
# Digital Library

# User Guide

*Ver 1.0*

*Draft*



**Acknowledgements**

**Note**: This document is intended to be read in conjunction with Digital Library Ver 1.0 firmware.

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# 1. Introduction

The Digital Library project is intended to provide a low cost WiFi device hosting a library of electronic documents, browser based applications and other materials suitable for use in a classroom or similar environment, with PCs, tablets and mobile smart phones as client devices.

No Internet connection is required to use the device – the content is stored locally on the digital Library.

Several off-the-shelf router devices may be used, starting at a cost of around $20. The software is based on the well proven OpenWRT software.

Library content may be stored on USB, SD Card memory devices which may be 8GB to 128GB in size. A USB connected SSD may also be used for larger storage. Multiple USB devices may be used, allowing local content to be managed separately to the main library.

A basic library image has been developed containing some 40GB of content, largely drawn from the OER2GO website (oer2go.org). The library contains material with licences that allow free use. Additional applications such as Sugarizer (which provides the interactive Sugar graphical learning environment from XO laptops for younger students -sugarizer.org) have been included.

The basic library image includes:

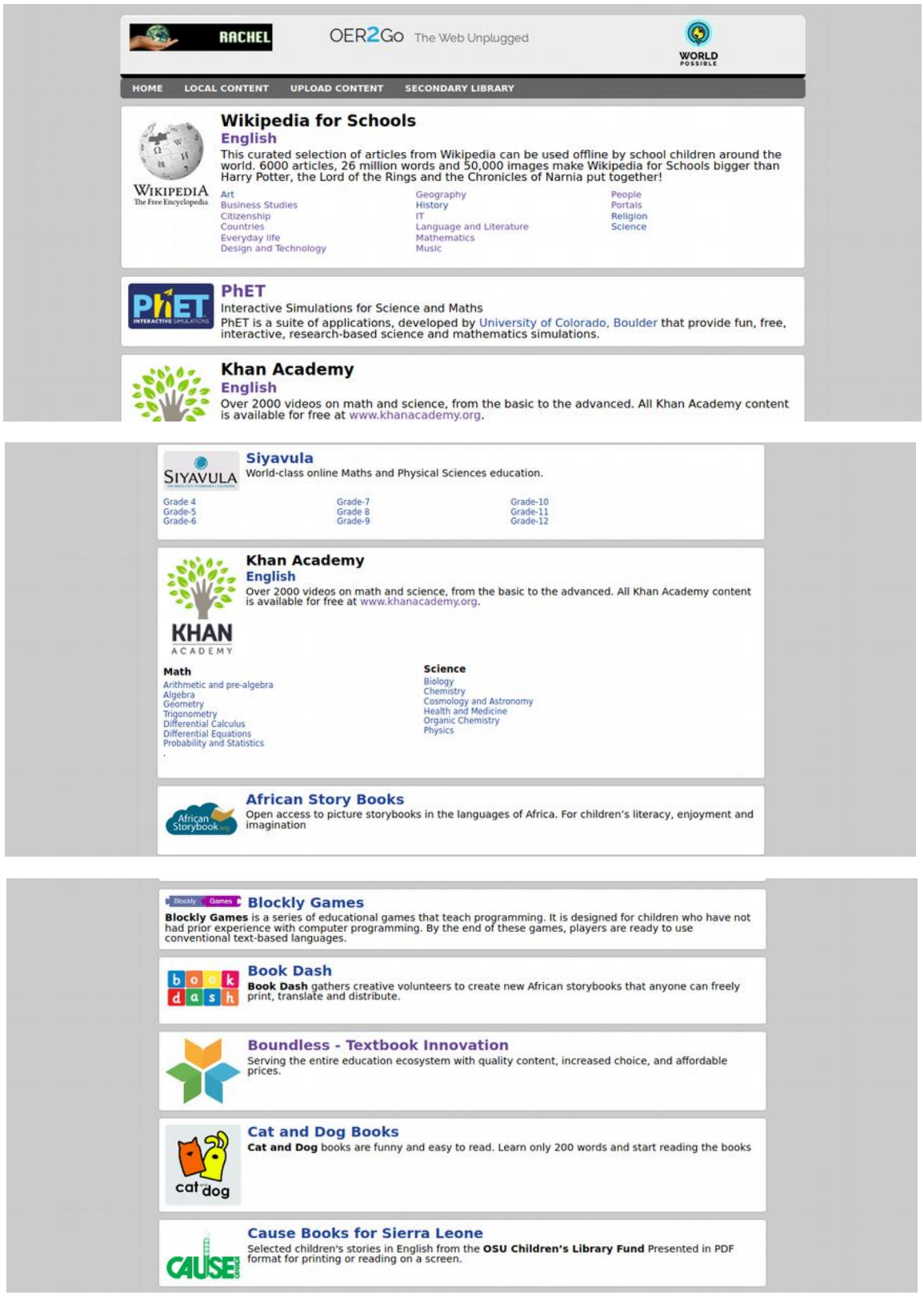
- Wikipedia for Schools
- Khan Academy Maths and Science Videos
- Phet Interactive Simulations for Science and Maths
- Siyavula / CK-12 Textbooks
- African Story Books / Book Dash / Cat and Dog Books / Mustard Seed Books / English Storybooks
- Gutenberg Project – Great Books of the World
- Blockly Games
- OLE Nepal Collection of Digital Learning Materials
- Women in African History
- Maps of the World
- MedlinePlus / Hesperian / Khan Academy Health and Medicine
- InfoNet-Biovision Articles on Agriculture, Environment and Health subjects.
- Practical Action Knowledge Bank of Technologies
- Sugarizer Interactive Sugar graphical learning environment from XO laptops.

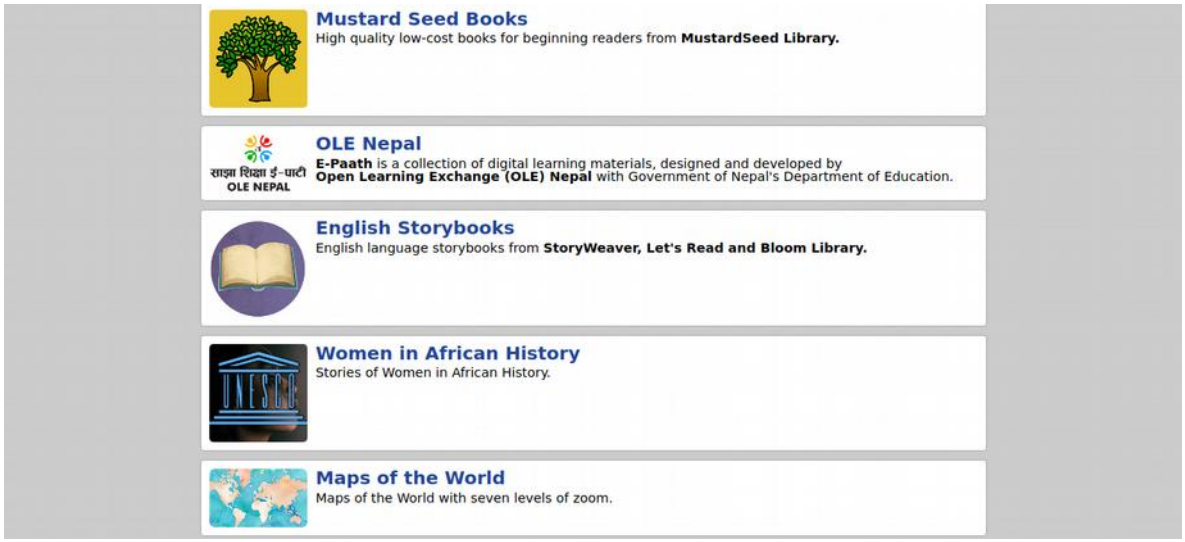
Users can add local content to the main library memory device or to a second memory device, either by uploading files via the web interface, or by preparing files for the memory devices on a separate PC.

The Digital Library can connect to an upstream network via Ethernet or WiFi in order to provide access to additional on line resources such as an Internet connection.

DNS Filtering is supported to ensure inappropriate content is not accessible through the Digital Library.

## Default Digital Library Home Page

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High quality low-cost books for beginning readers from MustardSeed Library.
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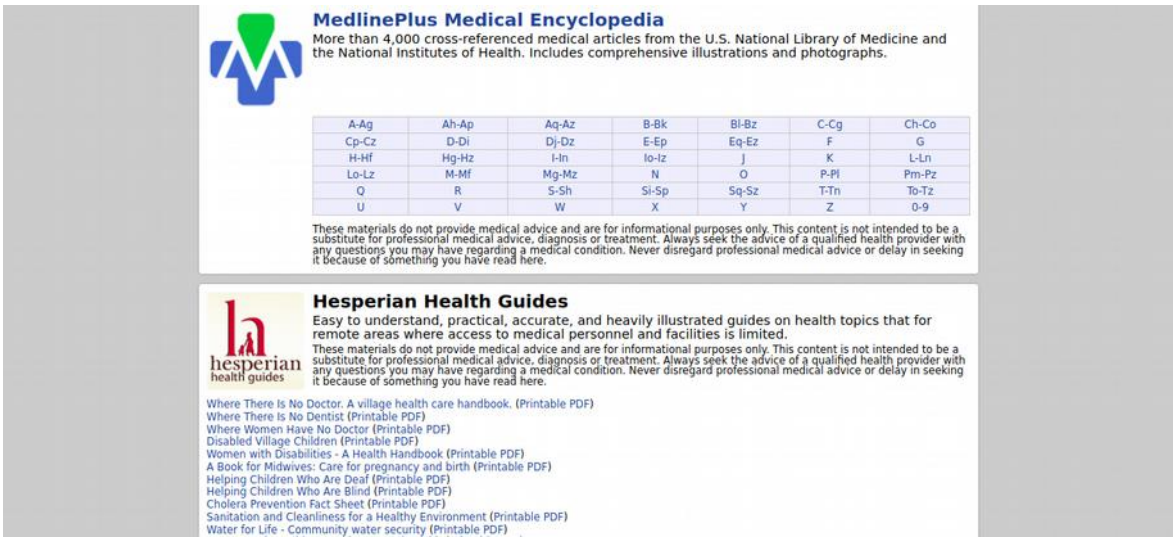
English Storybooks
English language storybooks from StoryWeaver, Let's Read and Bloom Library.
Women in African History
Stories of Women in African History.
Maps of the World
Maps of the World with seven levels of zoom.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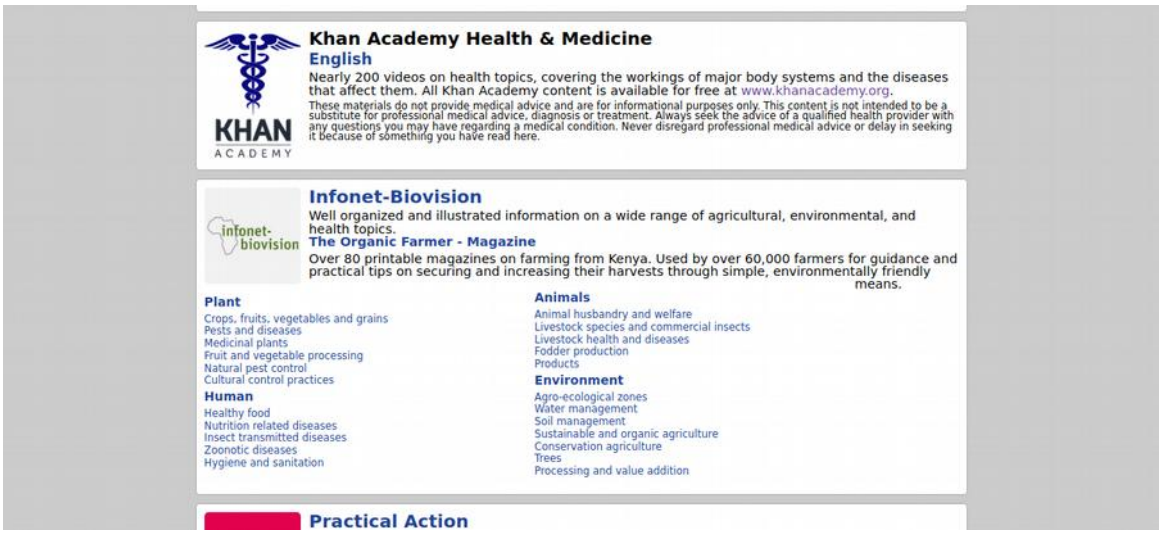
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Products
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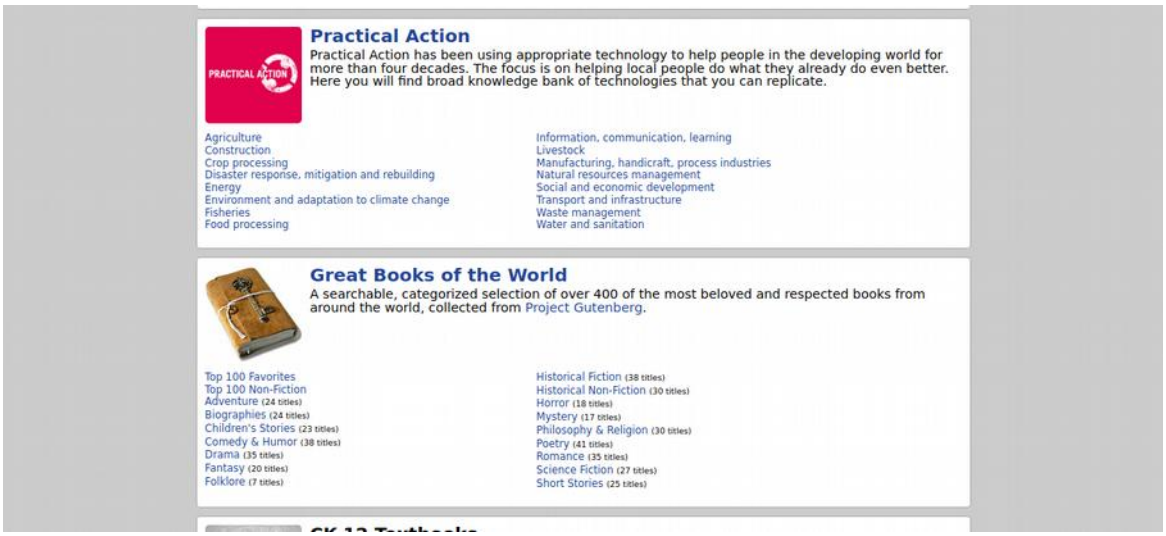
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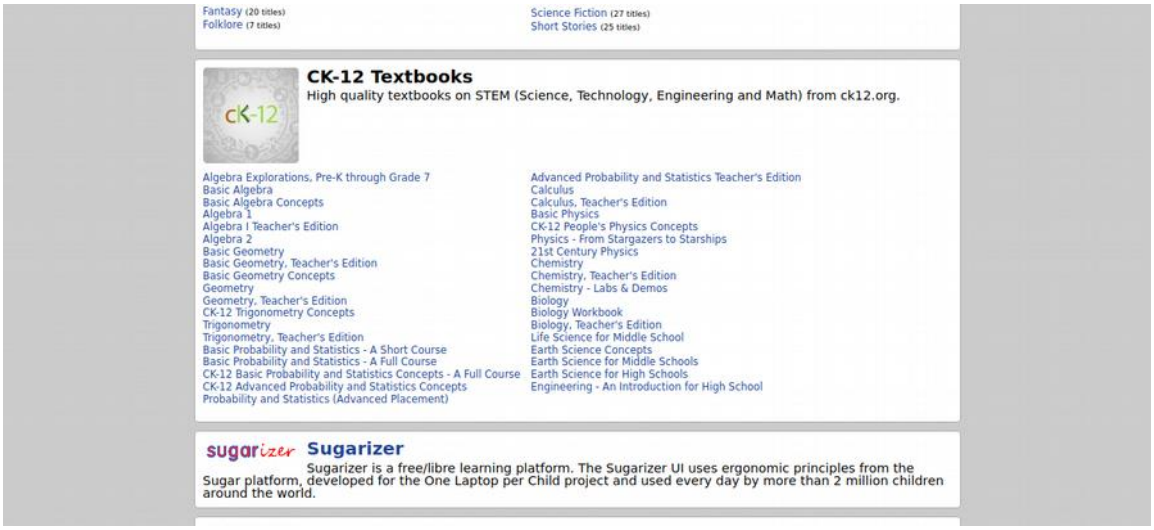
Romance (35 titles)
Science Fiction (27 titles)
Short Stories (25 titles)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Short Stories (25 titles)
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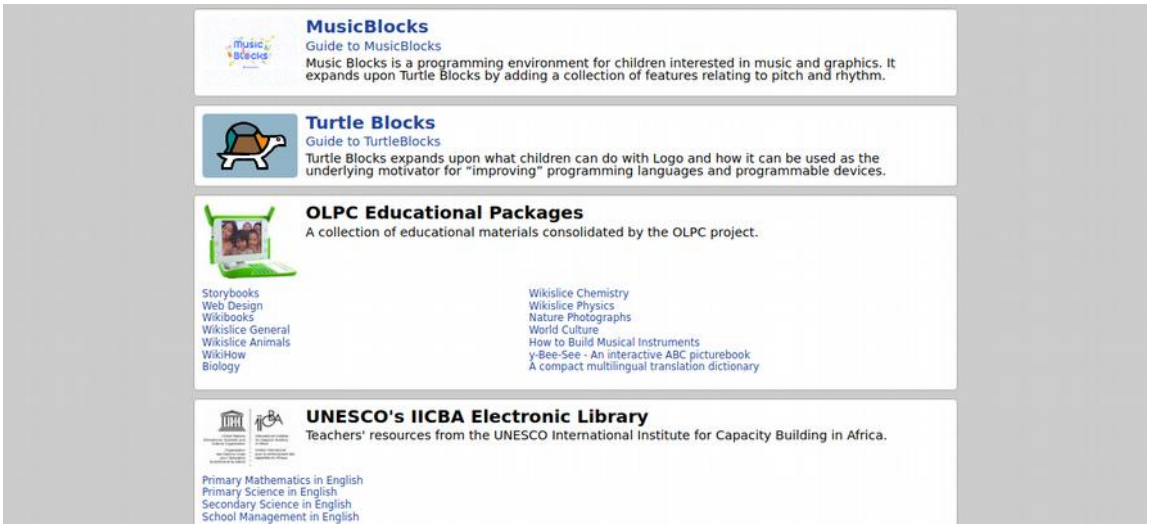
Sugarizer
Sugarizer is a free/libre learning platform. The Sugarizer UI uses ergonomic principles from the Sugar platform, developed for the One Laptop per Child project and used every day by more than 2 million children around the world.


MusicBlocks
Guide to MusicBlocks
Music Blocks is a programming environment for children interested in music and graphics. It expands upon Turtle Blocks by adding a collection of features relating to pitch and rhythm.
Turtle Blocks
Guide to TurtleBlocks
Turtle Blocks expands upon what children can do with Logo and how it can be used as the underlying motivator for "improving" programming languages and programmable devices.
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Nature Photographs
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Primary Science in English
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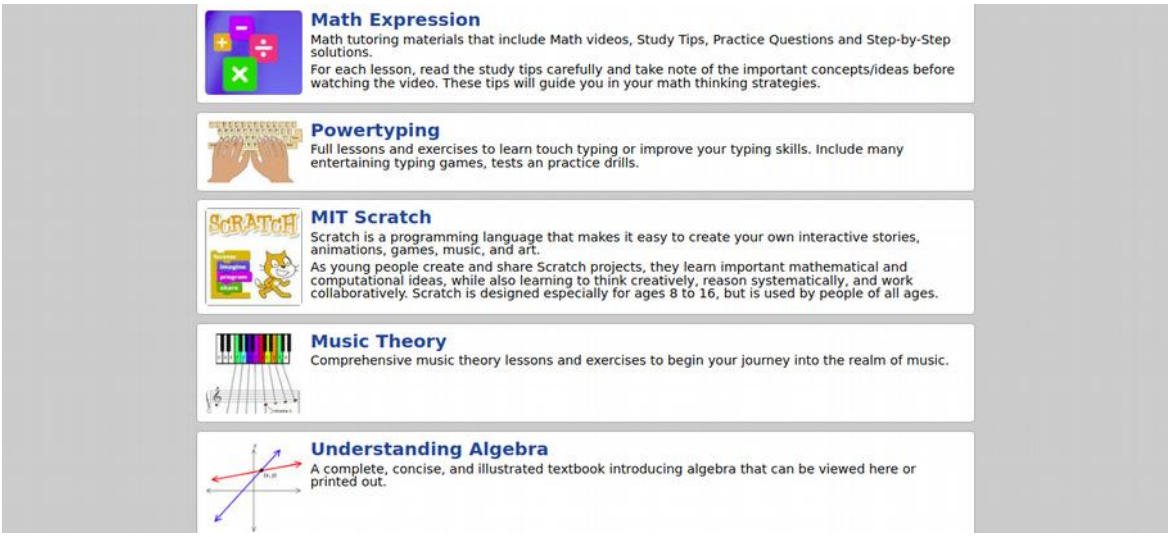
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# 2. Getting Started

When a new Digital Library (DL) device is received, it will likely need to have the Digital Library software installed. The process for doing this is covered in a later section of the document.

Once the software is installed, disconnect the power and connect the USB memory device containing the Library content. Power up the device, wait a minute or so for it to start up, then look for a WiFi network on your PC, Tablet or Smartphone. You will see two WiFi Access Points, one called “Digital-Library” and another called “Digital-Library-Guest”.

You can connect your PC, Tablet or SmartPhone to one of these Access Points. The default WiFi passwords are “password” and “passwordguest” respectively.

The operation of these two Access Points is essentially the same in relation to the Library, but if the DL device is connected to an upstream network, for example with an Internet connection, the “Guest” Access Point will not allow access to the upstream network or the Internet connection.

Once you have made a successful WiFi connection to the Digital Library, open a web browser and enter the URL “Digital-Library” into the browser address field and click Enter. The browser will load up the home page of the Digital Library which allows you to navigate to the various content modules. You may also use the default IP Address ***http://10.10.10.1*** as the URL to access the Digital Library page. (Or ***http://10.10.11.1*** for a ***Guest*** WiFi connection).

If there is no Library memory device connected, you will see the Library home page, but you will not be able to navigate to any of the content modules.

Clicking on a content item on the Library home page will open a new tab on the browser, showing the Home page for the particular module. The main Library home page tab will remain open and you can swap between the two. You may also right click on an item and choose to open the item in a new browser tab or window.

Once you have checked that the Digital Library is working correctly, you can proceed to the administration web pages in order to set up the device configuration to suit your particular needs.

In particular, you should change the default passwords as a minimum.

# 3. Administration

To access the Administration web pages for the Digital Library, open a new browser tab and enter the URL ***http://digital-library/admin*** (or ***http://10.10.10.1/admin*** for the Digital-Library WiFi or the Ethernet LAN connection, or ***http://10.10.11.1/admin*** for the Digital-Library-Guest WiFi connection).

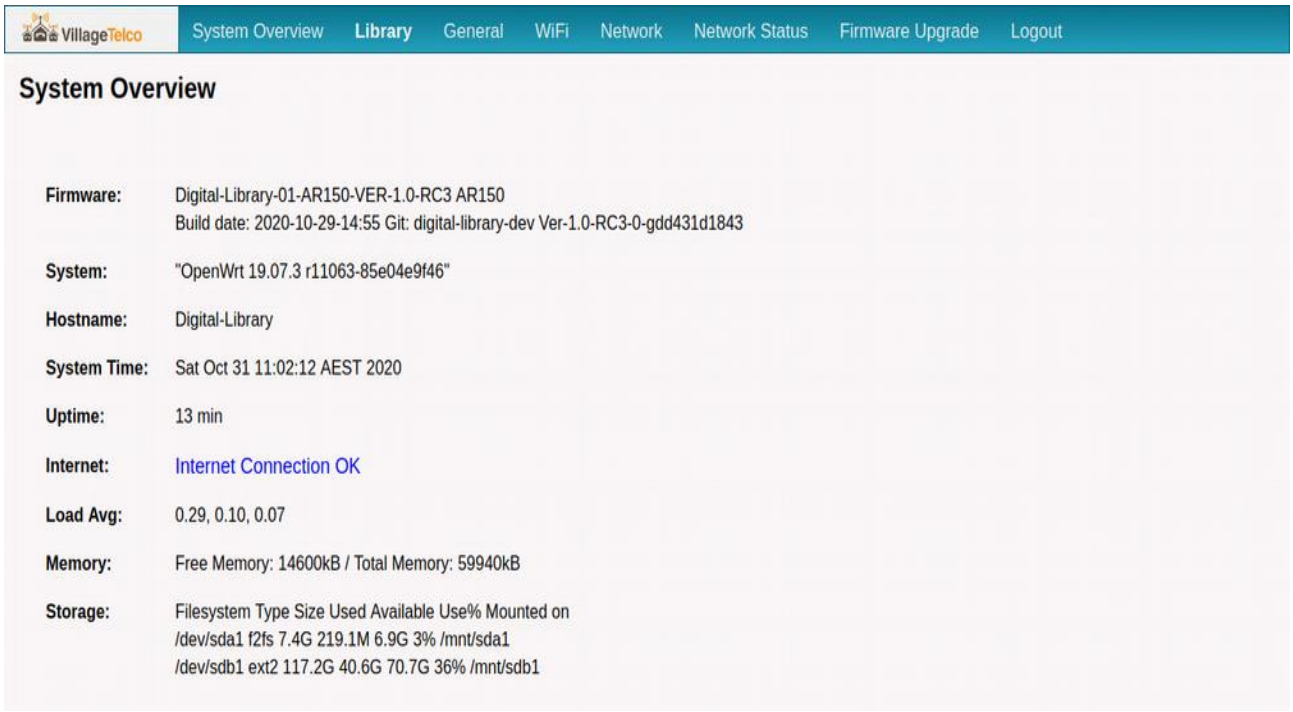
You will be prompted for login credentials.

There are two accounts which may be used, ***admin*** and ***root***.
The default passwords for these accounts are ***adminpassword*** and ***password*** respectively.

Once you have logged in, the browser will display the ***System Overview*** page as shown below.

Other configuration pages may be selected from the menu at the top of the page.

## 3.1 Overview Screen




The System Overview screen displays the device identification and software version data, along with some operational information including time, Internet connection status, system load, system memory utilisation, and storage usage.

On this screen you can see that the device is an ***AR150*** and that there are two memory devices in use, one is a 8GB (7.4) device and the other is a 128GB (117.2) device.

The 128GB device contains the main Library and is 30% full, and the 8GB device contains 219MB of additional local content.

## 3.2 Library Management Screens

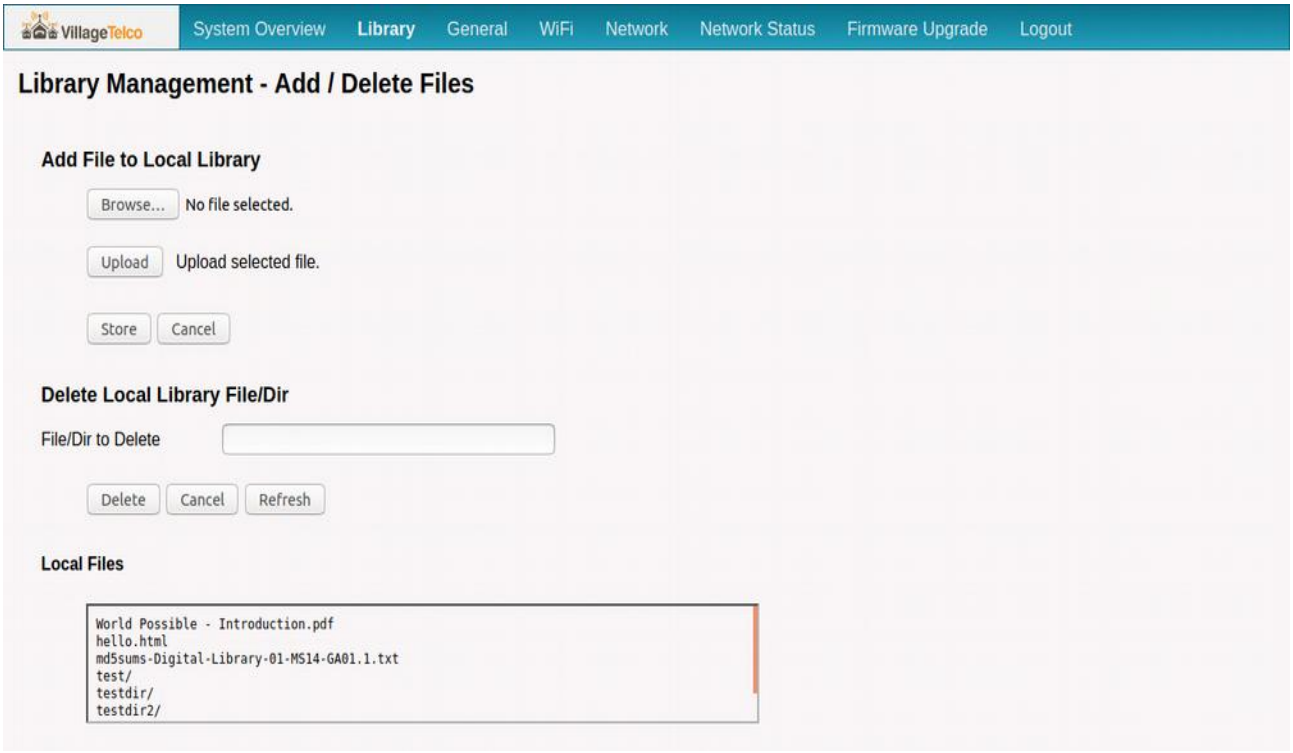
The Library Management screens allow you to add files from your PC to the main Library storage memory device in an area called ***Local Content 1***, which may be accessed from the Library Home page via the menu at the top of the home page.

These pages are intended to be used primarily from a PC connected to the Digital Library.

There are two Library Management pages, ***Add / Delete*** and ***Copy***.

There is also a menu item that will take you to the main Library Home page.

### Library Add / Delete Screen




The Library Add / Delete screen allows you to add files from your PC to the main Library storage memory device in an area called ***Local Content 1***, which may be accessed from the Library Home page via the menu at the top of the home page. You may also delete files from this area.

This screen does not allow you to add or remove files from the main Library content area.

### Adding Files

To add a file or directory, click on the ***Browse*** button to open a file browsing window showing the file system of your PC.

Select a file or directory that you want to upload and click ***Enter***. The details of the selected upload will be displayed so you can check them.

Click on the ***Upload*** button to transfer the file(s) to the Digital Library.

Once the transfer is complete, click on the ***Store*** button to save the file(s) in the ***Local Content*** area.

A message will displayed showing success of the copy operation.

Note that there is a limit of 16MB on the size of individual uploads. For large uploads, it is better to put the memory device into your PC and load the files directly.

After loading new files, go to the Library home page and click on the ***Local Content*** link, and you will see the files listed in the file system structure. Clicking on an individual file in the list will open the file in the browser or whatever application is appropriate, depending on the file type.

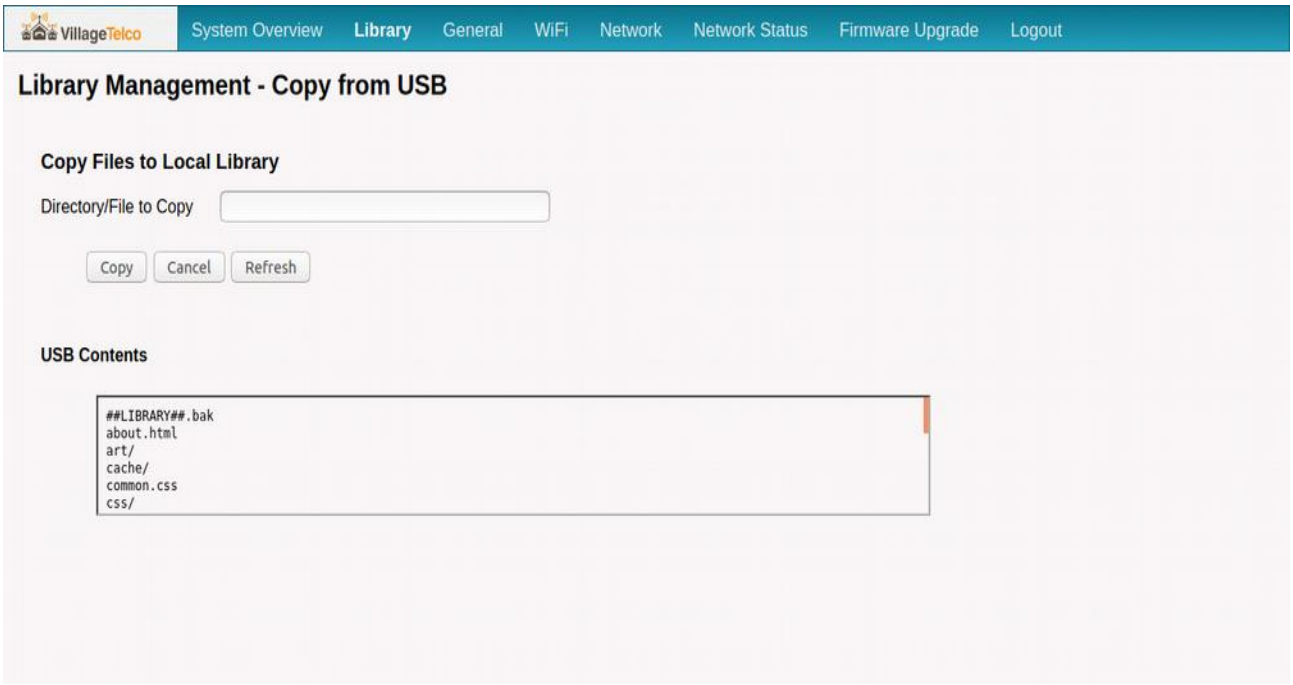
Note that if you load an "i*ndex.html*" or similar file into the top level of the ***Local Content*** directory, when you access the link from the Library home page, then the contents of the "index.html" file will be displayed instead of the file list.

### Deleting Files

To delete a file (or directory), simply enter the file (or directory) name into the ***Delete*** field and click on the ***Delete*** button.

You can copy the file name from the list shown in the box at the bottom of the page and then paste it into the ***Delete*** field.

## Library Copy Screen




The ***Library Copy*** screen allows you to copy files or directories from a Secondary memory storage device onto the main Library storage device.

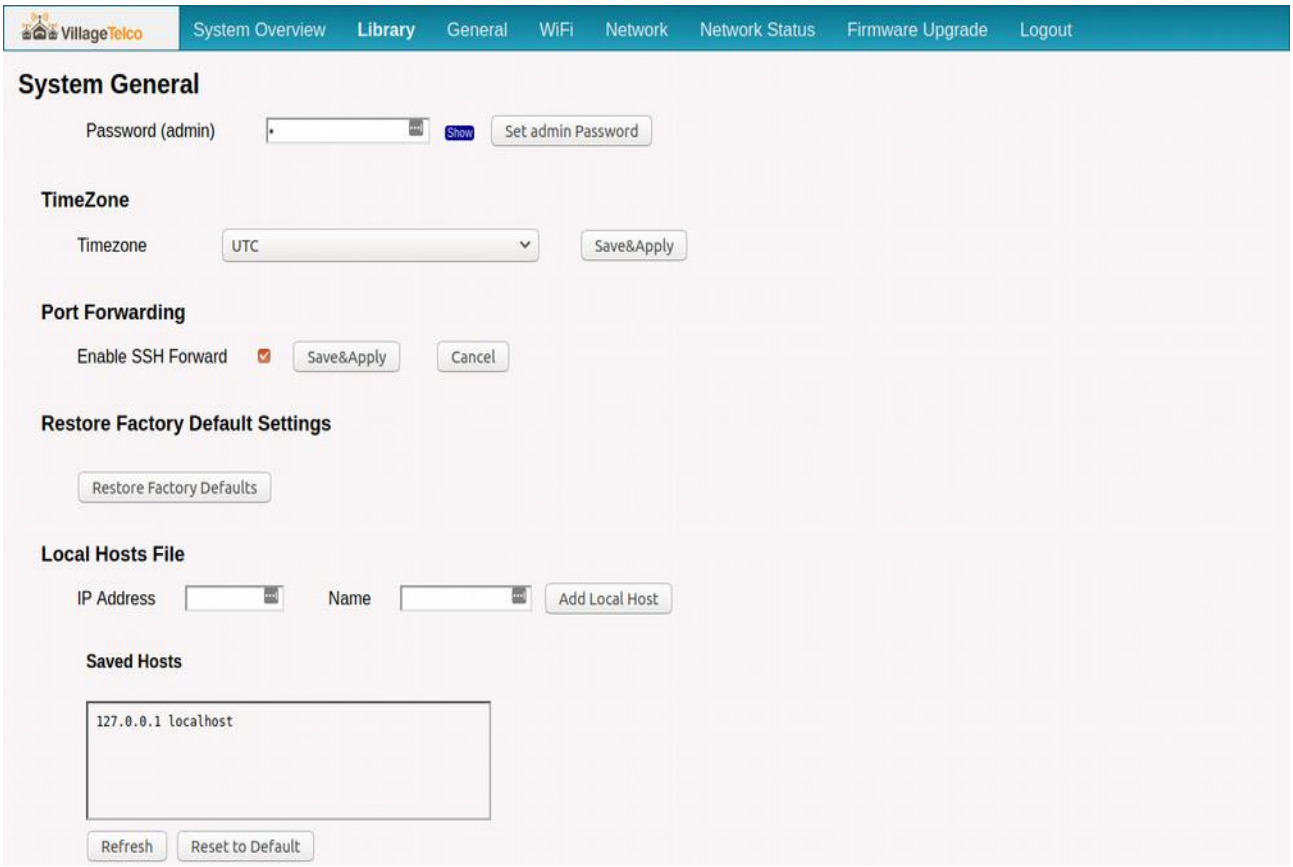
The ***USB Contents*** box will display the contents of the secondary memory device.

To copy a file or directory, enter the name into the ***Copy*** field and click on the ***Copy*** button.

You may copy the name from the ***USB Contents*** list and paste it into the ***Copy*** field.

A message will displayed showing success of the copy operation.

## 3.3 General Configuration Screen




### Passwords

This section allows you to set the passwords for the ***admin*** and ***root*** accounts on the Digital Library system.

If the current login is the ***root*** account, the password fields for both accounts will be displayed.

If the current login is the ***admin*** account, only the password field for the ***admin*** account will be displayed.

Stored passwords will not be displayed.

To enter a new password, type the password into the field, click on ***Show*** to display the password, and when you have checked that it is correct, click on the respective ***Set*** button.

### Time Zone

Select the required Time Zone from the drop down list and click on the ***Save&Apply*** button.

### Restore factory Settings

Click on the button to restore all setting to Factory Default.

A message will be displayed when the settings have been reset.

To put the new settings into effect, reboot the Digital Library device.

You will be promted to login again to the browser with the default password.

### Local Hosts

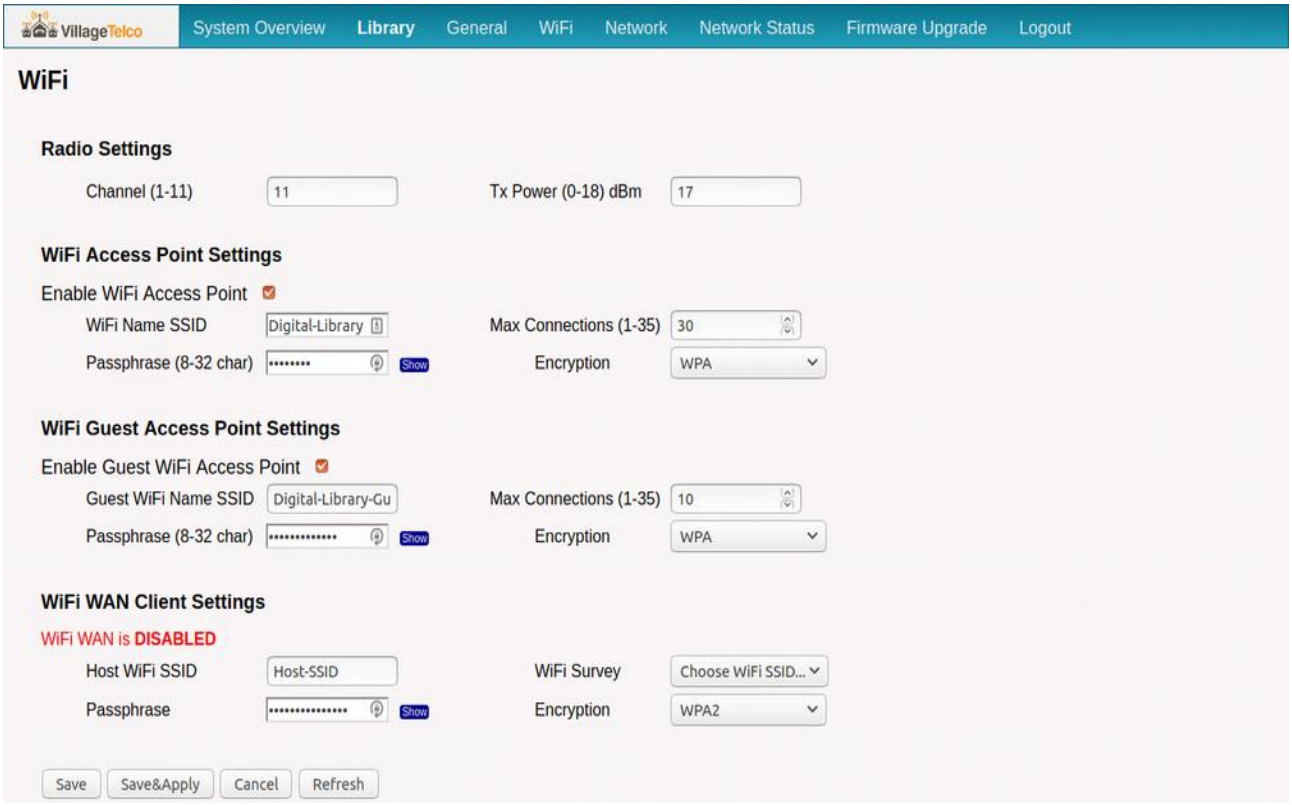
This section allows you to make an entry into the ***etc/localhosts*** file. This allows you to access a resource on an upstream network by name rather than by IP address.

The current entries in the hosts file are shown in the box.

Enter the required new ***IP Address*** and ***Name*** into the respective fields and click on the ***Add Local Host*** button.

You may restore the hosts file to default by clicking on the ***Reset to Default*** Button. This will remove all additions to the file and leave just the default ***localhost*** entry.

## 3.4 WiFi Configuration Screen




The WiFi configuration screen allows you to set up the operational parameters of the WiFi sub system.

### Radio Settings

This section allows you to set the ***Channel*** and ***Tx Power*** level.

**Note**: It is recommended for 2.4 GHz systems, that the channel selected is one of the three non-overlapping channels i.e. ***1, 6 or 11***.

It is recommended to set the ***Tx Power*** level to the minimum level which gives correct operation. For a classroom situation, a level of 9 or 12dBm is generally sufficient.

After making the required changes, click ***Save&Apply*** to store the settings and restart the WiFi sub-system.

### WiFi Access Point Settings

These sectons allow you to enable the two Access Points, and to set the SSID name, the WiFi ***Passphrase*** and the ***Encryption*** type for each one.

You may also set the ***Max Connections*** limit for the Access Points to ensure that the system does not get overloaded and remains stable. A maximum of 40 connections in total is recommended.

After making the required changes, click ***Save&Apply*** to store the settings and restart the WiFi sub-system.

### WiFi WAN Settings

This section allows you to set up the connection details for the ***WiFi WAN*** connection. This allows you to connect to an upstream network via Wifi.

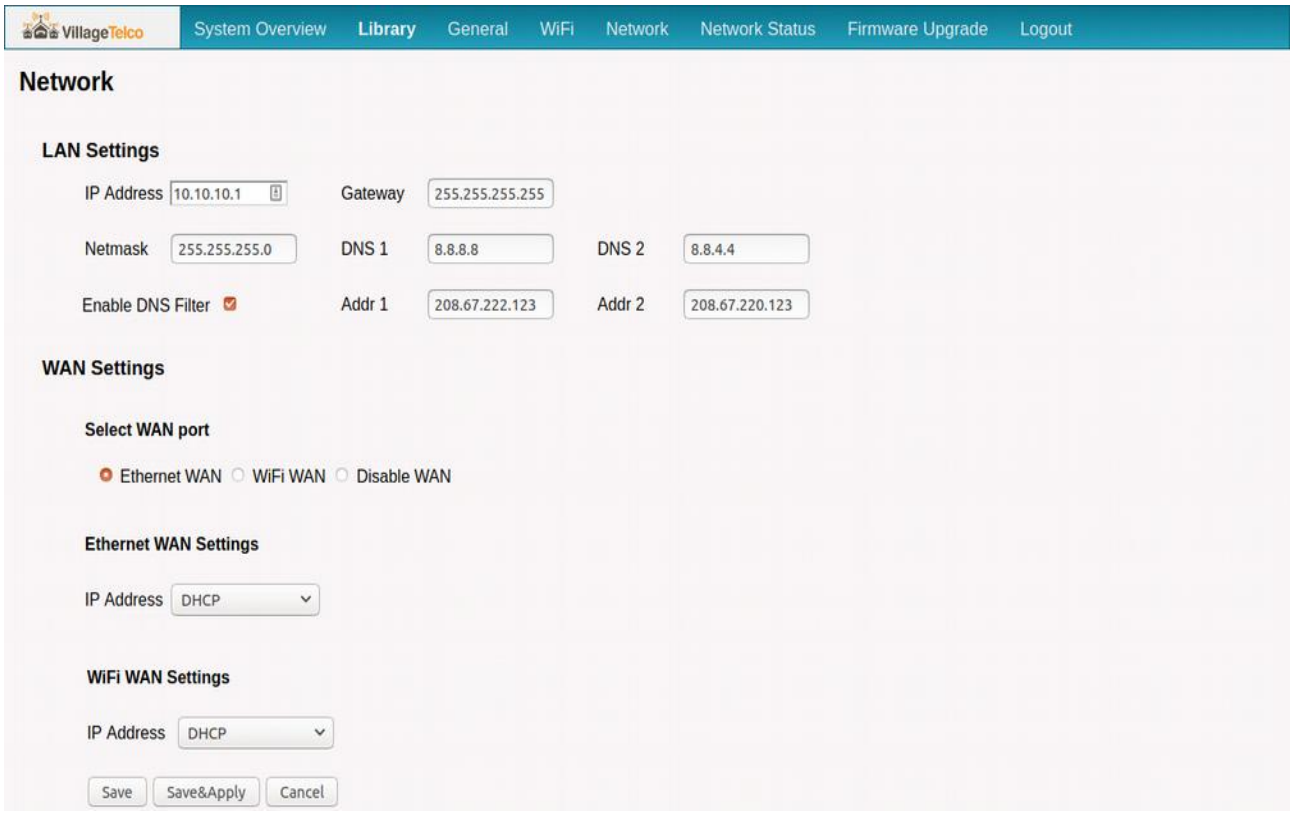
The ***WiFi Survey*** list will show all active WiFi Access Points in the area, and you can select one from the list to automatically populate the ***SSID*** and ***Encryption*** fields.

You must enter the ***PassPhrase*** details by typing into the field.

After making the required changes, click ***Save*** to store the settings and restart the WiFi sub-system.

To enable the connection, you must then move to the ***Network*** screen and select the ***WiFi WAN*** option, followed by ***Save&Apply*** on that screen.

## 3.5 Network Configuration Screen




The Network screen allows you to set up the networking parameters of the Digital Library.

### LAN Settings

These settings control the IP parameters for the LAN to which the client devices connect.

These settings will not normally require to be changed unless you are integrating the Digital Library into an existing LAN.

#### Enable DNS Filter

By default, the Digital Library will utilise a DNS Filter to ensure that any content downloaded is appropriate for the intended classroom use.

The default ***DNS Filter*** addresses (208.67.222.123 and 208.67.220.123) are for the **Open DNS *Family Shield*** service, which blocks links to sites containing malware, phishing and adult content.

If the DNS Filter is not enabled, then the settings in the normal DNS fields will be used.

After making the required changes, click ***Save&Apply*** to store the settings and restart the Network sub-system.

### WAN Settings

These settings allow you to connect the Digital Library to an upstream network via Ethernet or WiFi.

By default the ***WAN Port*** is set to use the ***Ethernet*** connection.
This setting is OK to use for standlone operation of the Digital Library.

Alternatively, the ***WAN Port*** may be set to ***WiFi WAN***, or ***Disabled***.

The ***WiFi WAN*** setting configures a WiFi Client interface to connect to an upstream network Access Point.

If the port is set to Disabled, neither Ethernet or WiFi Client is enabled.

For devices with a single Ethernet connector, this connector will be configured as a LAN port if the ***WAN Port*** setting is selected as either ***Disabled*** or ***WiFi WAN***. This ensures that the Digital Library device can be accessed via Ethernet cable in the event that the WiFi subsystem is not operating correctly. (See below)

**Ethernet WAN Settings**

If the Ethernet WAN ***IP Address*** field is set to ***DHCP***, the network settings for the Ethernet WAN port will be set automatically by the upstream network DHCP server.

If the Ethernet WAN ***IP Address*** field is set to ***Static***, the network settings for the Ethernet WAN port may be set manually by entering the appropriate values for ***IP Address***, ***Netmask***, ***Gateway*** and ***DNS*** in the respective fields which will be displayed when the selection is made.

**WiFi WAN Settings**

If the WiFi WAN ***IP Address*** field is set to ***DHCP***, the network settings for the WiFi WAN port will be set automatically by the upstream network DHCP server.

If the WiFi WAN ***IP Address*** field is set to ***Static***, the network settings for the WiFi WAN port may be set manually by entering the appropriate values for ***IP Address***, ***Netmask***, ***Gateway*** and ***DNS*** in the respective fields which will be displayed when the selection is made.

When the required changes have been made to the settings, click on ***Save&Apply*** to store the settings and restart the Network sub-system.

**WiFi WAN Interface Operation**

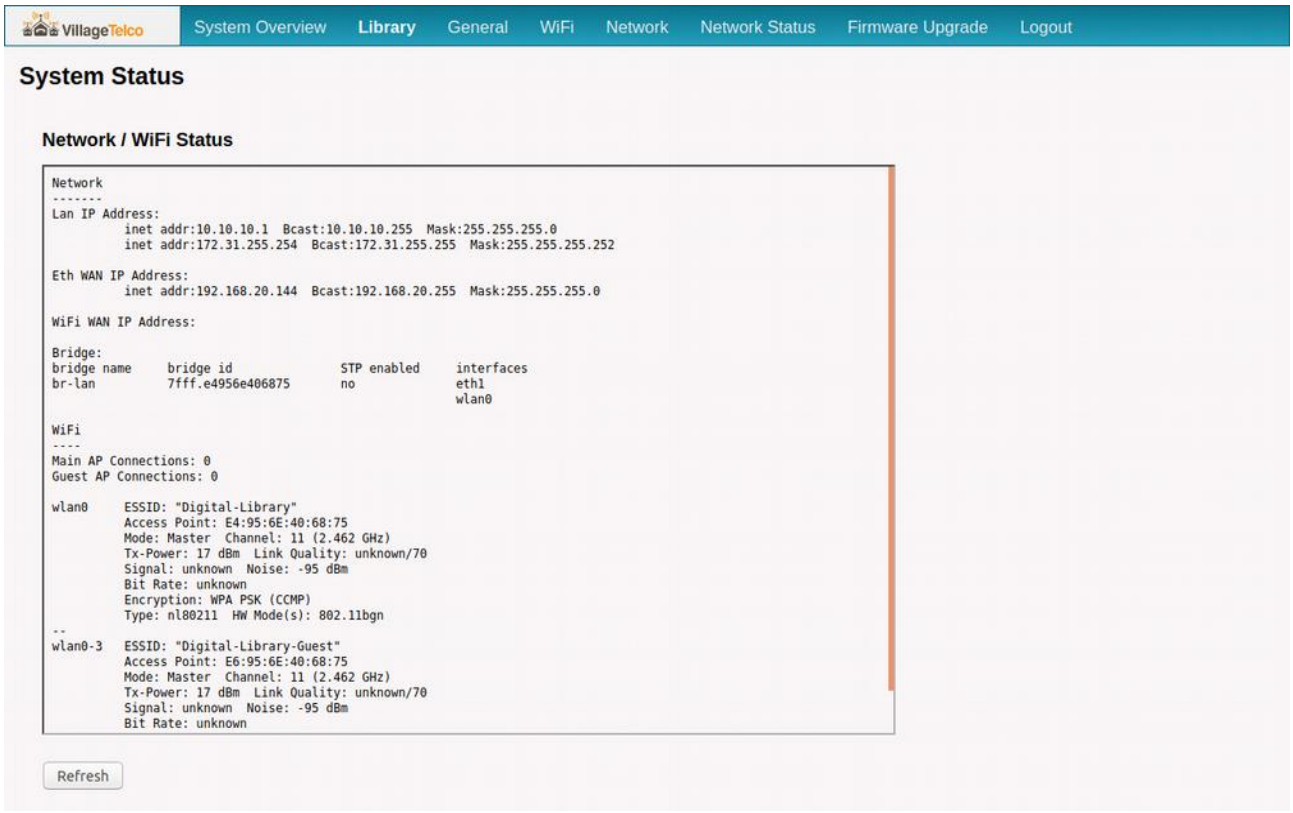
Note that if the Digital Library is configured to use WiFi WAN, and the device is not able to connect to the host Access Point, then the whole WiFi sub-system will not operate.

On system start up, or after a Network or WiFi sub-system restart, the Digital Library will survey to check if the host Access Point is present, and, if not, the WiFi sub-system will be configured with the WiFi Client interface disabled in order that the Access Points will operate correctly.

Similarly if the host Access Point is present but a connection can not successfully be made to it within a minute, the WiFi sub-system will be configured with the WiFi Client interface disabled in order that the Access Points will operate correctly.

If the host Access Point fails during operation, the connection from the Digital Library will be lost and the Access Points will cease to operate. In this event it is necessary to restart the Digital Library so that it can reconfigure itself to operate the Access Points correctly.

## 3.6 Network Status Screen




This screen shows the status of the various Network interfaces.

It shows the LAN IP settings, and the WAN IP settings depending on which WAN Port mode has been selected – Ethernet or WiFi WAN.

**Fallback IP Address**

Note that there is a Fallback IP address (172.31.255.254) operating on the LAN or WAN interface depending on the particular configuration of the Digital Library device.

This interface is to support administrative connections via Ethernet cable to the Digital Library device in the event that the main network inetrfaces are not operating correctly.

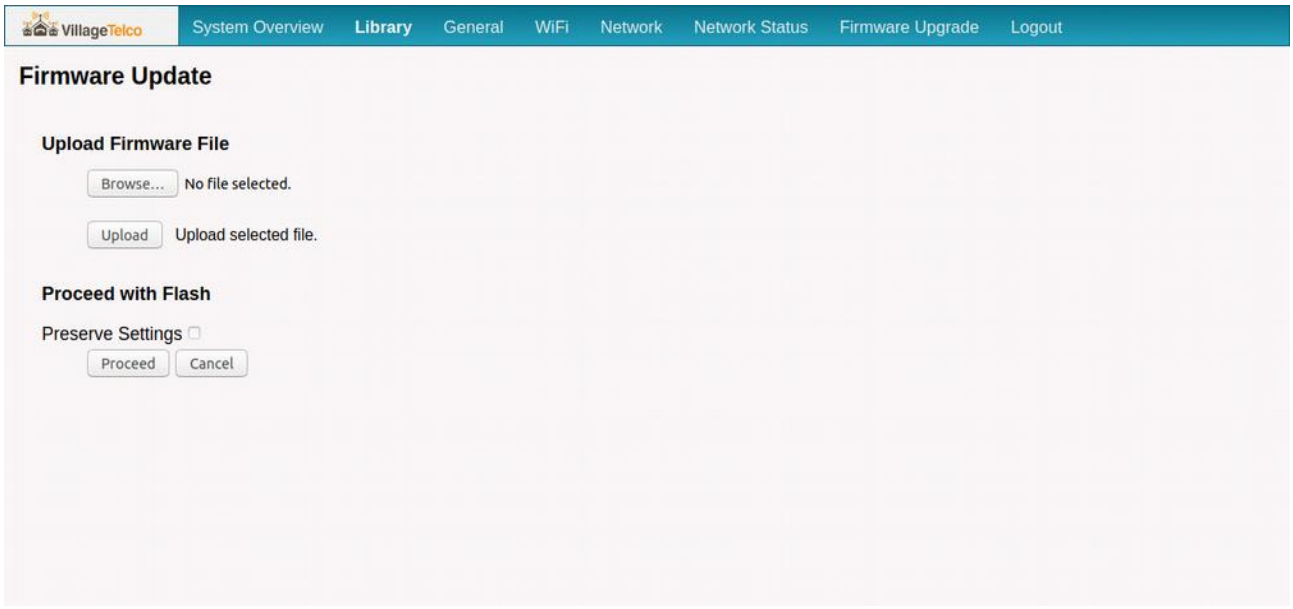
In particular, devices with single Ethernet connectors will be configured with the Fallback interface operating on the WAN interface.

This interface has a restricted Network Mask and will only accept connections from a device with its IP Address set to 172.31.255.253 with Network Mask set to 255.255.255.252.

When operating on the LAN, the Fallback interface supports HTTP and SSH connections.

When operating on the WAN, the Fallback interface supports only SSH on port 2222.

## 3.7 Firmware Update Screen




This screen allows you to update the firmware on the device by uploading a sysupgrade file from your PC.

### Upload File

Click the Browse button to bring up a file browser window and select the required sysupgrade.bin file.

Click the Upload button to transfer the file to the Digital Library.

An upload message will be displayed including checksums for the file.

### Flash Firmware

Check that the displayed checksum is correct, then click the Proceed button to flash the new firmware onto the Digital Library device.

**Preserve Settings**

You may choose to click the ***Preserve Settings*** check box to have the device operate the new firmware with the previous system settings.

**Note:** Use this facility with caution as there is generally no guarantee of complete settings compatibility between versions.

It is recommended that ***Preserve Settings*** is not generally used, and the device is set up starting from the default settings to avoid the possibility of subtle configuration error issues.

## 3.8 Installing The Digital Library Firmware

You may receive a device that does not have the Digital Library firmware installed and you will need to download the firmware files and upgrade the firmware on the device.

**Download the Firmware**

The firmware may be downloaded from the VillageTelco Downloads site:

http://download.villagetelco.org/firmware/digital-library/

This site contains Development and Relese versions of the firmware for a range of devices.

Select the correct version for your device and download the firmware file and the checksum file.

**Install the Firmware**

The existing firmware on the device will have a facility for upgrading the firmware.

Power up the device and log in to the administration pages in accordance with the manufacturer's instructions.

Identify the administration page that provides the firmware upgrade facility.

Upload the correct new firmware file to the device and start the upgrade process in accordance with the manufacturer's instructions.

**Note: If there is an option to Save or Preserve Settings during the firmware upgrade, ensure that this option is NOT selected.**

The new firmware needs to set up its own settings and not use the previous firmware settings.

For devices that are based on OpenWrt, (e.g. GL-iNet, Dragino, SEEED) the firmware file will be called:

***openwrt.<version-device>-sysupgrade.bin***

For devices that have original firmware that is not based on OpenWrt (e.g. TP-Link) there will be two firmware files called:

***openwrt.<version-device>-sysupgrade.bin***

***openwrt.<version-device>-factory.bin***

When the device is being re-flashed from the manufacturer's firmware to the Digital Library firmware, use the ***factory*** version of the firmware. Subsequently, to update to a newer version of the Digital Library firmware, use the ***sysupgrade*** version of the firmware.

**CAUTION**

**Re-flashing the operating system firmware on devices is a critical process.**

**If you interrupt the process you will likely make the device unserviceable.**

**Use a cable connection rather than WiFi if possible.**

**Do NOT disconnect power or cables on the device or host PC during the process.**

**Wait at least five minutes for the re-flashing process to complete and for the device to restart.**

**Be patient...**

## 3.9 Preparing Library Memory Devices

### Choose a Memory Device

You will need to choose a memory device that suits the Digital Library device that you have.
All devices will have a USB port, and some will have an SD Card slot. SD Cards may also be used with a USB adapter and fitted to the USB port.

If possible, use an SD Card either directly or with an adapter in the USB port.

Good quality SD Cards are generally better performing that USB memory sticks as they are rated for speed for use in cameras and similar equipment. They are also generally lower power which means that they will run cool and have better long term life.

Choose a good quality memory device from a reputable supplier. Unbranded memory devices are usually not of a high enough specification for use in the Digital Library.

You will need a 32GB, 64GB or 128GB memory device. To acccommodate the default Library, it is recommended that 64GB devices are used as the content currently occupies some 40GB.

Note that some devices will not accommodate flash memory devices larger than 32GB (e.g. MR3020), and most will not accommodate flash memory devices larger than 128GB.

You may also choose to use a low power SSD or HDD device as the Library memory, in which case these size limits will not apply.

### Format the Memory Device

The memory device will generally need to be re-formatted in order to be able to accommodate the large number of files in the Library. By default, memory devices are normally formatted with a large block sizes eg 128kB and this makes them too inefficient to store the Library files. They are also commonly formatted as FAT32 or NTFS.

You will need  to format the memory device with a block size of 4kB.

The Digital Library software supports EXT, F2FS and EXFAT file systems for the Library memory. NTFS is not supported.

The preferred file system to use is EXT, and specifically ***ext2***. It is simple to format devices to this file system on a Linux PC (e.g. Ubuntu). This format uses a block size of 4kB by default.
The **ext2** file system has proven to be very robust in use.

F2FS (Flash Friendly File System) and EXFAT may also be used, but will need to be specifically formatted for a 4kB block size. EXFAT is supported on recent MS Windows PCs.

It is recommended not use FAT32 (or NTFS) format for the main Library as they are problematic in service in this application.

**Note**: If you place multiple partitions on the memory device, only the first will be used by the Digital Library software. Additional partitions will be ignored.

**Note**: A Secondary library memory which generally has a relatively small number of files may use FAT32 format which makes it possible to manage the content on any type of PC – Linux/Ubuntu, MS Windows or Apple.

### Install the VT Digital Library Template

You may install any content you wish onto the memory device.

If there is an ***index.html*** or similar file in the root directory of the memory device, this will be used as the home page.

If there is no ***index.html*** or similar file, the contents of the memory device will be displayed as a list of files and directories which you can navigate around.

To use the standard VT Digital Library Home page, download the compressed Zip file containing the Template from the VT Downloads page:

http://download.villagetelco.org/firmware/digital-library/

Unpack the compressed file into the root directory of the memory device.

You will then have the files necessary to display the default VT Digital Library home page.

### Install the Content Modules

After installing the Template, you will see a directory called ***modules***, which in turn contains a directory for each of the items of content listed on the default Home page.

You can copy the required files for each module into the respective directories.

The content modules may be copied from another Digital Library memory device, or they may be downloaded from the OER2GO website:

***http://www.oer2go.org***

The content modules contain quite large amounts of data and downloading them reliably can be problematic. The site offers ***rsync*** and ***Zip*** file downloads.

It is recommended to use the ***rsync*** download method from the OER2GO if possible as this method is the most reliable for large transfers, and, if interrupted, you may restart the download and it will resume from where it left off.

**Note**: The Template will place a few files in some of the module directories, typically a logo image file and an index.html file. These files are used by the Home page and need to be retained when the rest of the module content is added.

### Using Multiple Memory Devices

You may use an addditional memory device with the Digital Library to provide a ***Secondary Library***. This is useful for easily managing local content without modifying the main Library memory.

The Secondary memory device may contain any files you wish. The content may be accessed from the ***Secondary Library*** link on the main ***Home*** page top menu.

If there is an ***index.html*** or similar file in the root directory of the Secondary memory device, this will be used as the home page for the Secondary Library. If there is no ***index.html*** or similar file, the contents of the memory device will be displayed as a list of files and directories which you can navigate around.

You can use a USB Hub device to provide a second USB port. The Digital Library will detect both memory devices and look for a signature file called ***##Digital-Library##*** in the root directory to identify the main Library device.

The System Overview administration page on the Digital Library will display details of the memory devices that have been detected.

**Note**: Not all USB Hub devices will work satisfactorily in this application. The majority of devices we have tested are OK, but a few have issues. Check the System overview page to make sure that both devices have been correctly detected.

## 3.10 Accessing the Digital Library File System from a PC

The Digital Library software supports ***SSH*** (Secure Shell), ***SCP*** (Secure Copy), and ***SFTP*** (Secure FTP) connections.

This allows you to connect your PC to the Digital Library and access the command line and the file system using the ***root*** account.

**Caution**: You will have unrestricted access to the complete file system, including the operating system. Be careful not to modify or delete any files that you are not completely sure about. Make a backup of files before you modify them.

The USB memory Library file system is located at ***/www/rachel***

On a ***Linux*** (e.g. Ubuntu) PC you can access the SSH and SCP from the ***Terminal*** application command line with commands like:

$ ssh root@10.10.10.1

$ scp ./myfile root@10.10.10.1:/www Transfer myfile to /***www*** on the DL device.

In both cases you will be prompted for the ***root*** account password on the DL device.

You can access the file system using the ***Nautilus File Browser*** application by selecting:

***Other Locations / Connect to Server***

and entering the URL :

sftp://root@10.10.10.1/www This will display the contents of the ***/www*** directory.

On a ***MS Windows*** PC, you can use the applications such as ***OpenSSH***, ***PuTTY*** and ***WinSCP*** and connect with:

root@10.10.10.1

Windows 10 2018 update now provides a basic built-in SSH client.

On an ***Apple*** PC, you can use the ***Terminal*** program for SSH and SCP, and access the file system from a third party SFTP client such as ***CyberDuck*** or ***FileZilla*** applications