

SCUOLA SUPERIORE SANT'ANNA AND
UNIVERSITY OF PISA

EMBEDDED SYSTEM DESIGN

TECHNICAL REPORT

Wav Audio Playback

Author:

Diego Alejandro Parra Guzman

Author:

Yaneakay

Supervisor:

Dr. Antonio Di Natale



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1 abstract

On this document is contained the principal topics developed during the module embedded system design. where is exploited in detail some that is called model base design; Therefore the document is focused on three developing phases such as: requirements, behavior, architecture, and verification.

The above schema will be applied in one specific project called audio playback which consist of a simple graphical application able to reproduce files in format WAV allocated in an external flash disk commonly called SDCard.

2 Introduction

As was mentioned before in this document is reported the design and the implementation of an audio playback player over a stm32f4 discovery board, during the following sections we will see all the steps used for get this final result, in additional is recommended to the reader have a basic knowledge's on embedded systems, finite state machines and C language.

Now the document structure is focus on the requirement analysis (Section 3), functional analysis (Section 4), architecture design (Section 5), Coding or implementation (Section 6), and finally a set of conclusion (section 7).

3 requirements

This section contain the requirement specification at the user level which basically is a description of what the device must to do using natural language. Then we will move to the extraction of the functional and not functional requirements.

3.1 User Requirements

Is necessary design a system able to reproduce a WAV audio format files, The data could be taken from a external disk as memory flash USB, or SDcard. The system must to contain a visual element like LCD screen able to show the current state of the system and the elements inside of the disk in such way that the users are able to control the system and navigate around the

folders, It means also that the user could chose a file inside of any folder for its reproduction.

The Wav file have to contain the follow specifications:

1. Audio Format: PCM uncompressed unsigned 8 bits.
2. Sample Rate : 8000, 11025, 22050, 44100 Hz
3. Bits Per Sample: 8-bit (range [0-255]).
4. Number of channels : monophonic.

The system has to take the data store in the Wav file and verify the file specifications, and then start the reproduction. Others formats which are not supported as Mp3 or mpeg must to be indicated before to start the reproduction, In case in which a wrong format is selected or the file don't satisfies the specification the system have to go back to the principal menu.

During the selection of the file the users have the possibility to navigate around the folders, thus is possible go forward or backward around them, and the reproduction must to start form any possible folder allocation. As addition, the system must to be portable, safety, and low power consumption.

3.2 Functional Requirements

Based in the user requirements, is possible obtain the functional requirements as follow:

1. Open/Read/Write/Close Operations on the SDCard.
2. Visualize the folders and files within of the SDCard.
3. Navigate among the file system.
4. Validate The file before to reproduce it (parsing).
5. Play/Stop the Wav Reproduction.

Thus, the system could has certain physical characteristics which accomplish the above functional description which is reported as follow:

1. The system must to has a sdcard port able to interchange data as Input/Output.
2. The system must to Open/Close/Read/Write on the SDCard.
3. The system must to has a internal memory such that make easy the data transfer.
4. The system must to contain a screen in order to visualize the general state of the system.
5. The system must to contain a DAC. "Digital to Analog convert" for the audio sound generation it could be trigger using a internal control signal.

3.3 Non Functional Requirements

This implementation is a model which non required any specific production restriction, but required a shot time period for its development no more that 2 months of work, of course it must to be secure, easy to use, and has a special performance behavior, it is discoursed in the next section. In addition the implementation must to be monetarily economic it make easy its implementation and its production.

3.4 Performance Requirements

As was mentioned before, is necessary implement a system able to express high performance behavior, it is doing identified a set of operations: the visual part, the SDCard control operation, and finally the playback operation. Notes that this operations could be executed as a three different and independent tasks which cooperating through operations, Thus is important define a proper mechanisms for interchange information between each task. It guarantee very high performance during the execution of each task specially during the playback operation.

3.5 Input/Output Definition

3.5.1 •

3.6 Comments

Comments can be added to the margins of the document using the `todo` command, as shown in the example on the right. You can also add inline comments too:

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3.7 Tables and Figures

Use the `table` and `tabular` commands for basic tables — see Table ??, for example. You can upload a figure (JPEG, PNG or PDF) using the files menu. To include it in your document, use the `includegraphics` command as in the code for Figure ?? below.

3.8 Mathematics

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$$S_n = \frac{X_1 + X_2 + \dots + X_n}{n} = \frac{1}{n} \sum_i^n X_i$$

denote their mean. Then as n approaches infinity, the random variables $\sqrt{n}(S_n - \mu)$ converge in distribution to a normal $\mathcal{N}(0, \sigma^2)$.

3.9 Lists

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