Developing RFID Applications and Masses with Simulation Using Software Defined Radio

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Abstract: Initially RFID tags were developed to eventually replace barcodes in supply chains. Their advantages are that they can be read wirelessly and without line of sight, contain more information than barcodes, and are more robust Radio Frequency Identification (RFID) is currently the hottest technology in wireless applications area. Its unique advantages such as data transmission with extreme low power or even without power in tag can be the biggest beneficial for goods management. With recent advances in semiconductor processing technology and the development of reconfigurable devices, high bit-rate software-defined radio (SDR) has become practical for commercial applications. Ascertain convergence occurs when multiple technologies align in time to make possible those things that once were only dreamed. In this paper, we build an RFID application simulation environment over the SDR. We do the source to sink transmission simulation by using Quadrature Amplitude Modulation, Then, we compare the differences of BER versus SNR performances for input and output signals. A software-defined radio is characterized by its flexibility: Simply modifying or replacing software programs can completely change its functionality. This allows easy upgrade to new modes and improved performance without the need to replace hardware. An SDR can also be easily modified to accommodate the operating needs of individual applications. In our Proposed work we are also develop Improvement of simulation in wireless networks.

Index Terms: *Software defined radio, quadrature amplitude modulation, Software prototyping, Semiconductor waveguide .*

2 Introduction :

The world becomes wireless. Radio Frequency Identification (RFID) is the hottest technology in wireless applications area. Its unique advantages such as data transmission with extreme low power or even without power in tag can be the biggest beneficial for goods management. UHF RFID system can be divided to two parts, readers and tags. Generally, an RFID system contains several readers and a large amount of tags in practical application. The collision problems of both tags and readers are resolved in the arithmetic [4] and MAC protocol [5].

Software Defined Radio is a radio communications transceiver system in which all the typical components of a communication system such as mixers, modulators/demodulators, detectors, amplifiers are implemented through software rather than hardware. This approach is helpful because there is a scope of developing a system which is compatible with more than one mobile communication standard. This can be achieved by using reconfigurable hardware and swapping the software for different technologies.

A software-defined radio (SDR) is a wireless communications system where much of the signal processing is implemented in software [6, 7]. By simply downloading a new program, a software radio is able to interoperate with different wireless protocols, incorporate new services, and upgrade to new standards. In the past 20 years, there has been a big advancement in the wireless communication area [8]. Wireless communications technologies have revolutionized business and personal communications. However, there are many problems raised by using traditional ways to develop wireless products, and also the communication among various standards: The product was usually developed according to a particular release of a particular standard. When new technology emerges or the standard is upgraded or a new service is required, a new product generation has to use newly developed dedicated chips. Therefore, the application of new technology and new service is restrained, and the investment risk of manufactures and operators will be increased. People now enjoy the convenience of wireless connectivity by using different devices. Unfortunately, most of them use different standards, so we are forced to carry around a bag full of devices to take advantage of the connectivity options. And to make matters worse, in some emergency cases, like disasters, it's hard for the fireman whose device's radio is digital and in Very High Frequency (VHF) band (30MHz to 300MHz), to communicate with the policeman who can only receive 800 MHz analog signals. DSP plays a prominent role in SDR. It offers development flexibility and is used primarily for number crunching operations in signal processing algorithms. Traditionally, DSP techniques were used for pre-modulation and post-detection functions in radio receivers. In recent times, DSP techniques have been used extensively for advanced digital communications transceiver designs, finding their way into detection, equalization, demodulation, frequency synthesis and channel filtering [9-12]. SDR system can tune to any frequency band and receive any modulation across a large frequency spectrum by means of a programmable hardware which is controlled by software. An SDR perform significant amounts of signal processing in a general purpose computer, or a reconfigurable piece of digital electronics. It can produce a radio that can receive and transmit a new form of radio protocol just by running new software. In this paper we build the Software Defined Radio for RFID application.

1.1 History of software defined radio Evolution

The initial developments of software defined radio took place during 1970's. During that phase VLF radios which are based on ADC connected to an 8085 microprocessor are used by the ground forces of USA and Great Britain. The first major push for the development of the SDRs is made through US military paper named SpeakEasy. The primary goal of the SpeakEasy paper was to use programmable processing to emulate more than 10 existing military radios, operating in frequency bands between 2 and 2000MHz. Further, another design goal was to be able to easily incorporate new coding and modulation standards in the future, so that military communications can keep pace with advances in coding and modulation techniques. This paper went on in two phases.

1.2 Factors to be considered for installation of WLAN.

One of the first considerations facing the enterprise that wants to deploy wireless networking is – which wireless technologies
to adopt and when? This part examines the three prevalent standards, 802.11b, 802.11g, and 802.11a and chooses an appropriate standard. We should also lo k at two wireless LAN (WLAN) architectures – standalone access points and centrally controlled coordinated access points – and choose implementation considerations that can help to decide which type of architectures to adopt in a particular environment. To help decide which standards-based products to implement a
site survey should be performed that identifies the most appropriate wireless technologies and architectures for your environment.

2 METHODOLOGIES

variants, produced by many different manufacturers, but RFID system is mainly consists of the following components.

A. Tag (transponder)

A device that transmits data to reader which is located on the object to be identifies.

B. Reader (Transceiver)

This device is used to read and/or write data to RFID tags. Antenna could be build inside the reader. The antenna is the channel between the tag and the transceiver, which control the systems data access and communication. These components communicate via radio signals that carry data either uni-directionally or bi-directionally (Figure 1).

Figure 1: RFID System with SDR

A Quadrature Amplitude Modulation (QAM)

Quadrature amplitude modulation (QAM) can be viewed as a combination of ASK and PSK. That means that digital information is carried in both the phase and the amplitude of the carrier signal. QAM is

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a method for sending two separate (and uniquely different) channels of information. The carrier is shifted to create two carriers namely the sine and cosine versions. The outputs of both modulators are algebraically summed, the results of which is a single signal to be transmitted, containing the In-phase (I) and Quadrature (Q) information. The set of possible combinations of amplitudes, as shown on an x-y plot, is a pattern of dots known as a QAM constellation as shown in Figure 2

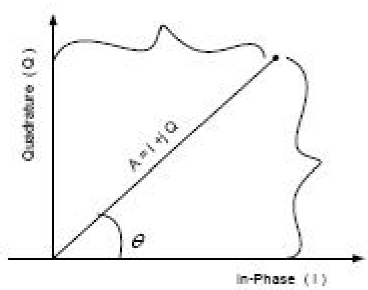

Figure : IQ Constellation Diagram

Consider the 64 QAM modulation schemes, in which 6 bits are processed to produce a single vector. The resultant constellation consist four different amplitude distributed in 12 different phases as shown in Figure 4.

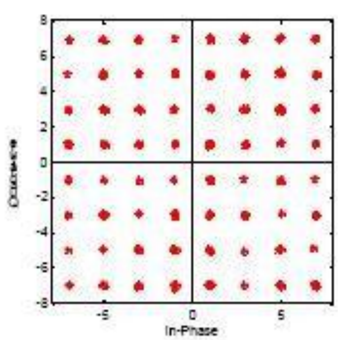

Figure . 64 QAM Constellation

B Issues regarding the implementation of this paper and final implementation

The reasons for not going into hardware implementation for the paper are as follows. The hardware implementation for this paper takes longer time, not possible to complete in a few months. The hardware required for this paper is highly costly and complex to operate. It demands complex embedded systems and other resources such as computing platforms running on Vx-Works. Hardware implementation requires work to be done in various fields and it requires assistance from a large number of professionals. Moreover this is an emerging technology and not very commonly available so it would be difficult to obtain references for the model for its performance evaluation in the real time functionalities. The implementation is done in SIMULINK because of the following reasons. The graphical user interface provided by the Simulink will be better to demonstrate the functioning of different key components such as CPUs and the DSPs. With MATLAB and SIMULINK it will be easy to implement various Base Band signal operations. The S-function builder blocks can be used to function exactly as we programmed them so the various programming methodologies can be implemented on them. The paper closely resembles to the Hardware Implementation.

3 Results

By taking advantage of the SDR simulation, we add the RFID application in this paper in order to study its transmission performances. The simulation is done in Matlab. The modulation used in transmission from source to sink is QAM. Just like in other applications, the input data are generated by SOURCE, and then fed into modulator. The
data is then fed into Additive White Gaussian Noise (AWGN) for RFID application. In communications, the AWGN channel model is one in which the only impairment is the linear addition of wideband or white noise with a constant spectral density (expressed as watts per hertz of bandwidth) and a Gaussian distribution of amplitude. The model does not account for the phenomena of fading, frequency selectivity, interference, nonlinearity or dispersion. However, it produces simple, tractable mathematical. Models which are useful for gaining insight into the underlying behavior of a system before these other phenomena are considered. Based on the normal positions between reader and tag in RFID application, we choose simulate in AWGN channel. Before demodulating the data from TX, the filter is used to filter the data coming and process data back to the original. Then the data is send to the output of RX. We initially assume ideal conditions including no feedback delay or error, perfect channel estimation, and perfect channel quality estimation.
We will then relax the
first two restrictions to examine their impact. Finally, we collect all the data in SINK. In our initial simulation work we have assumed ideal conditions. Specifically, we have simulated the performanceof

QAM modulation in AGWN channel for different BER performance of carrier frequency of 32 KHz, 64 KHz and 128 KHz. They gave us error of 1.34%, 0.60% and 0.105% respectively. Figures 5, 6 and 7 show the simulated and theoretical BER performance of the QAM under ideal conditions. As the error is lowest, thus, the preferable carrier frequency is 128 KHz for QAM modulation.

Digital Modulation

In digital modulation, the information signals, whether audio, video, or data are all digital. As a result, the digital information modulates an analog sinusoidal waveform carrier. The sinusoid has just three features that can be modified to carry the information: amplitude, frequency, and phase. Thus bandpass modulation can be defined as the process whereby the amplitude, frequency, or phase of the carrier, or a combination of them, is varied in accordance with the digital information to be transmitted. If the amplitude, frequency, or phase of the carrier is altered by the digital information, then the modulation is called amplitude shift keying (ASK), frequency shift keying (FSK), or phase shift keying (PSK), respectively.

Basic modulation schemes

The BPSK generated signals for a sample set of data at 1 MHz Frequency is as follows.

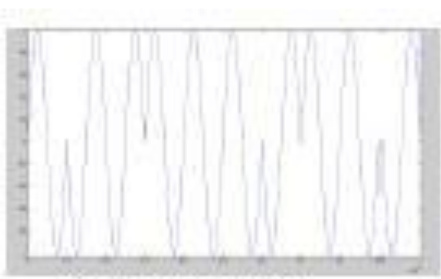

Fig 3 Modulation scheme 1

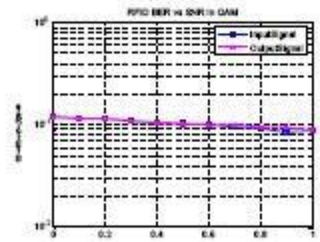

Figure BER performance of QAM with 32 KHz with carrier frequency

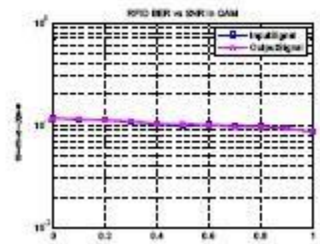

Figure BER performance of QAM with 64 KHz with carrier frequency

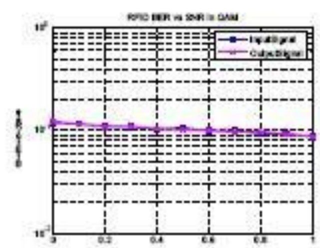

Figure BER performance of QAM with 128 KHz with carrier frequency

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Fig 4 Modulation scheme 2
BPSK modulation for the sample set of bit [1 0 0 1 1 1 0 1 1 0].

5.2 Effect of noise on the BPSK modulation for different values of channel parameter m

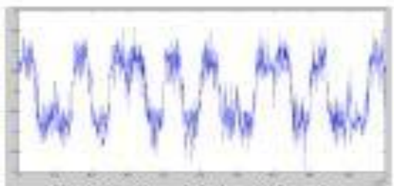

Fig 5 BPSK modulation With m=1

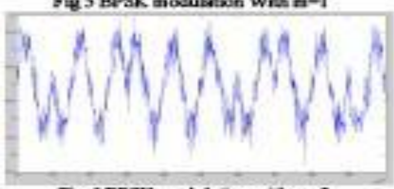

Fig 6 BPSK modulation with m=2

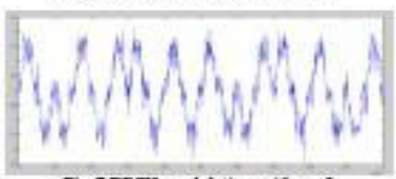

Fig 7 BPSK modulation with m=3

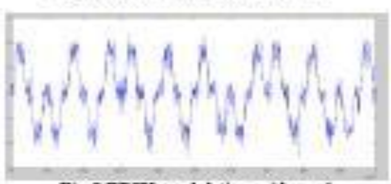

Fig 8 BPSK modulation with m=4

So from the above plots it is clear that as the value of m is increasing the noise level of the signal also decreases.
Now the smoothened signal for m=4 is shown below

Conclusion

Transceivers for the communication standard can be implemented in a pure software platform than the prevailing architectures. This implementation will narrow down the differences between the equipment currently in the present day market. Users will be greatly benefited from the equipment built using the SDR platform as they support multiple communication standards with the same given hardware. There will be no need of buying multiple equipments for multiple purposes as one equipment can take care of all the things. Active research is being carried out in this area and much commercial SDR equipment for different applications is available for commercial use. Presently their costs are very huge. In the near future all the mobiles, talkies that are used will become more and more flexible and tend towards SDR platform rather than the traditional architectures being used now. With the advancements made in VLSI and the microprocessors fields the architecture of an SDR becomes simplified rapidly. A day will come where a single transceiver can act as all in one and can be used as a mobile phone which can support both GSM and CDMA, which can also be connected to a WLAN access point, which has got Bluetooth connectivity, which can receive FM signals and work as FM radio etc.

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