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Abstract – The decision of the FCC to open up television frequencies called the white space for unlicensed broadcasting opened new possibility and dimension to the world of wireless communication and transmission. The propagation characteristics at TVWS band are far better than the 2.4 and/or 5 GHz unlicensed bands and transceiver implementation is also relatively less expensive. All these advantages appear to make this available spectrum extremely attractive for wireless applications. The TV White Space Spectrum is considered prime real estate because its signals travel well, making it ideally suited for mobile wireless devices. However there are certain drawbacks like interference issues, crowding out of the availability of white space spectrum and power limitations 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, Cognitive radio

I. 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.
II. 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 quantify, in detail, the availability of TV white spaces in the 470-790 MHz UHF band for a number of European countries, extending our 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], we 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 1.

![Fig. 1 The Senseless System Architecture](image)

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 very significant spectrum opportunity for a range of indoor and outdoor applications and services.
Detection and incumbent protection:

Secondary operation of cognitive radios in TV bands relies on the ability of cognitive devices to successfully detect TVWS, and is conditioned by regulators on the ability of these devices to avoid harmful interference to licensed users of these bands, which in addition to DTV include also wireless microphones. Both the FCC and Ofcom have considered three methods for ensuring that cognitive devices do not cause harmful interference to incumbent: beacons, geo-location combined with access to a database, and sensing. Currently, the database approach seems to offer the best short-term solution for incumbent detection and interference avoidance. Both in the US and UK regulatory and industry efforts is, therefore, underway to further develop the concepts, algorithms and regulatory framework necessary for this approach.

Beacons:

With the beacon method, unlicensed devices only transmit if they receive a control signal (beacon) identifying vacant channels within their service areas. The signal can be received from a TV station, FM broadcast station, or TV band fixed unlicensed transmitter. Without reception of this control signal, no transmissions are permitted. One issue 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 mechanisms similar to the hidden node problem.

Geo-location combined with database:

In this method, an unlicensed device incorporates a GPS receiver to determine its location and accesses a database to determine the TV channels that are vacant at that location. There are at least three issues associated with this method. There is a need for a new entity to build and maintain the database.

Devices need to know their location with a prescribed 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.

Sensing:

Finally, in the sensing method, unlicensed devices autonomously detect the presence of TV signals and only use the channels that are not used by TV broadcaster. Detection of the TV signal can be subject to the hidden node problem. This problem can arise when there is blockage between the unlicensed device and a TV station, but no blockage between the TV station and a TV receiver antenna and no blockage between the unlicensed device and the same TV receiver antenna. In such a case, a cognitive radio may not detect the presence of the TV signal and could start using an occupied channel, causing harmful interference to the TV receiver.

![Fig. 2 The UK UHF bands after completion of Digital Switchover](image-url)

From the above chart it appears that there is significant capacity available for cognitive access in the UHF bands. However, due to its secondary nature the availability and frequency decomposition of the UHF spectrum for cognitive access is not the same at all locations and depends also on the power levels used by cognitive devices [8]. This is an important feature of license-exempt cognitive access to TV bands which distinguish it from, e.g. WiFi access to the ISM bands. Potential commercial applications of TVWS devices will strongly depend on how the availability of this spectrum varies; both from location to location and as a function of transmit power of cognitive devices.

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 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.

ZigBee and other wireless technologies operating in the (2.4GHz) ISM band are being applied in Wireless Body Area Networks (WBAN) for many medical applications. However, these low duty cycles, low power, and low data rate medical WBANs suffer from WiFi co-channel interferences.

WiFi interference can lead to longer latency and higher packet losses in WBANs, which can be particularly harmful to safety-critical applications with stringent temporal requirements. Existing solutions to WiFi- WBAN coexistence either require modifications to WiFi or WBAN devices, or have limited applicability. Specifically, the WiCop Fake-PHY-Header policing strategy uses a fake WiFi PHY preamble-header broadcast to mute other WiFi interferers for the duration of WBAN active interval; while the WiCop DSSS-Nulling policing strategy uses repeated WiFi PHY preamble (with its spectrum side lobe nulled by a band-pass filter) to mute other WiFi interferers throughout the duration of WBAN active interval. The resulted WiFi temporal white-spaces can be utilized for delivering low duty cycle WBAN traffic.

We have implemented and validated WiCop on SORA, a software defined radio platform.

III. OVERVIEW OF 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 project, 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.

IV. ACKNOWLEDGMENT

In this project 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 conventional broadcast signals.

V. REFERENCES


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98