Congnitive Radio For "Dedicated" Traces Detecting Human Flesh Detection

Mourad Mohammed Henchiri

Lecturer, Department of Information Systems
University of Nizwa
Nizwa, Sultanate of Oman
mourad@unizwa.edu.om

Md. Shafakhatullah Khan (Member IAENG)

Software Developer, Planning Trusteeship
University of Nizwa
Nizwa, Sultanate of Oman
shafakhat@unizwa.edu.om

Abstract

Radio Detection and Ranging; is a former technology used in a verity of disciplines. Nowadays, it proves its effectiveness through the mandatory and necessary adoption of such technology; which owe the name RADAR. This available technology has a verity of structural designs while behaving; the search and tracking of objects is the main purpose while scanning different height levels and distance ranges, here, many clutter technique are adopted which impose the birth of a verity of RADAR list. Intelligence is a target aimed to be ameliorated nowadays through all new intelligent inventions and case studies. For such case study and solution implementation Cognitive Radio is a well intelligent tool to be used. This study treated here, in this paper, is becoming more familiar to us; the human users. Regarding the concept of wireless sensor networks, it's increasing remarkably, and is promising new fields of application and areas. In our paper, Radio detecting network, based on the activity of the cognitive radio, is pre-assumed to be a reason of raising the wealth of technology, by presenting a monopole radio transceiver based system, responsible for emitting and receiving radio signals that do detects the presence of human being bodies. Here, the realization of the system within the transceiver radio network coverage, we need a high scalable system with a real time scan and process potential. We are implementing a new mechanism aimed to detect Human beings within a précised and closed areas, through the use of radio transceiver as a focal point for the system. The aim is to bring to life a system that assures a secured environment and giving the possibility of free movement to all. It could also be integrated in different fields of activity; presence and attendance system, limitation and identification of Humans and Human existence. Within this paper we projected the way how to achieve this enhancement in technology, based on the use of the existing technology strength via computerized equipment and network. Our work is to design and to build and integrate a cognitive radio sensor into a computer unit, which would be working by making analysis on the surrounding RF, and also do the adjustment of the spectrum of use. This system would act as programmed at the time it detects a Human; which is a target of the CR waves within the defined area range.

Keywords- Intelligence, Cognitive Radio, Radio Detecting Network, Radio Frequency.

I. INTRODUCTION

So many commercial companies are taken into consideration and under point of view the research topic of Cognitive Radios. We are here, in this paper, proving and recommending beliefs that are extracted from the real life. And since that the RADAR are a commonly used technology, our research is made on that. Such projects and systems do needs two extremities, front end application and a back end application. Regarding the front end part, it needs to be adequate to different situations and different user skills. And also here, you have to be aware that if you want to be practical, strong transceiver nodes are needed.

Scanning and following human beings in a closed area, for a purpose that could be managed in a computerized domain, do require a strong and trusty system that does the activity of Human detection within the scan range. Through this research we come out with a proved prognostication in a well architecture system, combining the strength of a two-party relationship, computer unit and transceiver unit; ensuring external communication and area scanning.

When studying the acceptability issues of this system, we keep carrying on. Since the physical study of the human sensor or human radar is not getting the increase and positive growth as it should be, while looking at the wireless telecommunication industry, it is getting a strong positive growth in the wireless services. Here we recommended, as a perspective, the use of mobile phones along with the mobile telephony network for a vaster study field. Here, also, we have to define, a radio signals transmission range, it basically consists of end transceiver node which is used to scan environmental changes in the pre-given parameters; weather; humidity, temperature, pressure, etc… and also, the network, formed basically through the coverage area of this transceiver. The system, that we come out with, is basically formed by two entities inter-cooperating; a transmission/reception unit (transceiver), a processing unit and the SDR (Software Defined Radio); for taking care of the analyze work.

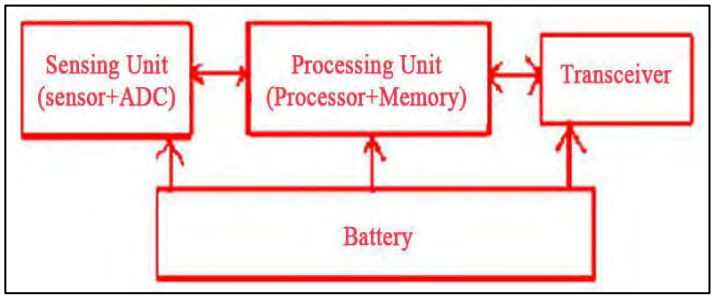


Figure 1: Radar Unit.

In this system, the transceiver is responsible of sending the digital signals or electromagnetic pulses within the range of visibility and also do receives the signals in income. Sensing unit is in charge of converting analog sensed data to digital resultant data. Then after, here this data is processed and stored by the processing unit, which is mad of the DSP; Digital Signal Processor, and a memory for storage activities.

At the implementation phase and as per definition in communication transmission; multi transmission from multi nodes at a same time leads to collisions. There are different protocols used to trespass collisions [4]. In the FDMA (Frequency Division Multiple Access) access mode many nodes can send and transmit upon different shipper frequencies. This needs additional hardware and intelligence at each node since it decreases the bandwidth of each node by dividing it. The CDMA (Code Division Multiple Access), this is an access mode also, the negative point at this method is that it increases the complexity of both, the transmitter and the receiver since it works by assigning a unique code to each node to encode its message to transmit. A third access mode is the TDMA (Time Division Multiple Access), the connection between nodes is made upon circle of time, where each node is given a predetermined period of time to use for transmission. When using this easy to implement in software access mode, we need a synchronized clocks whenever and where ever we place a node.

The whole upcoming future is well promising when taken the sensor networks with us in so many fields of activity. In our case of study, the Human detection [5], there are constraints that limit the system behavior;

1- A sensor network do have a mandatory issue to be taken into consideration; the power consumption, because of the communication in real time. And to avoid power consumption different schemes are proposed via turning off the redundant and interfered nodes or sensors. This is considered as a physical damage, since the failure in power leads to a non- functional node, thus sensor.

2- A reliable and sustainable communication made in real time, could refer to a multi-hop path for data to reach destination, this is the end to end communication, and here the *delay* would be existing, and this is a parameter to be taken in consideration too. Also, in multi-hop path, the node near the base station has not to be failed; otherwise, it would make a weighted difficulty to transmit data till the base station. This end to end delay could be noticeably reduced by making a soft delay bound.

3- Extra criteria have to be handled; the scalability of the system, Human being detecting system has to be strongly scalable assuring a fast transmission. This would be realized on specific area, sensors on this area can vary from few hundreds till few thousands per square kilometer. Here, a more property enhances the use of the telephony network with mobile phones and exploiting the COGNITIVE RADIO [6]. In real world, we have a different contexts of implementation; yet, the system is basically working on a tiny small soft sensors integrated in a mobile phone responsible for scanning the surrounding area

   within a fixed range individually, and assuring communication inter-nodes and the ability of fixing the communication parameters; carrier frequency, the modulation, transmission power dynamically. For

the unique purpose; sending the sensory information to the nearest base station. All mobile are behaving as sensors, with the existence of the cell phone base station. Here, so many multi-hop routing would be avoided, since each cell can transmit data directly to the base station. Like so, transmission time would be greatly reduced.

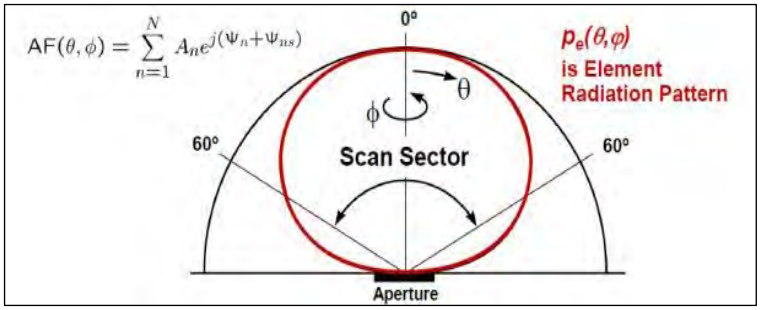
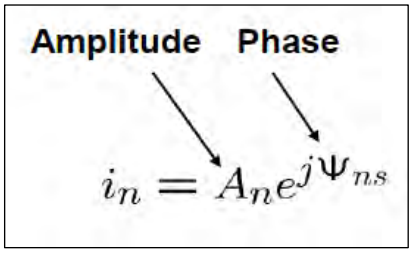


Figure 2: Radiation pattern and range.

Where:



i = currents (time).

We are dealing in the implementation on a hardware based transceiver, which would be capable of detecting available and vacant channels to communicate on dynamically. The strength of the Cognitive Radio is shown when coming to reconfigure and monitor the radio channels, frequency and the amplitude used to communicate the necessary data without needs of any hard reconfiguration. To ensure the full activity of the system, we will use a SDR (Software Defined Radio) [8].

II. AN OVERVIEW TO THE SOFTWARE DEFINED RADIO

The low level of a SDR system is a processor (hardware), on which runs a reconfigurable and re-programmable software, which is regarded to play the role of a transceiver, this is called as a Software Radio (SR) [10-12]. And this SR has to comprise the entire communication standards layer.

Only on a digital processor, it could be implemented and controlled a digital radio (DR). The SDR could behavior on application software, and accept a broad range of frequencies of fully programmed data traffic. Here, we get a proof to theory; the SDR is an SR like practical distribution. SDR and SR, while receiving a flow of data, it would pass through the selection filter, then after sampled.

From the other hand, the CR (Cognitive Radio) is a Software-Defined Radio; it behaves upon its environment discoveries [10, 13]. A CR is an intelligent autonomous tool that communicates frequently exchanging information with networks and also can communicate with other CRs.

When looking at the different wireless standards; GSM, GPRS, EDGE, WCDMA, HSDPA, LTE, GPS, mobile TV, Wi-Fi, Bluetooth and UWB, a communication device working with a single standard service cannot tolerate the ability of communicating over different standards. So here, we prove the necessity of using the dedicated hard device, capable of interpreting more than a standard.

When we need to integrate a third standard to the above architecture, it would cause an increase in radio hardware, certainly price and also complexity. This is here impractical. CR or any SDR technology, attracts us here, due to its ability of supporting by re-using different wave forms because of the high ability of fixing its parameters in software; like so, we would live an enormous befits; in size, ease of use, re- programmability and re-configuration and interoperability, even through the use of different transmitter/receiver algorithms.

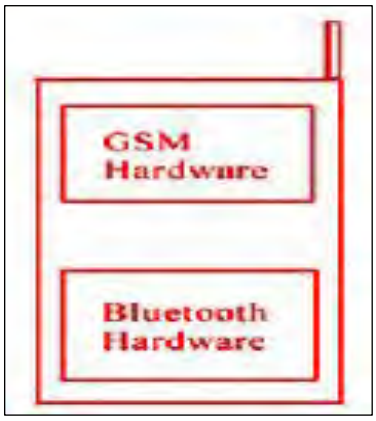


Figure 3: Handset supporting multi-standard for wireless communication.

For the implementation, different programming languages in object oriented methodology, could be used for the algorithms. The SDR, many tools are possible to be used for its implementation on the hardware; the FPGA, DSP processor, ASIC (application specific integrated circuit)

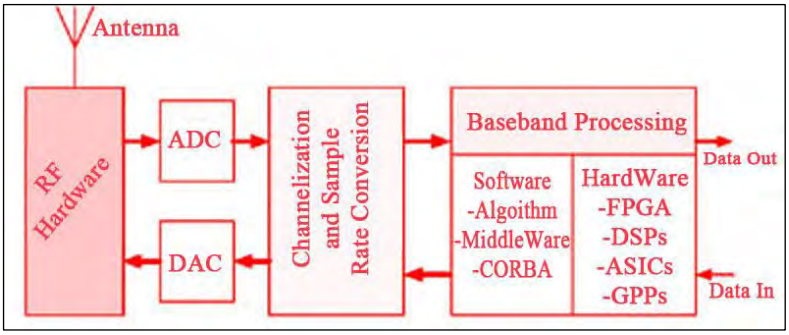


Figure 4: a schematic SDR architecture. [9, 13, 14]

The front-end RF is used for filtering and amplifying signals:

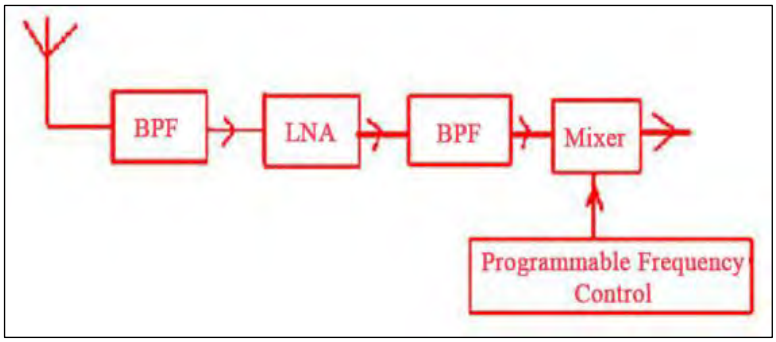


Figure 5: a front-end block diagram.

Where in (Figure 5): 1st BPF is the Band Pass Filtering; used for the initial filtering.

2nd BPF; used for decreasing harmonic distortion. LAN is the Low Noise Amplifier, which generates signal amplification.

Mixer stages:

- In transmitter, used for up conversion.
- In receiver, used for down conversion.

And due to the SDR potential, the mixer frequency is controlled by the software. Signal's digitization is made in the IF range (intermediate Frequency) to trespass the carrier offset problems, and during the use of the super-heterodyne method for digitizing the signal while involving imaging.

Sample rate conversion are used along with the channelization on the transmit path for interfacing the ADC with the digital hardware and on the received path the processing hardware to the ADC. From the digitized RF bands, channels of interest are extracted by the channelizer in the receiver, where it comes after, the base band processing. After that, in the transmitter the channel is inserted into a RF band. [13]

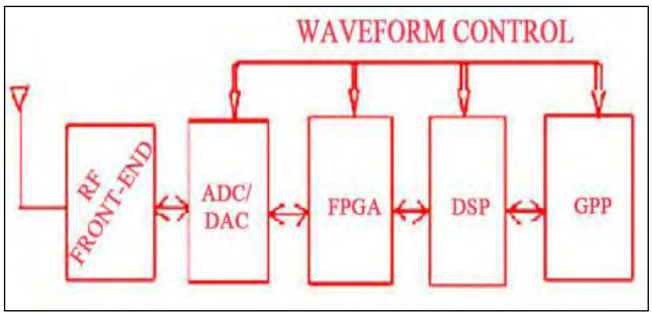


Figure 6: JTRS ' Joint Tactical Radio System' by the department of US defenses.

Where in (Figure 6): FPGA: Field Programmable Gate Array; a digital signal processor. *GPP*: General Purpose Processor; implements the medium access control layer.

III. IMPLEMENTATION

The system is implemented using electromagnetic transceiver and integrated side by side with the SDR.

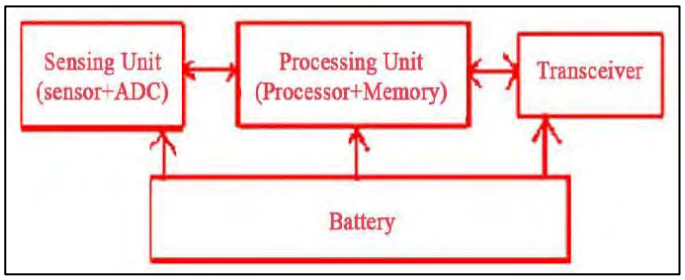


Figure 7: Transceiver node.

An array of sensory data would be generated, which will generate an analogue signal in reason of absorbing the changes made on the signal wave. The Analog to Digital converter (ADC) will be processing the data in order to be converted to digital signals.

Our algorithm on the processing unit, where to store data, has to determine and recognize the detected obstacle. This processing unit behaves and starts by gathering the spectrum of usage data upon sensing the spectrum and then selects the parameters of transmission through the channel; modulation, power of transmission, ... This is known as spectrum decision. Here after, it makes the transceiver on the SDR send the sensory data to the next hop.

From the real perspectives of a such system is to formulate a real time network side by side to the radar system; and this is what actually achieved in a former paper presented at the ICAICT conference Muscat, held on the 28-29th April 2014 at the Middle east college Muscat. A sensor network responsible for communicating relative data over an ad-hoc network based on the CR technology; here we gave the sensors the name HCRSN (Hidden Cognitive Radio Sensor Network).

To accomplish a communication over a transmission band, two users could do; first user is the mobile set user, and the second user is the HCRSN as it doesn't cause an interference with the first user. It have the ability of creating ad-hoc networks for a purpose of sending data to the base station in case of non-existing cell phone tower. Also, the HCRSN should have the ability of changing and switching the channel if the actual channel's status gets worse. This is known as spectrum handoff; yet, this could incur delays.

This is the final approach, and for to be implemented, two challenges we face; a power efficient design and a cost effective HCRSN. Which have to have the ability of communicating over both; licensed and unlicensed bands, with maintain of a minimum delay; designed end to end delay and interference with the cell user, since he is the first user? This hole research have to be realized on a mobile dynamic spectrum solution and different methods of power adaptive control to control and test the behavior and the trade-off of power source and inter-user interference.

IV. CONCLUSION

A hidden Cognitive Sensor network could be an innovative technology for human security and servicing facilities in next near future. In this paper, we approached a study on SDR, the technology of using the Cognitive Radio to scan a pre- determined area and do formulate what is in, as faced objects through a Software Defined Radio (SDR). Ultimately an approach to implementing a HCRSN has been presented from a former research accepted for publication at the Elsevier Journal. While implementation phase, a careful design of the algorithm have to be considered in order to reduce power consumption; which the major portion of power is used by the RF section. This case study is pretended to give each nation the ability of creating an effective national global security network.

REFERENCES

[1] US NAVY. Washington DC 20350-1200 http://www.navy.mil/navydata/fact_display.asp?cid=2100&tid=306&ct= 2
[2] Introduction to Radar Systems December 20, 2002 | ISBN-10: 0072881380
[3] Beginning Sensor Networks with Arduino and Raspberry Pi November 21, 2013 | ISBN-10: 1430258241
[4] A Guide to the Collision Avoidance Rules, Seventh Edition January 5, 2012 | ISBN-10: 0080971709
[5] Cognitive Radio Communications and Networks: Principles and Practice December 8, 2009 | ISBN-10: 0123747155
[6] Y. F. Li, Z. T. He and T. Voigt, "A Software Radio Empowered Sensor Network," Proceedings of 9th Scandinavian Workshop on Wireless Ad Hoc Networks, Uppsala, 4-5 May 2009, pp. 1-3. http://soda.swedish-ict. se/3607/1/sncnw09-sdr-demo.pdf
[7] F. K. Jondral, "Software-Defined Radio—Basics and Evolution to Cognitive Radio," EURASIP Journal on Wireless Communications and Networking, Vol. 2005, No. 3, 2005, pp. 275-283. doi:10.1155/WCN.2005.275
[8] S. Weiss, A. Sligersky, S. Abendroth, J. S. Reeve, L. A. V. Moreau, T.E. Dodgson and D. Babb, "A Software Defined Radio Testbed Implementation," Proceedings of IEE Colloquium on DSP Enable Radio, 22-23 September 2003, Livingston, pp. 268-274.
[9] E. L. Org, R. J. Cyr, G. Dawe, J. Kilpatrick and T. Counihan, "Software Defined Radio—Different Archi-tectures for Different Applications," Proceedings of the Software Defined Radio Technical Conference and Prod-uct Exposition, Denver, 5-9 November 2007, pp. 1-5.
[10] J. Polson, "Cognitive Radio Applications in Software Defined Radios," Proceedings of the Software Defined Radio Technical Conference and Product Exposition, Phoenix, 15-18 November 2004, pp. 1-24.
[11] L. Pucker, "Channelization Techniques for Software De-fined Radio," Proceedings of SDR Forum Conference, Orlando, 17-19 November 2003, pp. 1-6. http://www.spectrumsignal.com/channel_techniques/channelization_p aper_sdr_forum.pdf.
[12] L. S. Nagurney, "Software Defined Radio in the Electri-cal and Computer Engineering Curriculum," Proceedings of 39th ASEE/IEEE Frontiers in Education Conference, San Antonio, 18-21 October 2009, pp. 1-6.
[13] N. Bagherzadeh and T. Eichenberg, "Mobile Software Defined Radio Solution Using High Performance, Low- Power reconfigurable DSP Architecture," Proceedings of the Software Defined Radio Technical Conference and Product Exposition, Orange County, 14-18 November 2005, pp. 1-5.