Open Source Software Defined Radio Using GNU Radio AND USRP
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A B S T R A C T
Cognitive radio is a approach, which automatically find outs the available channels in wireless spectrum, on top of that it will changes its transmission or reception parameters to basically allows concurrent wireless communication in a given spectrum band at one location, which helps us to provide dynamic spectrum utilization with the next generation network and it will leads to proper management of fixed assigned spectrum. In today's world of wireless communication for small changes we need to replace costly hardware for such aspect cognitive radio concept comes into picture. According to this concept of SDR (Software Defined Radio) Replacing rigid Hardware with flexible software based solutions. So that configuring hardware by making little changes in software is much efficient. Along with this performance of the upper layer protocols likely routing and transport are introduced.

I. INTRODUCTION
The restricted available spectrum as well as inefficiency in the spectrum usage causes a new communication prototype to perform the existing wireless spectrum [1]. The spectrum usage on certain portions of the spectrum while a more amount of the spectrum remains unused. According to Federal Communications Commission (FCC) [2], temporal and geographical variations in the utilization of the assigned spectrum range from 15% to 85%. Dynamic spectrum access is use to solve current spectrum inefficiency problem. DARPAs approach on Dynamic Spectrum Access network, also called next Generation (xG) program aims to implement the policy based intelligent radios known as cognitive radios [3,4]. Various radio technologies and protocol standards need to be perceived through different IC (Integrated Circuit) chips. The integration of various protocol as well as radio frequency chips into a small device is most important challenge in recent years. The hardware radio system consist of elements like converters, modulators and demodulator, filters. the hardware part is costly and having low compatibility with other component. It is the reason software defined radio come into picture. People use SDR technology to realize many application because of this very little efforts require for the integration of different component. It is possible to use SDR on a personal wireless device. Reconfigurability is the capability of setting operating parameters for the transmission without any changes on the hardware components. There are several reconfigurable parameters that can be included into the cognitive radio [2]. With the help of reconfigurability radio can able to dynamically Programmed according to radio environment. It is possible to set or program cognitive radio to transmit and receive on a variety of frequencies and to use different transmission access technologies supported by its hardware design.

A. Cognitive Radio Network
Cognitive radio networks [2] are being studied competently. The epic motivation for this is the heavily underutilized frequency spectrum. In cognitive radio network spectrum utilization is done in dynamic Manner. Cognitive radio is a radio which can capable to sense the free spectrum hole. Cognitive radio try to achieve the opportunities using "spectrum hole" for communication. It is a distributive technology. Two main characteristics of cognitive radio [6][7]

B. Cognitive Capability

Cognitive capability mentions to the ability of the radio technology to capture as well as detect the information from its radio environment. This capability can be realized by applying more sophisticated technique to capture spatial variations in the radio environment. By viewing the power in some frequency band of interest but more sophisticated techniques are required in order to capture the temporal and spatial variations in the radio environment and avoid interference to other users. The portions of the spectrum that are unused at a specific time or location can be observed. The best spectrum and appropriate operating parameters can be selected. Each will be elaborate as follows:

![Classification of Spectrum Sensing Techniques](image)

1. Transmitter Detection (Non Cooperative detection)

The Transmitter detection technique is also called as non cooperative detection spectrum sensing technique. Generally cognitive radio divided between used and unused spectrum bands. The cognitive radio should provide ability to determine signal if it is from primary transmitter then it locally present from specific spectrum. The Transmitter Detection concept basically depend on the detection of weak signal which is transmitting from a primary transmitter under local observation xG users. We can define transmitter detection as follows [1]:

2. Matched filter detection

The Matched filter detection is basically used as a optimal detector in stationary Gaussian noise, it maximizes the received signal to noise ratio(SNR)[9]. The advantage of using matched filter is that it needs less time to acquire high processing gain only due to coherency and it need requires knowledge of primary user signal such as modulation type, pulse shape, along with the packet format. If this information is false then matched filter will not work effectively. So that it will be very much efficient to use Matched filter in spectrum sensing detection.

3. Energy Detection
When the receiver is not able to gather sufficient information about the primary user signal for example the strength of Gaussian noise is only known to the receiver at that time optimal detector is basically an energy detector [9]. When we need to measure the energy of the received signal as well as the band pass filter with the bandwidth which is squared and it is integrated under observation, the output of the integrator is checked with a threshold to check weather licensed user is present or not. Thus the energy detection leads to invalid detection triggered by unintended signals.

4. Cyclostationary feature detection

The cyclostationary featured detection is an alternative detection[10,11,12]. The modulated signal are Basically these features have been detected by analyzing a spectrum correlation function. Cyclostationary feature detection have advantages over energy detection only because of it differentiates the noise energy from modulated signal energy. Therefore Cyclostationary feature detection will perform better than energy detector against robustness towards the uncertainty in noise power[57].

II. COOPERATIVE DETECTION

The most of the time assumption of the primary transmitter detection is nothing but primary location of the primary receiver are unknown, because due to missing of signal between primary users and the xG users.[13,14]. Cooperative Detection within unlicensed user is theoretically increasingly more accurate so that detection single user should be reduced[15]. When the network is physically separated from the primary network so there is no connection between them. In such cases we need to use Cooperative detection for the sensing information basically from other users is essential for more précised detection.

A. Reconfigurability

Reconfigurability is the capability of setting operating parameters for the transmission. Without any change on the hardware components. There are several reconfigurable parameters that can be included into the cognitive radio [2]. It is possible to set or program cognitive radio to transmit and receive on a variety of frequencies and to use different transmission access technologies supported by its hardware design [8].

B. Software Defined Radio

In software define radio [4][5] traditional hardware is replaces by software module. The integration of various protocol as well as radio frequency chips Into a small device is most important challenge in recent years. The conventional hardware radio system consist of elements like filters, converters, modulators and demodulator. The hardware part is costly and having low compatibility with other component. Its is the reason software define radio come into existence. Reconfigure means ability to reconfigure means ability to configure hardware part by change in software. In recent years SDR Is a big research of part for digital communication. It having high data transfer rate as well as receive rate.

Software Radio is a supreme device[4][5] where antenna is connected directly to Analog to Digital Convertors(ADC)/Digital to Analog Convertors(DAC) where all the signal processing is done digitally using Field programmable High speed DSP. Mostly Because of this Filtering, modes of operation can be easily replaced depending upon need and new technology.SDR is Radio communication system in which all the components such are of hardware type ,and they are implemented by SDR on Computers. SDR have high service for military and cell phone service both of which are highly exchanged radio protocol in
real time. Once the functionality of radio component are implemented on software environment there are additional advantages gained such as greater flexibility & SDR can be flexible enough to avoid the limited spectrum.

The advantage of using software is that the data processing have been performed with any general purpose computer and eliminate the cost of buying expensive hardware. In today Academic, the bulk of learning and research in Digital communication includes developing software using computer. The software is most Valuable for educational establishment where components are plenty but the budget for hardware is moderate. As shown in fig, in case of SDR system the transducers, source encoder/decoder, channel encoder/decoder and digital modulator/demodulator block may be defined in software and ADC/DAC,RF front block can implemented in hardware, for this Relay communication system is implemented using GNU Radio, software kit and USRP SDR reduces the hardware to accommodate faster modification, easier modeling, minimum cost, high flexibility and reusability

III. DISCUSSION

According to survey a digital communication using software define radio [SDR] Is possibly best way to satisfy communication as well as transfer of data. On discussion in this survey keywords like Cognitive capability and reconfigrability is key points by which communication can be satisfied with software define radio. System can be connected by radio device like transmitter, Receiver and relay transmitter is use to transmit data packet receiver is use to receive data packet and relay is an intermediate node between sender and receiver with relay node gains data from transmitter and send to the receiver over a different frequency. Different frequencies are chose by user.

IV. REFERENCES


