Final Project: Multimedia Center

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Abstract

Development and application of a multimedia center executed from a Raspberry Pi, with access to streaming, image, video, and audio playback, as well as error configuration.

1 Introduction

The development of the final project is the implementation of various solutions for certain functions and applications, thus obtaining a stable product for a potential user, solving basic problems such as having a functional human-computer interface, up to the implementation of utilities in the Operating System to execute connection procedures to a Wi-Fi network.

In this report, it will be described in a way that the user does not find impossible to understand.

2 Background

2.1 Network Manager

Utility included with most LINUX-based Operating Systems, must be configured by the programmer. Linux (2024, March 18)

2.2 Chromium

Open source base for developing a web browser, meaning it allows changing a browser to obtain a desired graphical interface of internet sites. Projects (S.F.)

2.3 Raspberry Pi OS - Bullseye 11

Operating system of the multimedia center,

3 Materials

- Raspberry Pi 3 or higher.
- Power supply for Raspberry Pi (Cell phone charger case).
- HDMI cable (monitor-Raspberry Pi).
- microSD card with at least 8 GB of storage.
- USB memory with multimedia content (videos, photos, audios).
- Monitor.
- Keyboard.
- Mouse.
- Speakers or headphones with USB or 3.5mm (about 0.14 in) jack.

4 Health care information and risk warnings

Does not stand for a major risk to people's health.

Electronic devices heat up, handle with care.

If manipulation is needed, it should be unplugged for better care of the device and individual integrity.

5 Development

Colón . (2024) The operation of the multimedia center is divided into several modules:

- **GUI**
  - This directory stores the classes that show the customized graphical interface of the project in all its views, generating panels and divisions that allow us to organize buttons related to images to make it more attractive.
  - Likewise, in this path there are also methods to clean the panels and correctly display the one where the user is found.
  - Additionally, in the directory you can also find methods that pertain to the four different types of files on the USB that our Multimedia Center should be able to read.
- **Video**
  - Managing playback with the VLC library, an array is initialized, which will list the files it finds with extensions '.mp4', '.avi', '.mkv', '.mov' or '.wmv', so it will extract and play said video as soon as the array index matches it, incrementing each time the previous one finishes playing and returning to index '0' each time it moves past the last element of the array.
  - This class also has the addition of a new button, also with the tkinter library to stop video playback at any time, ending its audio as well and returning to the main menu.
- **Image**
  - The idea of the array that directly takes the number of images stored in the directory is resumed and increments every 3000 ms (about 3 seconds), that is, after three seconds it will change the image and continue the playback of the list in a loop.
- **Audio**
  - We re-implement an array that works as a list and reference to audio files in formats '.mp3', '.wav', '.ogg' and '.flac'.
  - **NOTE:** To listen to the audios, an audio output is needed either via USB-A or through the 3.5mm (about 0.14 in) JACK port that the Raspberry Pi has.
- **Mixed (Options 1, 2 and 3)**
  - For this case, it first displays an interface also generated with tkinter, which allows us to select between accessing the video, image, or audio choice. Depending on what is selected, it will display the interface of the possibility and use its programming logic.
- **IMG**
  - This directory stores all multimedia content for the graphical interface, that is, the logos for the applications that are referenced to a button that directs to hyperlinks opened with the Chromium open-source base.
- **UTIL**
  - In this PATH what we find is programming logic to adapt images to the interface with the PIL library, importing ImageTk.

- Likewise, it is here where the arrays are initialized for reference to the various types of files, the mounting and unmounting of the USB for reading external storage, as well as the internet connection using Network Manager, making use of the SSID attribute to list the networks it finds by the Wi-Fi protocol and connecting to them by entering a password.
- It is also relevant to highlight that in this directory the buttons and images are referenced to the hyperlinks which we access with Chromium, in addition to changing the interface with which the applications are displayed, without the typical navigation bar that we see on a web interface, nor the search bar.

6 Configuration

The multimedia center should be configured for use, the only thing the user should worry about is properly connecting to a wireless network to have internet access and be able to use its applications.

That is why the user must enter the *"Network Configuration"* menu, to search for the network of their choice and connect thanks to the implementation of Network Manager.

7 Conclusions

The development and application of a multimedia center using a Raspberry Pi turned out to involve deep work within the Raspberry Pi OS, requiring adaptation, installation, and configuration of dependencies so that the kiosk would be acceptable and pleasant for the end user, as intuitive as possible so that the user only worries about using the software and finding it functional.

I conclude this project by learning new tools for specific tasks, discovering new files within the Linux environment, and learning to handle Python libraries that I did not know.

References

a3Colón, E., Rossette, MA. Iturria, FC. 2024. Youtube Video / Funcionality Youtube video / funcionality. From.. https://youtu.be/YzcmBHdCG1M?si=KaBavCjd5GKCxrOd

a1Linux, B. 2024, March 18. Configure Network Settings Using Network Manager in Linux Configure network settings using network manager in linux. From.. https://www.baeldung.com/linux/network-manager

a2Projects, TC. S.F.. Chromium Chromium. From.. https://www.chromium.org/Home/