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Analysis of scanned channel estimation in 2.4 GHz ISM Band

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ABSTRACT: Wireless technology is being used widely for day to day communications, but existing source of frequency spectrum is limited. The real confront is to utilize the available bandwidth and frequency appropriately and to manage the communication without interferences in it. White space is not a technology but a conception which makes proper utilization of existing spectrum in nature. In this system the prime user is a licensed one which uses a frequency band and this frequency remains unused for particular time in a specific area. While doing this all, one should keep in mind that here should be not being any obstruction between primary and secondary user and communication should take place error free. In this paper a narrative approach using white space is proposed to detect the white space and to make a transmission of data with available free space.

KEYWORDS: White space, FCC, ISM Band, SNR.

I. INTRODUCTION

Communication in the current era is engaged mostly with digital mode. It is the most commonly used mode of communication which is characterised by higher frequency rates. Data communication is used to communicate between two or more devices using different approach. It is an action of communicating or passing on the information from source to desired destination, where a connection or a media used to allow access between person and places. Any communication is based on three main goals i.e., proper delivery should take place with more accuracy and within limited time. As the frequency spectrums are limited to use, proper utilization is necessary within available band. work on wireless technology which is tremendously increasing day by day.

The Number of users is increasing while the naturally available band of spectrum is restricted , it is a big challenge to use the available spectrum in efficient manner without any interference between communications. The main task of Spectrum sensing is done to determine available free space and free channel in the frequency spectrum band for receiving or transmitting the data . To overcome this problem of frequency spectrum band FCC gives permission to access the vacant frequency band. Allocation of a channel is defined such that the frequency spectrum that manages the spectrum in an efficient manner and perform the error free communication without any generation of interference.

II. RELATED WORK

Article [1] proposes use of cooperative spectrum sensing technique to sense the spectrum. spectrum sensing is one of the prior step in data communication. Authors compared maximum SNR based relay with various SNR relays and also evaluated their performance and selected relay based on SNR. For performance analysis using MATLAB software. In this article a representation of Cooperative Spectrum Sensing based on relay is discussed where n numbers of relay is connected. Each relay sensed the channel and takes their individual hard binary decision about the presence or absence of the primary signal. In many application the higher data rate is demanded in wireless communication. [2].

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In order to fulfil the need of extensive wireless services, higher data transmission rates are desired. This can be achieved by OFDM system which enhances the overall capacity of communication system. OFDM is well known for higher data transmission speed as well as its robustness against multipath fading. Authors have reviewed single value decomposition technique and water filling algorithm. These techniques are used in OFDM to boost channel capacities.

Mehdi Vasef [3] presented an investigative approach which includes Laplace's method for determining effective capacity of uncorrelated Rayleigh fading channel when uncorrelated Rayleigh fading interference is present. The accurateness of this investigative model is confirmed by numerical simulations. Author also provided the assessment of tail probability of the latency and peak sustainable rate. Article considers wireless mode of communication including a transmitter and a receiver. This scenario also involves one extra transmitter which contributes interference without focusing communication standards in wireless. Author derived the EC in the IL channels in the presence of a single interferer. It is of interest to obtain the EC in the presence of multiple interferers. S. Taruna et al. [4] studied the effect of techniques which are used to calculate energy on additive white Gaussian noise and Rayleigh fading. The only thing keep in mind that efficiently detect the empty spaces and provide them to the secondary devices without causing any interference to the primary (licensed) users. Authors concluded that performance of their method is higher with AWGN channel as compared to Rayleigh fading channel. Also they realized that when value of SNR is increased, the probability of energy detection also increased. Researchers in [5] put an idea of robust technique which enables spectrum sensing to determine white space on ISM band of capacity 2.4 GHz. An equipment can be used to create active spectrum access using agile frequency radio. This technique contributes to get advantages of established spectrum holes possible during transmission so as to reduce interference over ISM band. Dong Geun Jeong and his colleagues [6] states that ample advantage is provided in spectrum sensing when sequential detection is used. They found that sequential detection method can be used along with cyclostationary method so as to halve the time of detection. Also various hypothetical tests were anticipated to use phase information efficiently. Results suggested that time required for fixed single cycle detector is 50% of the time taken by sequential detector.

Research article [7] contributes to study the impact of variable threshold and uncertainty in noise on the probability index of detection as well as false alarm when energy detection method is used. Authors also anticipated relations among sampling sequences and SNR with the help of simulated results. Probability index of detection is characterized by detection of primary user. While false alarm probability is stated as wrong detection of primary user though it is abscent. It happens because of nature of noise in communication. Viren Sharma et al [8] evaluated spectrum sensing method over various fading channels such as Rician and Rayleigh channel etc. This was based on Receiver Operating Characteristics (ROC). Probability curves that were obtained for detection and SNR gave insights about evaluation of energy detection method which is also dominated by AWGN ROC curve. Results obtained by researchers shown that energy detection method for AWGN channel performed significantly better with low SNR value. False alarms and wrong detections increased in case of fading.

[9] Compared two ways of spectrum scanning viz, spectral covariance sensing (SCS) and energy detection using field measurement results. Their algorithm was tasted on probabilities of false alarm (Pf), detection (Pd) and misdetection. Authors stated that, Identification of noise and differentiating it from the noisy signal information is a difficult task. Spectrum sensing can be done in time domain mode as well as frequency domain mode using energy detection. In FDM, properties of noise and signal statistical correlation proven to be advantageous for Spectral Covariance Sensing (SCS) in their research. Researchers also felt the need to preserve equilibrium among Pd and Pf. For high value of threshold they noted that signal may pass similar as noise arising issues for noise detection.

Rijwan Y. Musani et al. ,[10] studied numerous patterns and features regarding frequency hopping in the ISM band. They used feature detection method for spectrum sensing. Researchers observed spectrum consistently based on whether it is free or secondary user is not allowed. They also proposed use of white space in time domain mode of communication. Research article [11] proposed the highly cost effectual solution on utilization of white space under ISM Band and provides solution Based on how to avoid the diversity problem with the design of single input with multiple output (SIMO) module. In this paper [12] author discussed about the comparative study of spectrum sensing techniques, where every method has its own advantages and limitations. For the channel allocation purpose Min-Max algorithm is used.

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III. PROPOSED METHOD

In the proposed method allocation of channel is done using dot net software the vacant space in channel shown with the help of bar chart. If the signal strength in dB shows maximum value in negative range, then that channel is free to use. Antenna acts as a converter which present between conducted and electromagnetic waves. These waves are propagated freely in space, here patch antenna is use. Transceiver is the combination of transmitter and receiver which used for the purpose of transmitting as well as receiving radio frequency signals. Controller Unit is used for the controlling purpose of the RF module the controlling is totally based on the result of scanning.

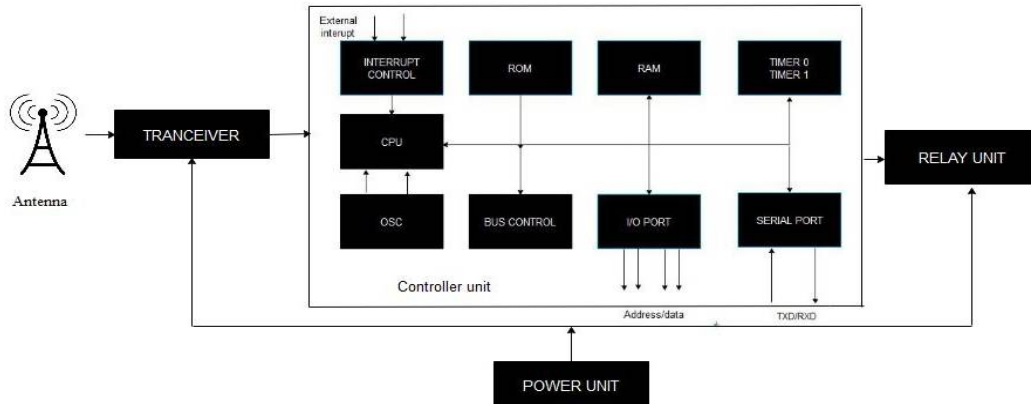

Fig 1 : Block Diagram for Radio Frequency Module.

Relay unit having panel of mechanical relays, for purpose of automatic tripping. Power unit is use to provide the power supply for operation. The table given below provides the specification of Arduino Micro Board, Atmega32u4 microcontroller is used with 5V operating voltage. On chip one universal asynchronous receiver transmitter is present, 32KB electrical erasable programmable read only memory with clock speed 16MHz provided.

Microcontroller	ATmega 32u4
Operating Voltage	5 V
Input Voltage	7-12 V
DC Current for 3.3V	50 mA
DC Current per I/O pin	40mA
Memory	32 KB
EEPROM	1 KB
Clock Speed	16MHz
USB	Micro
UART	1

Table 1: Specification of Arduino Micro Board

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IV. RESULT AND CONCLUSION

The table given below provides the frequencies for the total fourteen 802.11 Wi-Fi channels that are available around the globe, where x axis indicates the total number of channels and Y axis shows the frequency in MHz. The graph shows the lower frequency, center frequency and upper frequency for individual channel ,where the channels are varies from one to fourteen as well as the frequency also varies.

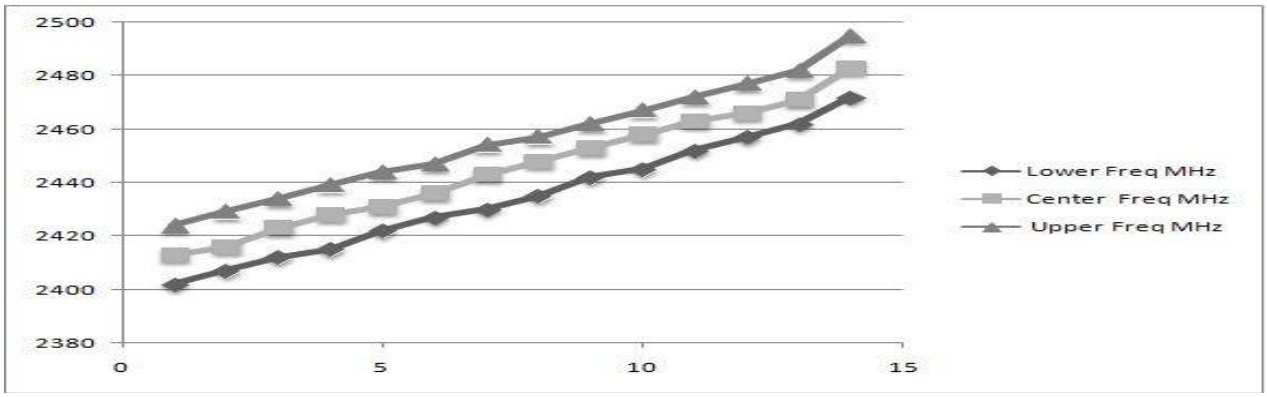

Fig 2 : 2.4 GHz Wi-Fi channel frequencies

In Wi-Fi all the versions present including 802.11n (a, b, g, n) operates on frequencies present between 2400 to 2500 MHz . These 14 channels present are separated by 20 MHz each , here for each single channel from channel number one to channel number 14 shows frequency range. Fortunately channel 1, 6,11 are placed far apart from each other because of that they don't overlie on each other.

Channel	Lower Freq	Center Freq	Upper Freq
1	2402	2413	2424
2	2407	2416	2429
3	2412	2423	2434
4	2415	2428	2439
5	2422	2431	2444
6	2427	2436	2447
7	2430	2443	2454
8	2435	2448	2457
9	2442	2453	2462
10	2445	2458	2467
11	2452	2463	2472
12	2457	2466	2477
13	2462	2471	2482
14	2472	2483	2496

Table 2 : Frequencies for 802.11 Wi-Fi channels

This paper gives the proportional study related with various techniques and methods of detection and allocation of white spaces. The module which discussed in paper is easy to implement practically with less complications, here the

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revealing of vacant channel is based on the strength of signal in dB after revealing it is easy to select that vacant channel for utilization with automatically switching with the help of relays.

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BIOGRAPHY

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