AN IMPLEMENTATION OF RECONFIGURABLE FILTER BANK FOR HEARING AID SYSTEM USING COGNITIVE RADIO


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ABSTRACT: A low power digital signal processor (DSP) for a digital hearing aid chip is bestowed. The DSP integrates 3 programmable digital finite impulse response (FIR) filters. Every FIR filter will have one pass-frequency out of seven predetermined frequencies so solely 3 FIR filters will have constant flexibility as seven filters. Hearing impaired folks have their own hearing disorder characteristics and listening preferences. thus hearing aid system ought to become a lot of natural, humanized and personalized, which needs the filter-bank in hearing aids provides versatile acoustic wave decomposition schemes, so patients square measure possible to use the foremost appropriate theme for his or her own hearing compensation strategy. The SPA-MCDM-FB is then combined with the higher confidence certain (UCB)-based decision-making algorithmic rule to look the vacant band(s) of any desired information measure for spectrum-sensing application in psychological feature radio (CR) is shown in Fig(1). The simulations results verify that the planned theme offers superior performance [i.e., improved utilization of vacant sub-band(s)] and wishes fewer gate counts compared to uniform filter bank and UCB-algorithm-based schemes.

Key words: SPA-MCDM(Multi Criteria Decision Making)-FB, UCB (cognitive radio), FIR(Finite Impulse Response)

INTRODUCTION

Two of the main problems in digital hearing aid style are high flexibility and low power consumption. High flexibility accounts for a lot of enhanced hearing clarity for the user. Lower power consumption prolongs battery time period during this method. The primary one is to decompose the inputting sound waves that are achieved by a filter-bank. The second is to by selection amplify the sub-band signals. The filter-banks used presently may be divided into 2classes, uniform filter-banks and non-uniform filter-banks. Abundant work has been worn out the look of uniform filter-banks for hearing aids a new analysis space of “Green Radio Communications” has received important attention with the anticipation of minimizing the energy consumption and magnetism pollution caused by ever-growing cellular networks. The main target of the analysis is on the planning of innovative techniques and economical architectures for radio devices and base stations with the aim of rising their average power potency thereby achieving longer energy usage (e.g., battery life) and therefore, lower magnetism pollution. Besides, the facility potency directly affects the budget items of the service supplier. The fundamental plan of a package outlined radio (SDR) is to exchange most of the analog signal process within the transceivers with digital signal process so as to supply the advantage of flexibility through reconfiguration. This can modify completely different air-interfaces to be enforced on one generic hardware platform. Broadband receivers in SDR should be completed to satisfy the demanding specifications of low power consumption and high speed. Reconfigurability of the receiver to merged with completely different wireless communication standards for a future advanced hearing aid, we tend to specify the requirement for a linear part (constant cluster delay) filter bank as hostile the rife nonlinear part infinite-impulse response (IIR) filter bank in current hearing aids. We tend to view the linear part response necessary for Associate in Nursing improved acoustic noise cancellation formula and for the potential of higher conserving the part cues for two-eared (as hostile bilateral) hearing once a try of hearing aids area unit at the same time. The major downside in a very linear section realization is that would like for
the order of the filter bank to be higher (hence inflated overheads) over a filter bank while not a linear section for constant magnitude response. An additional attribute that we tend to impose is higher stop-band attenuation for the filter channels than current-art hearing aids (typically fifty dB). a better stop-band has potential for inflated gain before the onset of acoustic feedback and larger magnitude response programmability. Here we tend to propose a replacement approach of reconfigurable filter bank style by combining FFB and a variable digital filter (VDF). A changed second-order frequency transformation based mostly low pass VDF (MFT-VDF) that gives wide cut off frequency vary than existing VDFs is planned. Then, the reconfigurable FFB (RFFB) is meant by replacement fixed-coefficient low-pass sub-filter within the initial stage of FFB with the MFT-VDF. The RFFB conjointly offers fine management over the middle frequency of mounted information measure sub-bands.

LITERATURE SURVEY: Reconfigurable low space complexity filter bank designs supported frequency response masking for non-uniform channelization in package radio receivers. [1] The planned FB has been enforced on zero CMOS technology and compared with laptop and DFTFB approaches. Synthesis results show that the planned FB offers space reduction of eighty fifth over the laptop approach and sixty seven.3% over DFTFB, static power reduction of forty eight.5% over the laptop approach and twenty five.5% over DFTFB, and improvement in speed of fifty six.7% over the laptop approach and forty two.4% over DFTFB. In future time period FRM techniques can increase the flexibleness of the planned reconfigurable FB. Reconfigurable Filter Bank with complete management over sub-band bandwidths for multi-standard wireless communication receivers. [2] to achieve the accurate classification in CSP, its necessary to find the frequency bands that relate to the brain activities associate with BCI tasks. The DFBCSP (Digital Filter Bank Common Spatial Pattern) can effectively extract discriminative features for MIBCI. The experimental results exhibit the DFBCSP can detect and extract the banks related to brain activities of motor imagery. [3] This paper planned a reconfigurable non-uniform filter bank for hearing aid. The reconfigurable filter bank relies on cosine-modulated filter bank and non-linear transformation. By adjusting the management parameters, four differing types of sub-band allocations with a similar structure square measure obtainable to provide numerous sound compensation schemes. Its lighter matching results and smaller cluster delay than recent approaches.[4] In reconfigurable FIR filter architectures supported a binary sub expression elimination (BSE) algorithmic rule has been planned. The design is consisted of a shift and add unit which is able to generate all the three-bit BCSs victimization 3 adders. The planned design of the filter for an 8 bit constant and money supply square measure 8:1 electronic devices. The input is given to the shift and add unit whose output is shared among the multiplexers. The projected design can inherently be less complicated with relevance. The projected design can have optimized delay[7-13].

EXISTING SYSTEM

In this paper, a linear phase reconfigurable filter bank was used that is predicated on the mixing of the farrow structure, SPA technique and therefore the MCDM, being termed as SPA-MCDM-FB. The overall work can be based on the farrow structure, SPA, MCDM [SPA-MCDM-FB].

Cognitive Radio Network in Action

The overall work can be based on the farrow structure, SPA, MCDM [SPA-MCDM-FB]. The study details, style examples and complexity comparisons show that the SPA-MCDM-FB is simple to style and offers substantial savings in gate
The output waveform can be shown in Fig(3). Moreover, psychological feature radio additionally utilized in this method that mechanically detects the out their channels during a wireless spectrum and alter transmission parameters sanctionive a lot of communications to run at the same time and also improve radio operative behaviour. The projected sub band filter bank is meant by obtaining low pass response with cut-off frequencies adequate falling band edges of sub bands and it has delay is shown in Tab (1) and the total static power used by using CDMA can be shown in Tab(2).

**Delay and power analysis**

<table>
<thead>
<tr>
<th>Cell</th>
<th>Fan out</th>
<th>Gate delay</th>
<th>Net delay</th>
<th>Logical name</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBUF: 1-0</td>
<td>54</td>
<td>0.821</td>
<td>2.375</td>
<td>Se1-0-IBUF(se1-0-IBUF)</td>
</tr>
<tr>
<td>LUT3: 10-0</td>
<td>1</td>
<td>0.551</td>
<td>0.000</td>
<td>Mmux-y1-mux0c00-4</td>
</tr>
<tr>
<td>MUXf5: 11-0</td>
<td>1</td>
<td>0.360</td>
<td>0.000</td>
<td>Mmux-y1-mux0c00-3-25</td>
</tr>
<tr>
<td>MUXf5: 11-0</td>
<td>1</td>
<td>0.342</td>
<td>0.000</td>
<td>Mmux-y1-mux0c00-4-26</td>
</tr>
<tr>
<td>FD:D</td>
<td>0.203</td>
<td>0.000</td>
<td>Y1-0</td>
<td></td>
</tr>
<tr>
<td>Total :</td>
<td>4.652ns</td>
<td>(logic 2.375ns route)</td>
<td>(48.9%logic 51.1% route)</td>
<td></td>
</tr>
</tbody>
</table>

**Tab(1) Delay for using CDMA**

<table>
<thead>
<tr>
<th>Clocks</th>
<th>Power (on)</th>
<th>used</th>
<th>Available</th>
<th>Utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logic</td>
<td>0.00</td>
<td>160</td>
<td>3840</td>
<td>4</td>
</tr>
<tr>
<td>Signals</td>
<td>0.00</td>
<td>213</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>I0S</td>
<td>0.00</td>
<td>20</td>
<td>97</td>
<td>21</td>
</tr>
<tr>
<td>MULTI3</td>
<td>0.00</td>
<td>4</td>
<td>12</td>
<td>33</td>
</tr>
<tr>
<td>Static power</td>
<td>41.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>41.01</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Tab(2) Power consumption in CDMA**

It performs the twin operation to it of the analysis filter bank adequate the rising edge cut-off frequency of sub-band from the low pass response whose cut-off frequency is adequate its falling edge-cut-off frequency. The sub-band with desired information measure, and the centre frequency is obtained. Though the projected filter bank style approach appearance simple and easy, the planning of the paradigm tunable low pass filter with full length management overcut-off frequencies of multiple low pass responses on entire nyquest band Associate in Nursing important and difficult analysis downside.
The constraints of the mounted TBW, multiple low pass responses with distinct cut-off frequencies likewise as minimum space, power, and delay requirements create it even harder.

**PROPOSED SYSTEM**

To reduce those issues the OFDM modulation theme is employed in CR system. Basically OFDM modulation theme transfers the information over multiple low rate subcarriers that area unit orthogonal to every alternative instead of single high rate carrier in typical psychological feature radio network. It reduces the lay to rest image interference, helps in spectrum sensing and additionally provides the lay to rest operability. OFDMA is predicated on orthogonal frequency division multiplexing (OFDM).

![Transmitter of OFDMA](image1)

**DIGITAL FILTER BANK:**

The digital filter bank is ready of band-pass filters with either a standard input or a summed output. An M-band analysis filter bank is shown in Fig(6).
The sub-filters $H_k(z)$ within the analysis filter bank are referred as analysis filters. The analysis filter bank is employed to decompose the input $x[n]$ into a group of sub-band signals with every sub-band signal occupying a little of the first waveband. L-band synthesis filter bank is shown Fig(7).

It performs the twin operation to it of the analysis filter bank. The OFDMA (Orthogonal Frequency Division Multiple Access) method in CR systems by using LTE (Long Time Evolution) reduces the delay and power analysis over the CDMA (Code Division Multiple Access). In OFDMA single frequency networks, where all transmitters can transmit on the same channel can be implemented. It having data carried at a low rate across all the carriers that effects of reflections and inter symbol interference can be overcome. The data are transmitted is split across all the carriers by using error correction techniques. If some carriers are lost because of multipath effects then the data are reconstructed. It reduces inter symbol interference and it acts vital role in spectrum sensing and it gives inter-operability...As an example, a Quadrature Amplitude Modulation (QAM) there are a pair of bits transmitted per tone. In 16 QAM there are 4 bits and 64 QAM yields 6 bits per sub-carrier. It is expected that everyone 4g systems are going to be spectrally economical with the utilization of modulation up to 64 QAM. The circuit will shown in Fig(8). Typical FFT sizes for OFDM systems area unit 512, 1024 and 2048, with the smaller 128 and 256 sizes additionally prospects. Among the bandwidth that may be supported area unit five, 10 and 20 MHz One helpful feature of this method is that the simple adaptation to totally different bandwidths.

RESULT:

Schematic diagram:

![Schematic diagram](Fig(8) OFDMA Circuit Diagram)

Output waveform
Typical FFT sizes for OFDM systems are 512, 1024 and 2048, with the smaller 128 and 256 sizes additionally prospects. The output waveform is shown in Fig(1.9). Among the bandwidth that may be supported are five, 10 and 20 MHz. One helpful feature of this method is that the simple adaptation to totally different bandwidths.

**Delay and power analysis**

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</tr>
</thead>
<tbody>
<tr>
<td>IBUF-F</td>
<td>1</td>
<td>0.821</td>
<td>0.801</td>
<td></td>
<td>rst–IBUF</td>
</tr>
<tr>
<td>FDR-R</td>
<td>1.026</td>
<td></td>
<td></td>
<td></td>
<td>R1/out-0</td>
</tr>
</tbody>
</table>

Total 2.648ns (1.847ns logic 0.801ns route) (69.8% logic 30.2% route) is shown in Tab(3) and the power analysis also can be reduced from 41.01mW to 33.61mW is shown in Tab(4).

**CONCLUSION:**

In this work, the most recent work done in the field of reconfigurable filter banks is discussed and also simplified hardware architecture for OFDM software defined cognitive radio. It provides an area and speed optimized architecture for direct digital frequency synthesis, one of the backbone for SDR. The delay can be reduced from 4.552 ns (2.277ns logic 2.375ns route)(48.9% logic 51.14 route) to 2.648ns (1.847ns logic 0.801ns route)(69.8% logic 30.2% route) is shown in Tab(3) and the power analysis also can be reduced from 41.01mW to 33.61mW is shown in Tab(4).

**REFERENCES:**

10. Dr.AntoBennet, M “A Novel Effective Refined Histogram For Supervised


