows how much free memory is available.

```
root@PiBOX:~# free
              total        used        free      shared  buff/cache   available
Mem:           945520       97200       116848        16764       731472       766012
Swap:          102396         2748         99648
```

- **Hostname:** This command tells you your hostname
- **lsusb:** Lists USB hardware connected to your Raspberry Pi.
- **UP key:** Pressing the UP key will print the last command entered into the command prompt. This is a quick way to repeat previous commands or make corrections to commands.
- **vcgencmd get\_mem arm && vcgencmd get\_mem gpu:** Shows the memory split between the CPU and GPU
- **vcgencmd measure\_temp:** Shows the temperature of the CPU

```
root@PiBOX:~# vcgencmd measure_temp
temp=52.6'C
root@PiBOX:~#
```

# AWESOME APPLICATIONS

Discover some of the software that comes with Raspbian, and find out how to install more

**R**aspbian comes with a selection of pre-installed software (which depends on which version you install), so you can start working, learning, and making things straight away. Ranging from productivity suites to games, you'll find a well-curated collection of software is just a click away, in the applications menu. There are lots more packages to browse and install, too.



#### **LibreOffice Writer** | OFFICE

No computer is complete without a word processor. LibreOffice Writer has all the font and formatting options you would expect, and has basic compatibility with Microsoft Word.



#### **LibreOffice Calc** | OFFICE

Work out your budgets with this spreadsheet package. If you're familiar with Microsoft Excel, you'll feel at home here. LibreOffice Calc can open and use typical Excel files.



#### **LibreOffice Impress** | OFFICE

If you're presenting to a room of people, don't panic: Impress has your back. Use it to craft and display your slide deck. It's largely compatible with Microsoft PowerPoint.



#### **Chromium** | INTERNET

Chromium is the open-source version of Google Chrome. The default search engine in Raspbian is Duck Duck Go, which promises not to track you online.



#### **Claws Mail** | INTERNET

Send and receive email. The setup wizard helps you add your email account, and the streamlined interface shows you your mailboxes, message list, and a preview of the selected message.



#### **VLC** | SOUND & VIDEO

Listen to music while you're coding using VLC, a fully featured media player for music and video. It can play digital files, streams, and physical media such as CDs and DVDs.



#### **Minecraft Pi** | GAMES

We call it a game, but it's more a way of life. With Minecraft Pi, you can build things in Creative mode, and write programs to change the (game) world.



#### **Python Games** | GAMES

These tea-break games are fun, but they're also great Python demos. Find the code in the `/usr/share/python_games` folder, and open it in a Python editor to see how it works.



#### **SmartSim** | PROGRAMMING

Experiment with designing and testing digital logic circuits. You can develop custom components, and then incorporate them into other circuits. Download examples and read tutorials at [smartsim.org.uk](http://smartsim.org.uk).



#### **Sense HAT Emulator** PROGRAMMING

This emulator features on-screen controls to simulate temperature, pressure, humidity, and device position changes. A great way to try out the Sense HAT before you buy one!

## Troubleshooting: LED flash codes

Sometimes when the Pi fails to boot for some reason, or has to shut down, the LED will be flashed a specific number of times to indicate what happened. The LED will blink for a number of long flashes (0 or more), then short flashes, to indicate the exact status. In most cases, the pattern will repeat after a 2 second gap.

Long flashes	Short flashes	Status
0	3	Generic failure to boot
0	4	start*.elf not found
0	7	Kernel image not found
0	8	SDRAM failure
0	9	Insufficient SDRAM
0	10	In HALT state
2	1	Partition not FAT
2	2	Failed to read from partition
2	3	Extended partition not FAT
4	2	File signature/hash mismatch - Pi 4
4	4	Unsupported board type
4	5	Fatal firmware error
4	6	Power failure type A
4	7	Power failure type B

## Config.txt file

The Raspberry Pi uses a configuration file. The system configuration parameters, which would traditionally be edited and stored using a BIOS (in conventional PC), are stored in an optional text file named config.txt. This is read by the GPU before the ARM CPU and NOOBS are initialised. The system configuration parameters like overclocking, mode of video output, camera settings, configuring GPIO pins are store/edited in config.txt

Troubleshooting a Pi or certain project's specifications may require you to edit some configuration settings. Editing the config.txt file can be done in one of many ways

- Booting into the recovery mode by holding the SHIFT key during power ON process.
- Locating the config.txt file at /boot/folder in the root directory of the microSD card, and editing with text editor, while the Pi is still powered ON
- Connecting the micro SD card to a PC/Laptop/MAC using a card reader, after powering OFF the Pi.

Editing the config.txt file should be exercised with extreme caution and it is recommended to make a copy of the original file, before editing.

## Recovery image of bootloader

Bootloader is a set of basic boot commands stored in the ROM of the Raspberry Pi board, which initializes the Pi when powered ON and instructs the Pi to read the OS from the SD card. If the Raspberry Pi is not booting, it's possible

that the bootloader in the EPROM is corrupted. This can easily be reprogrammed using the Raspberry Pi Imager tool, used earlier to burn OS image into an SD card.

- Insert an unused, formatted SD card and launch Raspberry Pi Imager tool.
- From the dropdown menu select as follow : CHOOSE OS >> Misc utility images >> Pi 4 EEPROM boot recovery.
- Select the SD card and initiate 'WRITE'.
- Insert the completed SD card into Pi and power ON.

Once complete, the green LED will blink rapidly in a steady pattern. Disconnect the device from power. Now you can remove the recovery SD card, insert your regular SD card with OS, and resume using your Raspberry Pi.

<https://www.raspberrypi.org/downloads/>

## Updating the bootloader/EEPROM

We recommend setting up your Pi so that it automatically updates the bootloader. This means you will get new features and bug fixes as they are released. Bootloader updates are performed by the rpi-eeprom package, which installs a service that runs at boot-time to check for critical updates.

```
sudo apt update  
sudo apt full-upgrade  
sudo apt install rpi-eeprom
```

If you wish to control when the updates are applied you can

disable the systemd service from running automatically and run *rpi-eeeprom-update* manually.

- *sudo systemctl mask rpi-eeeprom-update*

This can be run before the package is installed to prevent it ever running automatically.

- *sudo systemctl unmask rpi-eeeprom-update*

Enable the update to run. More information on the bootloader can be accessed using the link below. However, it is recommended that the beginners or intermediate users do not change the bootloader configuration settings.

<https://www.raspberrypi.org/documentation/hardware/raspberrypi/booteeeprom.md>

## FAQ

### 1. Raspberry Pi is powered ON, but no display.

Please follow the correct sequence of connecting the peripherals before powering ON the Pi. Please check the contents of the micro SD card to ensure that it has all the files and folders of the NOOBS ver3.2.1 or latest. For Pi4, please use HDMI0 port, which is the port next to the USB C power port to connect the display during initial setup.

Follow the *Software Setup* section of this book to install NOOBS.

### 2. The Green light of the Raspberry Pi is not ON.

The green light and the red light should turn on when the Pi4 is powered on. Green light indicates software activity. If the greenlight does not turn ON, please check the contents of



the micro SD card and ensure that the NOOBS OS files are not corrupted.

Follow the *Software Setup* section of this book to install NOOBS.

**3. SD card contains the correct version of NOOBS, but it gets stuck on the splash screen during boot.**

If NOOBS won't load once you have copied the files over, it may be that the SD card is corrupt. Please format the SD card using the SD card formatter tool and copy the NOOBS again.

**4. Raspberry Pi OS installation was successful and initial setup was complete. When the Pi4 is powered ON again, the display shows only rainbow screen.**

This is a common hotplug issue with the HDMI port of the Pi4. Boot the Pi in recovery mode and edit the *config.txt* file. Set (uncomment by removing the #) `hdmi_force_hotplug=1`. This code is used to force the Pi to use HDMI mode even if no HDMI monitor is detected. Refer to *Recovery Mode* section of this book.

**5. I need to access the NOOBS menu, after the OS installation. But the Pi always starts with the Desktop screen, after Power On.**

To load NOOBS menu after the OS is installed, hold down the Shift key as you connect power supply to the Pi. Doing so bypasses loading of the operating system and instead boots into NOOBS menu. Now a new option: the *Edit Config* icon is available at the top of the menu, to edit the *config.txt* for various hardware settings.

## 6. My Raspberry Pi does not recognize my USB device.

Check if the device works on a different computer. Once verified that the USB works, check the Raspberry Pi and the USB device. On your Pi, enter `sudo dmesg-C`. Next, insert the USB device and input `dmesg`

If detected, your USB device will be listed here, along with any related error message. If the device is not listed, two common reasons are:

- A fault with the USB device or the Pi's USB bus.
- Your Raspberry Pi isn't receiving enough power.

Use a suitable power supply for your Raspberry Pi, or a powered USB hub. If the USB is detected, but device is not working, look for a Linux driver. Please visit [https://elinux.org/RPi\\_VerifiedPeripherals](https://elinux.org/RPi_VerifiedPeripherals) for the list of USB devices.

## 7. I am unable to remotely access my Raspberry Pi via SSH/VNC.

Please check if SSH and VNC are enabled in the Raspberry Pi Configuration tool. Please verify the IP address using the `ifconfig` command in the command prompt. Use the SSH client or VNC viewer to login to the Pi. Please use username '`pi`' and password '`raspberrypi`'.

## Practical Project Ideas

The Pi is an excellent kit that can be configured as a ready-to-go micro PC that can do almost anything. Visit [www.pibox.in/blog](http://www.pibox.in/blog) for detailed procedure

- **HTPC media streaming**

Using Raspberry Pi as a media-streaming device is as easy

as running Kodi (formerly XBMC) on a Raspberry Pi, to playback any media you have on a hard drive or network-attached storage. You can also install a plugin to play YouTube videos.

- **Network Attached Storage**

Using Pi is a very cost effective method to build a fully featured NAS owing to the improved throughput of Raspberry Pi 4 with USB 3.0 and Gigabit Ethernet.

<https://magpi.raspberrypi.org/articles/build-a-raspberry-pi-nas>

- **Wireless network printer**

The Raspberry Pi can connect a printer via any network. Install CUPS, a printing system, which uses internet printing protocol (IPP) to run USB printers over internet.

- **Learn programming**

The Pi can be used as a low-cost introduction to programming and computer science. The mini-PC is loaded with very powerful programming tools like Scratch, Python, Greenfoot for Java, Sonic Pi and several other tools that encourages deep-level tinkering.

- **Play Minecraft**

There's a free Raspberry Pi version of Minecraft that anybody can download at no cost. Even better, it's designed to teach you how to use the Python programming language as you build out the world.

- **A music streaming machine**

Numerous operating systems have also been released that transform the device into a high-fidelity music player when connected to a speaker.

- **Smart TV with PI**

If you have a TV that you'd like to add web browsing and other basic computing abilities to, the Raspberry Pi does the

trick without costing anywhere near as much as a Chromecast or Windows-powered Compute Stick.

- **Extend your home network's range**

Make your Wi-Fi signal reach the farthest corners and help wipe out dead zones by configuring the mini-PC as a wireless range extender.

- **DIY CCTV Security System**

The camera uses object detection (with OpenCV) to send you an email whenever it sees an intruder. It also runs a webcam so you can view live video from the camera when you are away.

- **File storage server**

You can also have your Raspberry Pi play wingman for the other devices in the network, serving as a centralized device that performs helpful tasks.

## Useful Forums / Websites for Reference

### 1. MagPI Magazines:

<https://www.raspberrypi.org/magpi-issues/>

### 2. PIBOX – Feed

<https://www.pibox.in/blog>

### 3. Raspberry Media Player

<https://www.makeuseof.com/tag/4-ways-set-up-raspberry-pi-media-server/>

### 4. Best Raspberry Forums

<https://www.raspberrypi.org/forums/viewforum.php?f=12>

### 5. OSMC on Raspberry PI

<https://www.makeuseof.com/tag/4-ways-set-up-raspberry-pi-media-server/>

## 6. Kodi Raspberry PI

<https://mediaexperience.com/raspberry-pi-xbmc-with-raspbmc/>

## 7. Rasplex:

<https://github.com/RasPlex>

## 8. 26 Best Projects

<https://www.makeuseof.com/tag/different-uses-raspberry-pi/>

## 9. XDA Developer Forum

<https://forum.xda-developers.com/raspberry-pi>

## 10. Awesome Project Ideas

<https://projects.raspberrypi.org/en/projects/>



*Now that you have hit this page, you are at the end of the book. This was our sincere attempt at compiling some useful information for Raspberry Pi users. If you are a content creator, who would like to contribute to our next version, please feel free to contact us at [support@pibox.in](mailto:support@pibox.in)*

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