

Design and Implementation of Efficient Audio Streaming System Using Raspberry Pi

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Abstract— In streaming video and audio the travelling information is a stream of data from a server. The decoder is a stand-alone player or a plug-in that works as part of a web browser. The server information stream and decoder work together to let people watch live or pre-recorded broadcast. In this paper we implement audio streaming using Raspberry Pi and Icecast2.

Keywords-Raspberry Pi, DarkIce, Icecast2, Python Programming

I. INTRODUCTION

During past few years there is a rapid growth in the use of internet from industries to an individual. The use of internet made availability of streaming media. Audio streaming allows live transmission of audio over the internet, transforming internet as broadcasting medium. In streaming the parts of audio data need not be downloaded, it plays while it is received and encoded. Streaming technology became popular due to improvement in efficient audio and video compression algorithms, development in streaming servers, high bandwidth connectivity or broadband usage. The efficiency of streamed audio depends upon the audio quality. The audio quality depends on factors like bit rate, sample rate and bandwidth. Audio Format is a file format for storing the digital audio data on a computer. The encoding of the audio data is done by the encoder according to the file format specifications. MP3 is the most often used lossy format for downloading and listening content on-demand. It is part of MPEG-Layer III referred as MP3. For MP3 format the Mp3 streaming bitrates and sample rate for stereo may range from 96-320 kbps/44.1-48KHz, the preferred bitrates are 128 Kbps/44.1KHz, 96Kbps/44.1KHz. MP3 uses shout cast server, Icecast server as streaming server for live streaming application.

The project intend to present efficient audio streaming using Raspberry pi as a device used as a broadcaster encoded into mp3 audio file format with bit rate at 96kbps and 64kbps, Icecast2 streaming server serving the unicast streaming audio content over http request to the listeners. The audio can be

obtained to the listener at a particular URL with a unique mount point.

Implementation Methodology:

For streaming audio to a streaming server we need to setup the raspberry pi with the required software packages and connect it remotely using SSH (secure Shell). The encoder darkIce and Streaming server ICecast2 is to be installed and configured.

Block diagram:

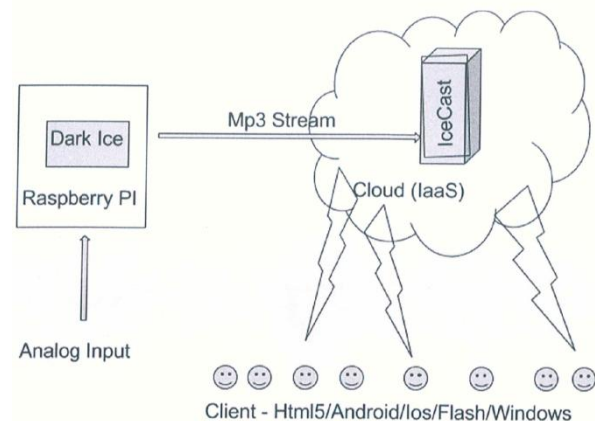


Figure 1. Block diagram

Installation of “Raspbian Wheezy” OS on the Raspberry Pi Module:

The raspberry pi is a credit card sized single-board computer. It has a Broadcom BCM2835 SoC, which includes ARM1176JZF-S 700 MHz processor, 512MB of RAM and does not include any built-in hard disk instead it operates on SD card for booting and long term storage. The SD card can be loaded with various images. In the current project SD Card is loaded with Debian OS called “Raspbian Wheezy (debian+rspi)”.

Raspbian is a debian-derived OS optimized for the Raspberry Pi hardware. Raspbian uses the linux kernel also popular as the Debian GNU/Linux Distribution. The Raspbian-Wheezy can be downloaded from Raspberry pi's official website.



Figure 2: Picture of Raspberry Pi Model-B

Connection of Raspberry Pi to a laptop with an Ethernet cable. Find the IP address of your system using if config, then install nmap to find the raspberry pi hosts address. Use 'Nmap-sn' to view all the hosts connecting to your LAN. We can find the IP address of Raspberry pi. Then connect to the pi device using ssh.

Installation of Darkice on Raspberry Pi:

DarkIce is a live audio streamer and open source software, it records the audio from an audio interface, encodes the audio into mp3 format using Lame library and sends it to a streaming server. For mp3 file format Lame library is supported which is used by DarkIce. DarkIce can record sound from many audio devices, it supports also devices. DarkIce runs on some of the Linux operating systems. Download the darkice package supporting the debian version on raspberry pi. Extract the files, modify the darkice source code to support only mp3 format and icecast2 server, configure the file, make file. Darkice is installed on Raspberry Pi.

Installation of Icecast2 streaming server on Raspberry Pi:

Icecast is a streaming server which enables us to distribute live audio across the internet. The icecast can transmit data in mp3 unicast stream over Http. Unicast represent only one listener available at a time. The mp3 data from DarkIce can be streamed from shout cast server, Icecast server. But icecast server is preferred over shout cast since icecast server operates on desired mount points and it can stream data through master and relay mount point which is secure and efficient way to deliver the audio content to the listeners.

The mount point is a unique name identifying a particular stream. A listener can only listen to a single mount point at a time. This means you can have a single icecast server contain either multiple broadcasts with different content, or possibly

the same broadcast but with streams of different bitrates or qualities. In this case each broadcast or stream is a separate mount point. The following entries should be specified in icecast server configuration file:

```

<Hostname>--DNS name or IP address used for stream
directory listings.
<Source password>--will be used for the source client
authentication
<adminpassword>--will be used for authenticating admin
features of icecast
<listen socket>--(both port and bind address)
<logdir>--directory where log files will be placed
<webroot>--directory for non admin content (file serving
root), status page is provided
<adminroot>--directory containing admin xslt files
<mount>
<mountname>/examplecomplex.ogg
</mountname>
<username>source</username>
<password>hackme</password>
</mount>

```

Test results obtained testing icecast config file.

One mountpoint name can have multiple ports.

One port can be used by multiple mount points.

One password can be applied to multiple mountpoints.

Starting the Icecast server:

Once the icecast.xml file has been properly configured, it is time to start the Icecast server. Do not run the server as root. In Linux, Icecast is controlled completely from the command line.

So to start Icecast the basic command is:

```

# icecast -c icecast.xml or from the path as
#/opt/icecast/latest/bin/icecast<full path-name> -c
/opt/icecast/latest/etc/icecast.xml<config file location path> -b
If we wish to restart the running icecast server use the
following command

```

```
#sudo service restarts icecast2.
```

Your server is now running as your icecast user and logs will be produced under/var/log/icecast:

```
# ls /var/log/icecast/
```

Connecting the sound driver to the Raspberry Pi device:

The Raspberry Pi uses the ALSA driver snd_bcm2835 as audio driver. Install the alsa-utils for alsa support.

```
$ sudo apt-get install alsa-utils
```

Configure the alsa driver and reboot the pi.

Raspberry pi supports certain sound devices for various support such as

arecord -To record audio onto the pi

aplay -To play the recorded audio

alsamixer -To change the volume settings

alsa -Audio driver for input as well as output.

The Raspberry pi supports the ALSA device support for audio input and output. The ALSA device is installed for darkice audio support.

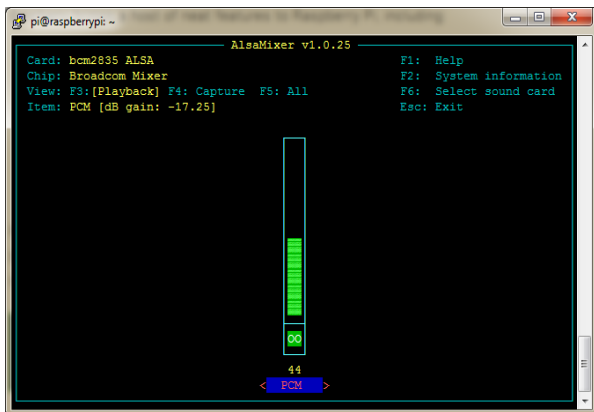


Figure 3:Alsa Mixer v1 0.25 GUI on raspi

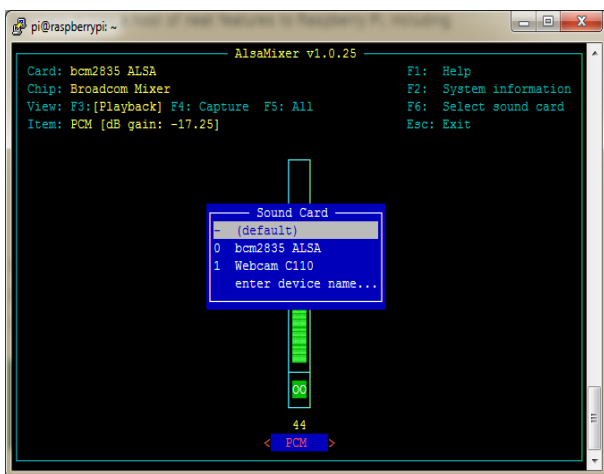


Figure4:Alsa Mixer support for audio

Modifying the darkice.cfg file:

The darkice configuration file is modified according on the icecast2.xml file settings. The unique mountname and hostname should be the same as per the icecast config file.

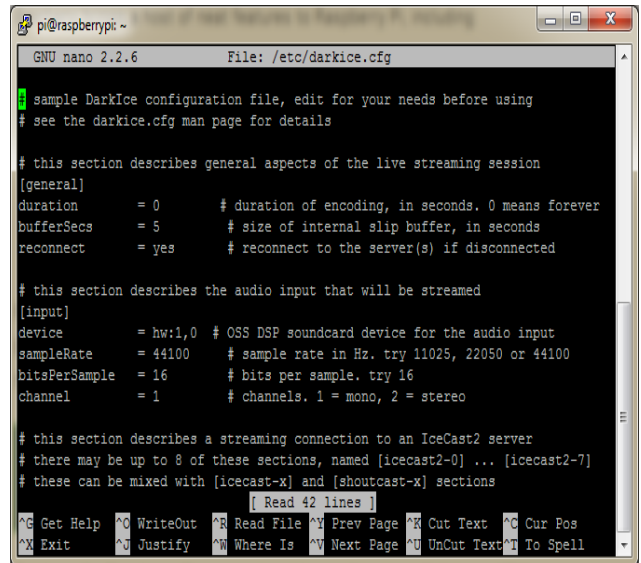


Figure 5:Darkice Config file

Starting the Streaming System:

With all the software setup on the raspberry pi, modifying the config files of icecast and darkice.Start the icecast server. Before starting the icecast server check the server host name, port number in both the config files are similar. The device is designed in such a way that a start up script is written in Raspberry pi to run the client i.e., darkice on boot up and icecast server is already set to start default.

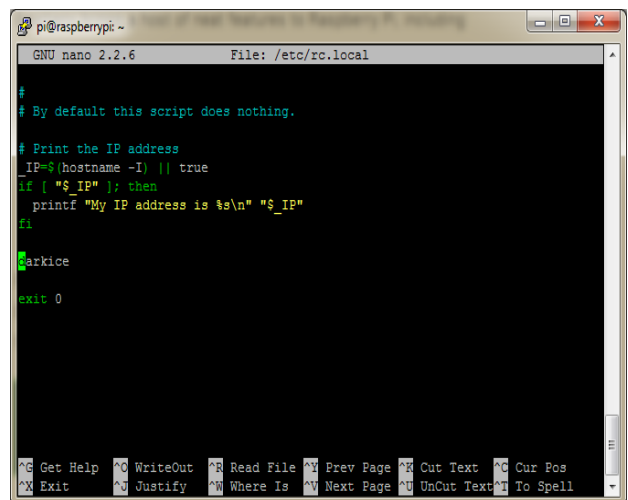


Figure 6:Startup script on boot

Plug in the audio input into the pi and power up the pi, the desired streaming output is obtained on the url http://localhost:port:/mountpoint. Mount point is unique for a stream.

II. RESULT

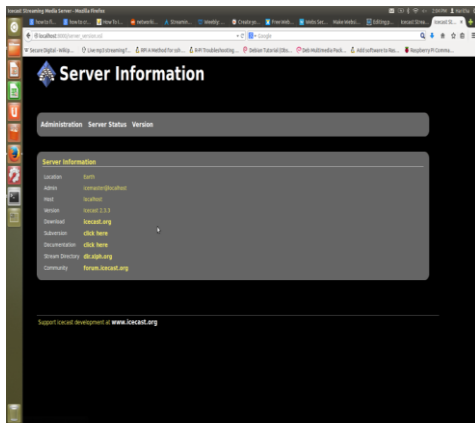


Figure 7:Icecast server at url

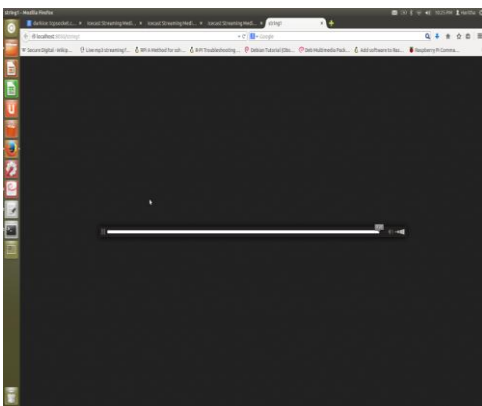


Figure 8: Streaming audio at the url

III. CONCLUSION

In this project, a secure and efficient audio streaming is done between the darkice and icecast2 using Raspberry pi. Audio Streaming using Raspberry Pi produces a low cost and efficient audio streaming used in radio stations and juke box, live teaching classes. The future work on audio Streaming Raspberry Pi can extend to adding scripts to server software to perform database events automatically.

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