A Design Approach To Remove Jitter In Wireless Network Using White Space

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Abstract:

The FCC decided to open up television frequencies called as the white space for unlicensed broadcasting which gives the new dimension and area to the world of wireless communication and transmission. The preoperational features at TVWS band are much better than the 2.4 or 5 GHz unlicensed bands and therefore transceiver implementation is also comparatively less expensive. Because of these advantages this spectrum became more attractive for wireless applications. The TV White Space Spectrum is considered as important and real, main estate because its signals travel well, making it suitable for mobile wireless devices. However there are certain drawbacks or disadvantages like power limitations, crowding out of the availability of white space spectrum and interference issues provided by the FCC. This paper will make use of the white spaces to remove the jitter occurred during communication. Through analysis and simulation, we demonstrate that the proposed technique is more efficient and effective for removing the jitter.

Keywords: *White space, wireless network, TDM, multiplexing*

1. Introduction

Following recent rulings by the US federal Communications Commission that opened up significant parts of the TV spectrum for unlicensed use, several other countries around the world are currently considering similar measures [1]. A key issue in these considerations is the quantitative evaluation of the available white spaces and their utility.

1.1 What is White Space

On 17th February 2009, all local television stations ceased broadcasting analog TV channels across the United States. Effective 18th February 2009, all TV transmission in the United States was made digital (Robert Charrette,). People who owned analog televisions and depended upon the over the air broadcast at the time, required converter box to keep watching televisions unless they were near a low power tv stations which were unaffected by the switchover. This was not the only backdrop however for the switch to digital; moreover even with a converter box or HDTV, it appeared that people were unable to receive the signal of the over the air broadcast.

According to research by Oded Bendov, president of TV Transmission Antenna Group the digital signals does not have the capacity to travel as far as the analog signals. The average threshold for digital signals was estimated by Oded Bendov to be 40 miles and therefore households in many cases required to buy extra antennas in order to get the same television signals to continue watching it. Since digital signals require more precise positioning than analog signals, the positioning of the antennas had to be changed and faced towards the direction of transmission of television signals.

But the most important part of the switchover from analog to digital transmission is the advantages that came with it. Digital broadcasting not only provides clearer and sharper picture but more over it also freed up a lot of airwaves. As a result of the digital
switchover large portion of frequencies between 50MHz and 700MHz were left unused in the new digital transmission. In the United States, the abandoned television frequencies lie in the upper UHF (Ultra High-Frequency) band covering TV channels 52-69 (698 to 806 MHz). Since digital transmission uses a smaller bandwidth of frequency to relay TV information over the air compared to analog transmission, more free bands of frequencies has developed. The unused TV frequencies that are not being used to broadcast are called TV White Space. The white space are already available space for TV channels. Wi-Fi and Wireless technology works on 2.4GHz but if this unused space is available then used of this space makes freedom to give services in rural areas. The drawback of Wi-Fi is that it only covers 100m to 300m on 2.4GHz but the by using this white space about 10km of area can be covered with 400MHz-470MHz. As it is a unused channel it cannot share or mix with another channel hence transmission of signal is high. Therefore low power utilization will occur from transmitter to receiver.

2. Literature Review

This section provides an overview of the current state of related work in the area of TV white space. We first discuss availability of TV white space. Then we describe the use of white space in various techniques.

2.1 Availability of TV white space:

Beek et al. [1] make a first attempt to find quantitative analysis , in detail, the availability of TV white spaces in the 470- 790 MHz UHF band for a number of European countries, extending there earlier work reported in [7]. This range of frequencies, appreciated for its attractive propagation properties, is what remains of the European UHF TV band after the assignment of the 800 MHz band (790- 860 MHz) for other, licensed services, a process that has taken place or is ongoing in several European countries. In order to obtain results comparable to those in [8], they use a similar methodology. As a key conclusion, they confirm that the availability of white spaces in Europe in the 470-790 MHz band is notably less than in the USA. Beek et al. [1] also study the influence of the propagation model on the estimates of white space availability. More specifically, in addition to the statistical propagation model used in [8], they also evaluate the availability of TV white spaces using the Longley-Rice propagation model which takes into account elevation characteristics of the terrain [1].

The No-Talk Region of a TV Transmitter:
The no-talk region of a transmitter is inherently related to its service region, the area with sufficiently high signal-to-interference-and-noise ratio to make TV reception possible [1]. In order to understand the influence of the propagation model on estimated availability of TV white spaces, they choose to evaluate two models: statistical, distance-based propagation models and deterministic, irregular terrain models that take into account environmental characteristics of a region. The particular models, they use are widely accepted and validated.

Statistical propagation model:
In the first approach, they adopt the ITU-R (international telecommunication union-radio communication) models, empirically constructed from large measurement campaigns [10], [13]. This model is also used in [8] and allows, therefore, for a direct comparison of the results. The critical parameter in this first, statistical propagation model is the distance to a TV transmitter.

A Deterministic Propagation Model:
In the second approach, they adopt the Longley-Rice irregular terrain model [1]. The Longley-Rice model takes into account a wide variety of factors from terrain shapes to atmospheric diffraction. Due to its high complexity, we do not give a detailed overview of the model here—instead we refer the reader to the guide [14] which also includes the implementation details for the required algorithms.

2.2 Senseless: system design:

The aim of the system is to enable infrastructure- based wireless networks operating in white spaces that primarily rely on the database as a means to determine white space availability [6]. The senseless system architecture is shown in fig 2.1

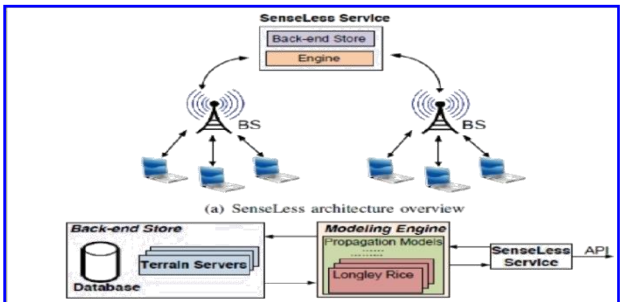

Fig. 2.1 The Senseless System Architecture

2.3 White space backup network:

This available white space can be used in wireless network. To build the white space backup network first they suggested the channel assignment [11]. To increase the compatibility between the network devices having heterogeneous white space access standards, they might implement the cross-layer approach in the white channel assignment [11]. They showed that with less delay time the network devices can deliver the messages or process transactions on the White Space Backup Network. The architecture of the white space backup network is used as the supplemental networks [11].

2.4 Cognitive radio:

Nekovee et al.[3] proposed spectrum opportunities for cognitive radios to be used in White spaces. Cognitive access to TV bands provides a range for indoor and outdoor applications and services.

Detection and incumbent protection:
The aim of cognitive radios in TV bands are to correctly detect TV white spaces, and there is a condition by rules and regulations that to avoid harmful interference to licensed users of these bands.

Beacons:
In this method, unlicensed devices only transmit or transfer if devices receive a control signal identifying unused channels within their work areas. The received signal can be from a FM broadcast station, TV band fixed unlicensed transmitter, or TV station .There is a one drawback with the control signal method is that it requires a beacon infrastructure to be in place, which needs to be maintained and operated, either by the incumbent or a third party. Furthermore, beacon signals can be lost due to a mechanism which is same as the hidden node problem.

Geo-location combined with database:
In this method, an unlicensed device involves a GPS receiver to find its location and accesses a database to find the TV channels that are unused or vacant at that location. There are three issues concern with this method. There is a need for a new entity to build and maintain the database. Devices must know their location with a given accuracy. For outdoor applications GPS can be used to support these requirements, but in the case of indoor application there are issues with the penetration of GPS deep inside buildings. Finally, devices need additional connectivity in a different band in order to be able to access the database prior to any transmission in DTV bands.

2.5 Wireless body area network:

It plays a key role in future e-health [4]. For example, one important WBAN application is multi-parameter monitoring, where multiple vital signs of a patient are monitored continuously. These vital signs are sampled by the sensors mounted on the patient, and displayed on a central monitor.
Traditionally, sensors are wirely connected to the central monitor. Wire connections limit the mobility of patients, and if sensors fall off due to patients' movements, or if people trip over wires, accidents may happen. To mitigate these problems, WBANs are proposed to connect the many sensors, monitors, and other medical devices wirelessly. There are many possible

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WBAN medical applications. One typical example is the multi-parameter monitoring. In multi-parameter monitoring, the sensors and the monitor form a single-hop wireless network with the monitor acting as a base-station and sensors as clients.

WBANs can be built upon various candidate wireless technologies operating in different Radio Frequency (RF) bands. For example, the IEEE 802.15.6 WBAN standardization working group are considering traditional Wireless Medical Telemetry Service (WMTS) band, Industrial Scientific and Medical (ISM) 2.4GHz band, Ultra Wide Bandwidth (UWB) band etc.

3. Proposed Work

In the proposed work, the focused is to use the White Space for removal of Jitter. It is going to implement by creating Trans- receiver on simulator during the communication occurred between transmitter and receiver. In this paper, first generating delay for high speed signal which then compared at receiver with own original message with respect to time scale and if jitter is present it will be again sent original message signal for this operation that is proposed to create white-space. For simulation the ModelSim SE 6.2c is used. Here the VHDL (VHSIC hardware description language) programming is used. The proposed shown in fig. 3.1

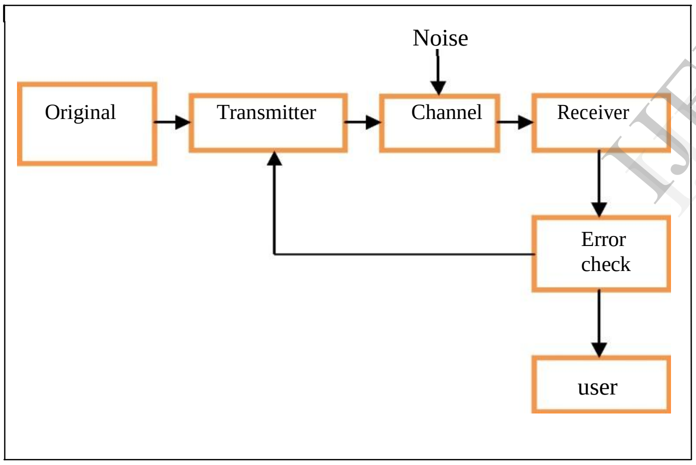

Fig. 3.1 Proposed Block Diagram for Removal of Jitter

3.1 Jitter

Jitter is the amount of variation in latency/response time, in milliseconds. Jitter is defined as the short-term variations of a digital signal's significant instants from their ideal positions in time.

3.2 Methodology

The current methodology has divided into three parts, they are as follows-

3.2.1 Message generator

In this part, input message generator is created. This message generator will be present at transmitter side. This is generated by using multiplexer (4:1). The message which is being generated it can be of any number of bits. The input message is through keyboard in binary form. Other number system can also be used for input message.

The message generator is made up of multiplexer, i.e. it is having several numbers of inputs and only one output, it also have selectors. The numbers of selectors are depending upon the ratio of multiplexer.

The next part is a priority message, in which we have to set a priority of message before transmit it. By using this concept it can be beneficial to transmit message when jitter is occur. If priorities are set earlier then at the time of delay the first priority message can be send first.

So to do this the high priority message is set in code first and then it will be compared with the input message, if the LSB bit comes as equal to the input message then the input message is considered as high priority message. The Messgae generator is shown in fig. 3.2

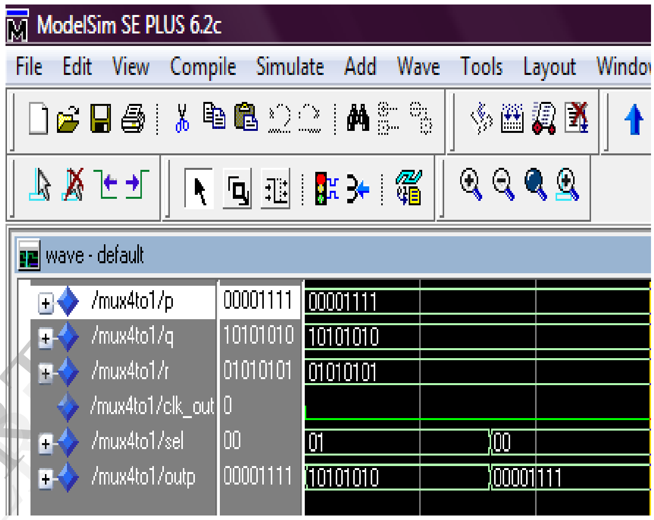

Fig. 3.2 Simulation of Message Generator

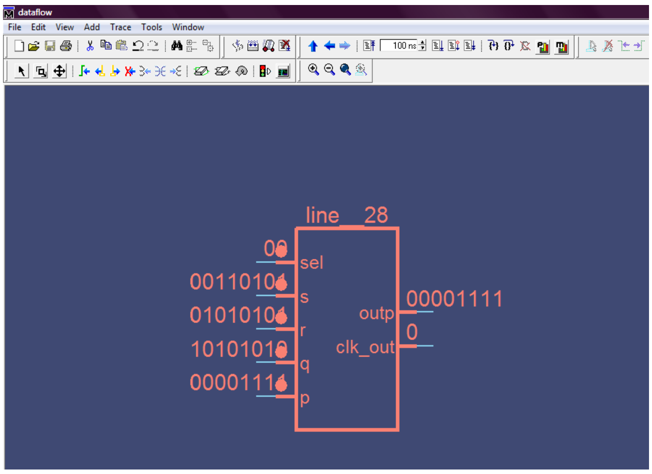

Fig. 3.2 Design of multiplexer

3.2.2 Transmitter and TDM

Transmitter will contain the message which is generated by the message generator. The message generator, itself is a part of the transmitter. The transmitter will give input to the TDM (Time Division Multiplexing).

Why TDM:

If TDM is used time will be utilized by every one.
Time division multiplexing (TDM) is a method of putting

multiple data streams in a single signal by separating the signal into many segments, each having a very short duration. Each individual data stream is reassembled at the receiving end based on the timing. The power requirement is less in TDM. It depends on analog methodology. TDM allow to use the entire bandwidth and channel capacity. TDM is more efficient than FDM because, it has more sub-channels and it can be derived. It is simpler than the FDM (frequency division multiplexing). Fig. 3.3 shows TDM

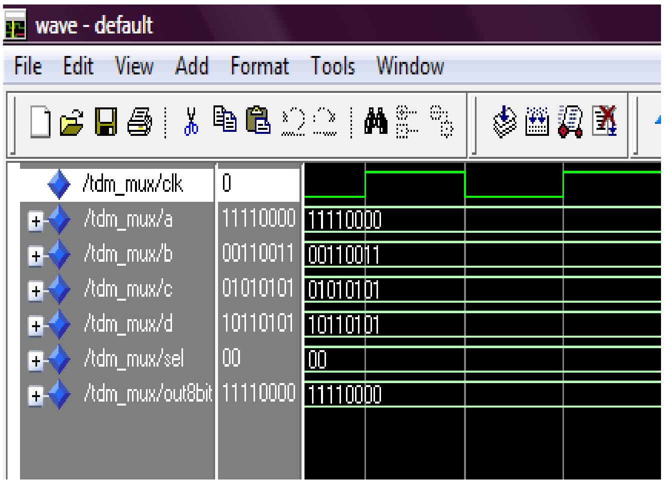

Fig. 3.3 Simulation of TDM

4. Future Work

After the message generator and TDM, transmitter is created then the jitter has to generated. The jitter is delebiratory has to generate because the frame is based on simulation. When the jitter is generated it will create the delayi.e one of packet is delayed. This delay of message ie equal to the white space. Because for some time message is not send, this time the space is created that is nothing but the white space.When message is delayed instead of that message, the priority bassed message which is generated by priority message generator is send. And hence the transmission will be continues without of jitter.

5. Conclusion

In this paper, it will make the use of white space to remove the jitter. In which the jitter will be generated as well as to remove that jitter the white spaces is also generated. It can be possible due to the advantages of white space i.e. it is possible to perform high-speed data communication in an available TV band without interfering with neighboring TV bands. White spaces are expected to have a range in kilometers instead of some few meters. They can travel through physical obstacles like convectional broadcast signals. Because all these features of white space the jitter is removed.

6. Reference

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