Cognitive Radio Communication Network for Spectrum Aggregation

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***Abstract*- The main functions of cognitive radios are Spectrum sensing, detecting unused spectrum and sharing it, without harmful interference to other users. The important requirement of the cognitive radio network is to sense empty spectrum. Detecting primary users is the most efficient way to detect empty spectrum. This system discusses the energy consumption of transmitting data when there is conflict between a primary user(PU) and a secondary user(SU).It increases the spectral and energy efficiency of the CRN. This can analyze both system level and link level of the interference channel of the network spectrum allocation is done by implementing a new game theory approach. A CR network (i.e. Primary network).In increased the number of mobile users.**

Keywords: Spectrum sensing, spectrum allocation, cognitive radio.

INTRODUCTION:

It is observed that the [2][6] spectrum is not utilized by the licensed users effectively and some of the holes remain vacant. So, it is indeed necessary that the spectrum should be utilized effectively.[1] Cognitive radio is secondary users who use the spectrum when the primary users are not using it. It is necessary due to the fast development of technology. [3] FCC has allowed cognitive users to use the unlicensed spectrum in 2003. Cognitive radio has the capability of sensing the spectrum in the real time environment and the dynamic wireless environment. [7] It can acquire information from the environment and gets adapted to the environment accordingly by changing its various parameter like frequency, power, etc. Using these changes cognitive radio senses the spectrum, learn from the environment, adapt to the environment. Primary users, who have the highest priority, exploit the spectrum and secondary users have to vacant the spectrum accordingly not to interfere in the operation of the primary users. [10] Communication network communication have many methods are found out to improve the energy efficiency. However, there are some limitations with these methods. So to build a system model that jointly considering the sensing / transmission tradeoff and wait/switch tradeoff. It's based on the reliability of sensing, the throughput and the delay of SU transmission the optimal value of sensing time and the probability of the SU waiting in the current channel. [10] Find out to make the energy consumption of one data packet transmission minimized. Also, two energy efficiency technologies in cooperative spectrum sensing are introduced. Which are spectrum sharing and aggregation.

BACKGROUND:

In existing spectral efficiency and energy efficiency is separately analyzed. Pricing based resource allocation is used. Channel allocation scheme that uses a distributed pricing strategy to improve the network's performance. [3] In this scheme, the spectrum allocation problem is modeled as a price-based iterative water-filling algorithm is proposed. Water filling algorithm is a general name given to the ideas in communication systems design and practice for equalization strategies on communication channels. As the name suggests, just as water finds its level even when filled in one part of a vessel with multiple openings, as a consequence of Pascal's law, the amplifier systems in communications network repeaters, or receivers amplify each [4] channel up to the requires power level compensating for the channel impairments. See, for example, channel power allocation in MIMO systems.

METHODOLOGY:

Greedy algorithm - [5] A greedy algorithm is a mathematical process that looks for simple, easy to implement solution to complex multi step problems by deciding which next step will provide the most obvious benefit. Such algorithms are called greedy because while the optimal solution to each smaller instance will provide an immediate output, the algorithm does not consider the larger problem as a whole. Once a decision has been made, it is never re considered greedy algorithm works by recursively constructing set of objects from the solution to a particular problem depends on solution to smaller instances of the problem. [5]The advantage to using greedy algorithm is that solution to smaller instances of the problem can be straight forward and easy to understand. The disadvantage is that it is entirely possible that the most optimal short term solutions may be lead to worst possible long term out come. Greedy algorithms are often used in Ad-hoc mobile networking to efficiently route packets with the fewest number of hops and the shortest delay possible. They are used in machine learning, business intelligent, artificial intelligence and programming.

RF MODULE:

Generally, an [5] RF module is a small size electronic device that is used to transmit or receive radio Signals between two devices. The main application of RF module is an embedded system to communicate With another device wirelessly.[5] This communication may be accomplished through radio frequency Communication. For many applications the medium of choice is RF, since is does not require line of sight RF communications incorporate a transmitter and receiver. They are of various types and ranges. In our Project using the RF range is 433MHz. most standard, well known types are covered here: transmitter Module, receiver module, transceiver module, system on a chip module. In our project we can separate Transmitter and receiver. RF module transmitter output is single pin which is called as A0. Here the pin A0 is splitted into 4 outputs with the help of ON/OFF buttons that is a, b, c, d. RF module 4 outputs are assume as a primary users. If the users button (PU) are normally in off state which means that the user is deactivated otherwise activated. RF module receiver have an antenna which is detect the transmission signal that are contains the how many users are activated/deactivated. This will feeder into ardiuno board.

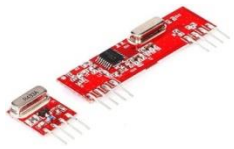


Fig: 1 RF module 433 MHz

ZIG-BEE MODULE:

In our project remaining 4 users are come out from Zig-bee module which will act as a secondary user. Zig-bee module code was developed from Mat lab software. Which incorporate with ardiuno board transmitter and receiver pin. Zig-bee transmitter have RS-232 port which is connected with the other port has USB which connected to PC. PC sends the data over zig-bee transmitter through RS-232.PC have separate setup which tells the details about user connection which user will be connected or not.[5] If first user is activated means the zig-bee transmitter sends the data to zig-bee receiver and after receive date that data is analog form which convert into digital and given to ardiuno board. Here the zig-bee transmitter transmits the data over wirelessly to zig-bee receiver. That communication comes under the CSMA-based MAC protocol.

Fig: 2 Zig-Bee Transmitter and Receiver PCB board

ARDIUNO UNO:

The Ardiuno Uno board is a microcontroller based on the ATmega328. It has 14 digital input/output pins, in which 6 can be used as PWM outputs, a 16MHz ceramic resonator, an ICSP header, a USB connection, 6 analog inputs, a power jack and rest button. This contains all the required support needed for microcontroller Ardiuno consists of both physical programmable circuit board (often referred to as microcontroller) and a piece of software, or IDE (integrated development environment) that runs on your computer, used to write and upload computer code to the physical board. Boost your Ham radios. Capabilities using low cost ardiuno microcontroller boards. [3] Due you want increase the functionality and value of your ham radio without spending a lot of money.

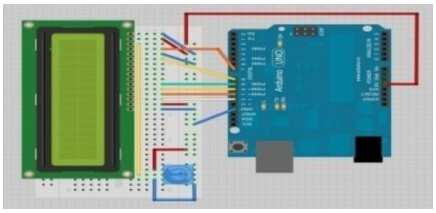


Fig: 3 Ardiuno Uno ATmega 328

ATMEGA 328:

The Atmega328 is a very popular microcontroller chip produced by Atmel. It is an 8 bit microcontroller 32k of flash memory, 1k of EEPROM, and 2k of internal SRAM. Atmega328 is one of the microcontroller chips that are used with the popular ardiuno duemilanove boards. Ardiuno duemilanove board comes with either one of two microcontroller chips, the ATmega168 or the Atmega328. Of this two, the Atmega328 is the upgraded, more advanced chip. Unlike the Atmega168 which as 16k of flash program memory and 512 bytes of internal SRAM, the Atmega328 as 32k of flash program memory and 2k of internal SRAM. The Atmega328 as 28 pins. It as 14digital input/outputs pins, of which 6 can be used as PWM outputs and 6 analog input pins. This I/O pins account for 20 of the pins. As stated before, 20 of the pins function as I/O ports. This means they can function as an input to the circuit or as output. Whether they are input or output is set in the software. 14 of the pins are digital pins, of which 6 can be function to give PWM output. 6 of the pins are analog i/o. two of the pins is for the crystal oscillator. This is provide a clock pulse for the Atmega chip a clock pulse is synchronization so that communication can occur in synchrony between the Atmega chip and a device that is connected to. The chip needs power so two of the pins, Vcc and ground provide it power so that it can operate. The Atmega328 is a low power chip, so it only needs between 1.8 to 5.5 volt of power to operate.

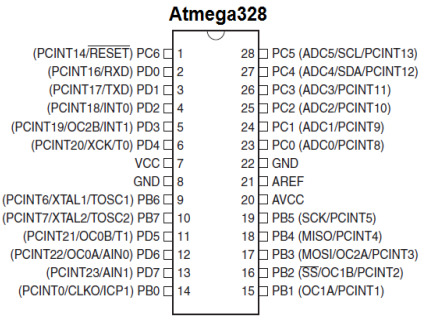


Fig: 4 Pin details of Atmega328.

16X2 LCD:

This LCD is basic 16 characters by 2 line display. Black text on green background. This LCD connecting to the ardiuno Uno board. In this project LCD display will be used for displaying the character of number of primary user (PU) and secondary user (SU) present in the spectrum. It shows the increase/decrease number of mobile user and also shows switching between Normal mode and Cognitive mode.

Fig: 5 16x2 LCD pin details

BLOCK DIAGRAM:

Mode indicator is used to indicate the normal mode and cognitive mode. Inside of Mode Indicator will contain 2LED's which is red and green. [1] The red led is ON, the normal mode is enable Otherwise the green led is ON, the cognitive mode is enabling.

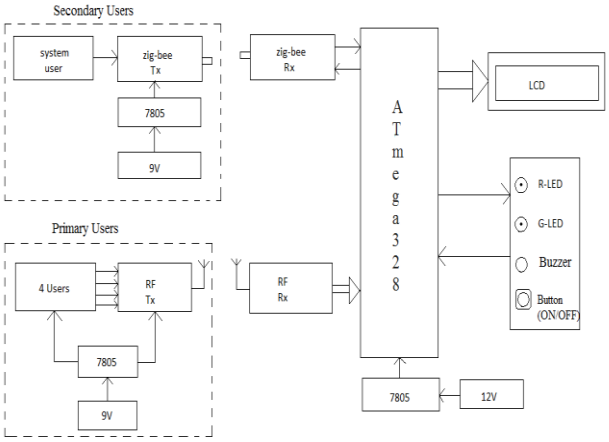
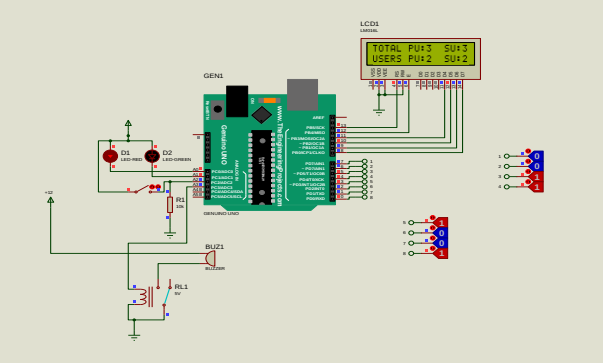


Fig: 6 Block diagram of CRCN for Spectrum Aggregation

Mode activation is act as a switch. [7] In normal mode when the user is increased going to switch over from normal mode to cognitive mode (cognitive mode is enabled). Microcontroller is the purpose of used to pass the command [8] how many normal mode users and cognitive mode users are connected when the program is uploaded. LCD display (16x2) is the purpose of displaying the character Normal Mode, cognitive Mode, number of user connected in the spectrum and spectrum availability. In real time Omni directional antenna is used. In our project toy tower will be used. [5] Primary antenna is placed in RF module which connects primary users and the Zig-bee (2.4 GHz) placed at another module which connects secondary users. The major work which exhibits the project is spectrum analyzing. [1] If whenever the users are fetch in to the tower for connecting call there comes the spectrum aggregation. User can be call in normal mode the operation should be done by normal mode, [1] [7] in case the channel may be busy means that require frequency for connecting call's can be take over from unlicensed spectrum which is present near by the ISM band. [1] OMNI directional antenna which is sense the remaining bandwidth which are not used in real time. In our project this will be done by both RF and Zig-Bee transmitted data can be process the Adriano board which have in build Atmega328 micro controller.



SIMULATION RESULTS:

Fig: 7 Spectrum aggregation of primary users and secondary users

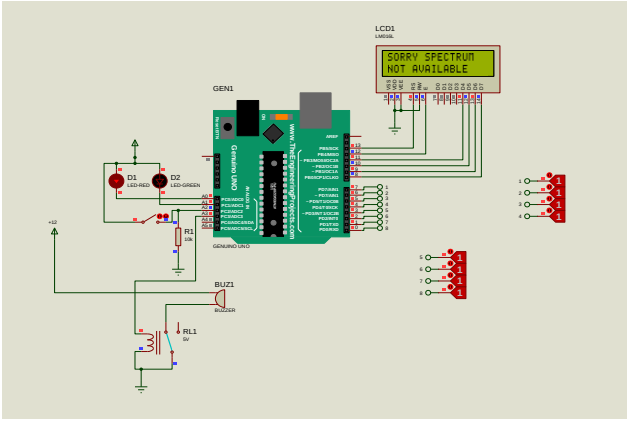


Fig: 8 spectrum availability in normal mode

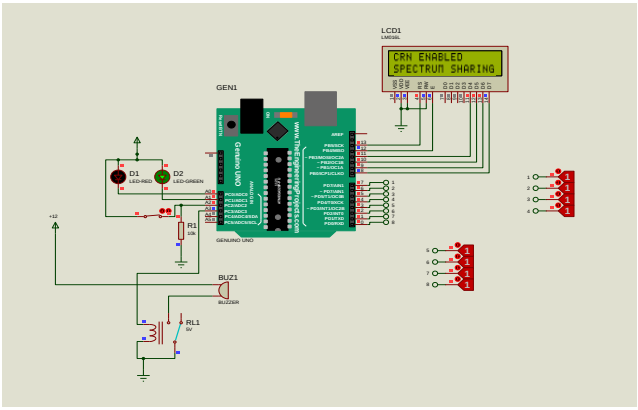


Fig 9: mode enabled in cognitive mode

In our project simulation work has to be done by PROTEUS ISIS 7.7 SP2.This work containsGenuinouno,LogicToggle, Relay, Re-sistor, LM016L, Switch,Buzzer, LED (Green,Red). These are components used for simulation work.The major part of the simulation work result would

obtain from LCD board.Fig 7 will be represents the total Number of user(pu&su) connected in the spectrum.Here the logic toggle would be used for call connecting feature.it is a logic toggle would take the input has logic 1 or logic 0.when the switch output is going to be 1,ardiuno consider that is the new user which depand upon the primary toggle or secondary toggle. After that the user count will increased that shown in the LCD board. Fig 8 represents the spectrum availabilty status.when the logic toggle will be pressed out that is consider has the user count.once the user count while increase the above specified count LCD shown the spectrum sharing details.In our project the Pu&Su maxium count is 4(each).If 3 counts on both (Pu&Su) the spectrum share the channel.when user count going to be 4 means normal mode of operation will be failure.The buzzer will immediately response once the channel fill. fig 8:represent spectrum not available. [7] Once the spectrum fill we allote spectrum for other users to connecting calls with the help of CRN.That Switch over operation would be done by Relay switch.when the relay switch is activated spectrum will be share by near by region spectrum which is shown in the Fig 9.

CONCLUSION:

A greedy algorithm is an algorithmic paradigm that follows the problem solving heuristic of making the locally optimal choice at each stage with the hope of finding the global optimal. In many problems, a greedy strategy does not in general produce in optimal solution, but nonetheless a greedy heuristic may yield locally optimal solution that approximate a global optimal solution in a reasonable time. for example the greedy strategy for the travelling salesman problem(which is of a high computational complexity is the following the heuristic:"at each stage visit and unvisited city nearest to the current city ".This heuristic need not find a best solution, but terminates in a reasonable number of steps; finding an optimal solution typically requires unreasonably many steps.

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