iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** IV **Month of publication:** April 2019

DOI: https://doi.org/10.22214/ijraset.2019.4081

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue IV, Apr 2019- Available at www.ijraset.com

Implementation of Cognitive Radio for the Checking of Channel Occupancy using Raspberry PI

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Abstract: ***The increasing demand of wireless applications has put a lot of limitation on the usage of available radio spectrum which is restricted as well as precious resource. If we look over and study a radio spectrum including revenue rich municipal areas, shows that some frequency bands in the spectrum are largely unused most of the time, some other frequency bands are partly occupied and the remaining frequency bands are comprehensively used. This leads to an under- utilization of radio spectrum. This imbalance of radio spectrum allocation is lessened by the Cognitive Radio.***
Cognitive Radio is a assuring technology which provides a solution to improve utilization of available electromagnetic spectrum efficiently. Spectrum identifying helps to detect the spectrum holes (underutilized bands of the spectrum) providing high spectral resolution capability. We are investigating the way of simulating a cognitive radio system to reuse locally unused spectrum to increase the total system capacity. This work focuses on the practical execution of a Cognitive radio system using Raspberry pi.
Keywords: Raspberry Pi, Cognitive Radio, Python

I. INTRODUCTION

The available electromagnetic radio spectrum is a limited natural resource and getting crowded day by day due to increase in wireless devices and applications. Deep study found that the allotted spectrum is underutilized because of the fixed allocation of the spectrum. Approaching spectrum management conservatively is very inflexible in the sense that each wireless operator is assigned an special license to operate in a certain frequency band. As critical radio spectrum already allocated, it is difficult to find unoccupied bands to either install new services or to improve existing ones. To eradicate this issue, we have to plan a method of better-quality utilization of the spectrum, creating opportunities for dynamic spectrum access. With the help of Cognitive Radio (CR) technology it is possible to solve the issue of spectrum underutilization in wireless communication. The design of Cognitive radios allow greatly consistent communication for all users of the network, everywhere and every time needed and enable effective utilization of the radio spectrum. Just like transceiver Cognitive Radio (CR) is an intelligent radio whish use the most effective wireless channel in its region. It automatically detects available channels and subsequently changes its transmission or reception constraints to permit a lot of parallel wireless communications in an exceedingly given spectrum band at one location. A cognitive radio (CR) is very adaptive, alter its transmission parameters based on the perceived availability of the spectrum bands in its operating environment. Cognitive radio network (CRN) is made up of primary users whose radios may not CR-aided and the secondary users with CR-aided radios.CR makes provision of dynamic spectrum admission and can enable a secondary unlicensed user to efficiently utilize the available underutilized spectrum allocated to the primary licensed users.

A. Problem Statement

The increasing demand of wireless applications has put a lot of limitation on the usage of available radio spectrum which is restricted as well as precious resource. If we look over and study a radio spectrum including revenue rich municipal areas, shows that some frequency bands in the spectrum are largely unused most of the time, some other frequency bands are partly occupied and the remaining frequency bands are comprehensively used. This leads to an under- utilization of radio spectrum. This imbalance of radio spectrum allocation is lessened by the Cognitive Radio. Cognitive Radio is a assuring technology which provides a solution to improve utilization of available electromagnetic spectrum efficiently. Spectrum identifying helps to detect the spectrum holes (underutilized bands of the spectrum) providing high spectral resolution capability. We are investigating the way of simulating a cognitive radio system to reuse locally unused spectrum to increase the total system capacity. This work focuses on the practical implementation of a Cognitive radio system using Raspberry pi.

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II. METHODOLOGY

A. Database of Frequency and Gain is generated by following Procedure

1) Step 1: The output of the micro strip antenna is connected to the frequency analyzer. The micro strip antenna will scan the frequency continuously. The scanned frequency and its gain will observed on frequency Analyzer.

2) Step 2: The frequency and gain are observed after every 15 min using analyzer. The output of the analyzer is in CSV file.

B. The following Process Followed By Us

1) Step 1: Using this CSV file the database file converted into Excel file.

2) Step 2: Started the actual programming in Python language using Python IDE.

3) Step 3: User will give Frequency and time as an input to Rasp- berry Pi.

4) Step 4: Input frequency gain is compared with its threshold level which is set by the programmer, if the gain of that frequency is less than threshold level then that frequency band is available for the given time else frequency band is not available for that time.

5) Step 5: For the given input frequency and time Raspberry Pi scan the database and compare given input with the database. According to the database given frequency is available or not for that particular time is shown on the Display.

System Design

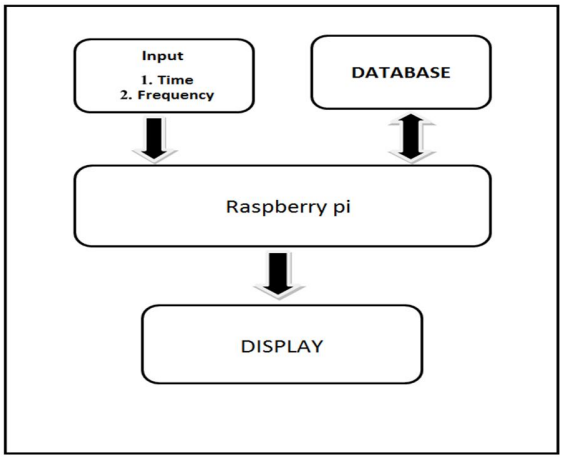


Figure 1.System Design

III. HARDWARE IMPLIMENTATION

The Raspberry Pi is a credit-card-sized single-board computer developed in the UK by the Raspberry Pi Foundation. The Raspberry Pi is made up of Broadcom BCM2835, consisting of ARM1176JZF-S 700 MHz processor, Video Core IV GPU, and RAM starting with 256 megabytes can upgraded to 512 MB. Raspberry Pi doesn't have its own built in memory or internal memory, It uses SD card for memory.

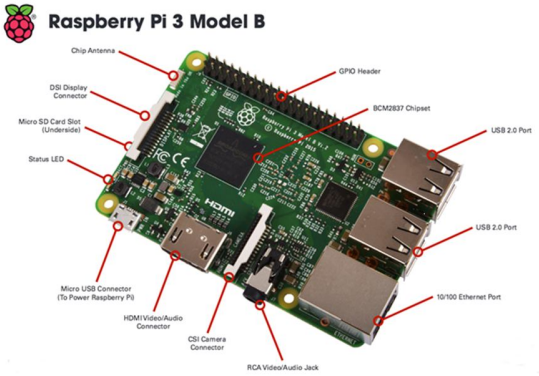


Figure 2.Raspberry Pi

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IV. SOFTWARE REQUIREMENT

1) *Linux Based Operating system (Raspbian):* Linux is operating system which is free and open source. We can install different version of linux on Raspberry Pi and design our Raspberry Pi accordingly.
2) *Python:* It is a high level and general purpose programming language. You can use Python for developing desktop GUI applications, websites and web applications. Also it allows you to focus on core functionality of the application by taking care of common programming tasks.

V. RESULTS

Frequency	Time Frequency	Availability
700	1 AM	YES
1000	2 AM	YES
1500	3 AM	NO
1700	4 AM	YES
2000	1 AM	NO
2500	2 AM	NO
2900	3 AM	YES

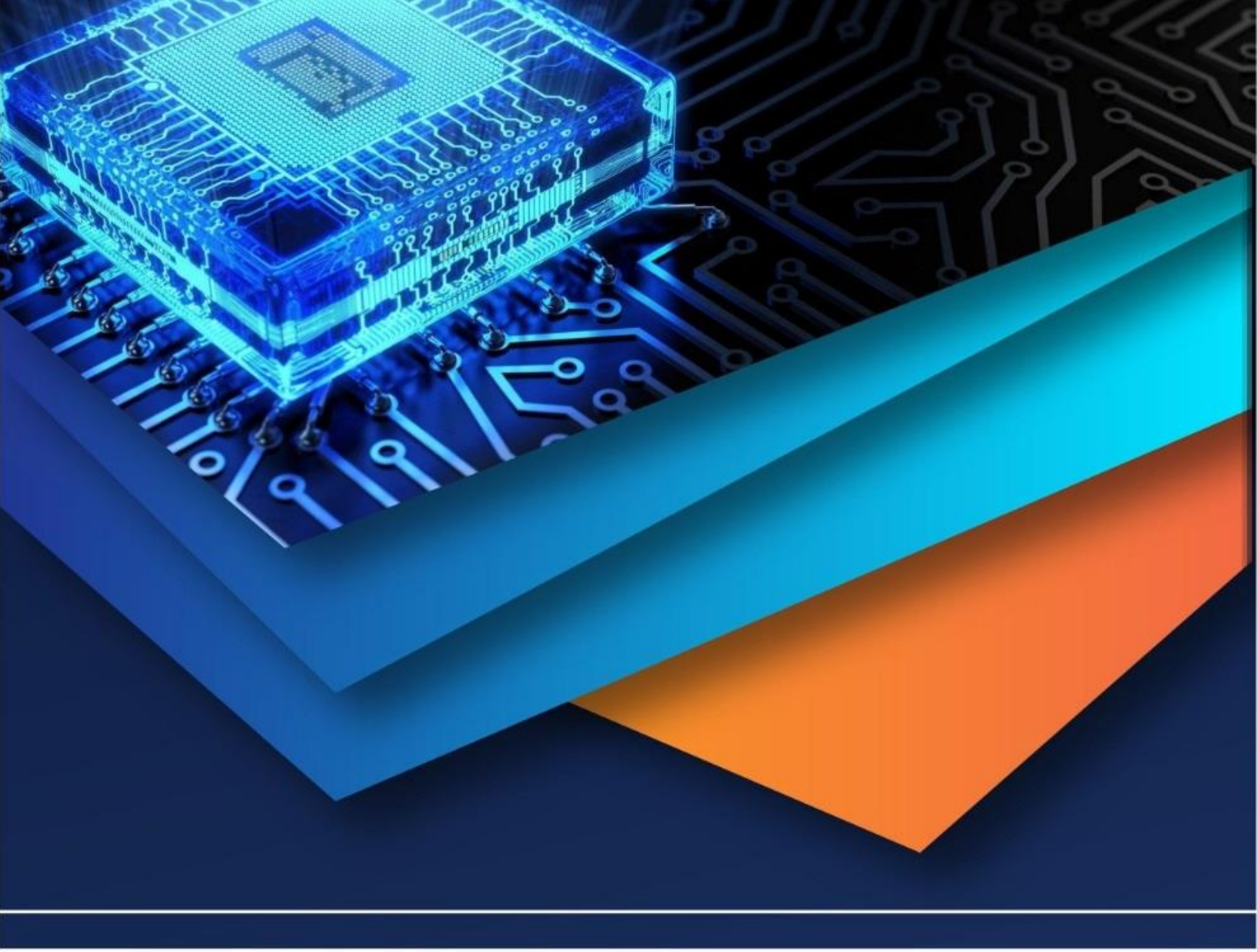
VI. CONCLUSION

The growing demand of wireless applications has put a lot of constraints on the usage of available radio spectrum. Cognitive Radio is a promising technology which provides a novel way to improve utilization of available electromagnetic spectrum efficiently.
Now a day's number of hardware platforms such as FPGA, DSP is available for Cognitive Radio. But these systems are complex and expensive. To overcome these problems, we are implemented cognitive Radio hardware platform using Raspberry pi with less complexity and cost.

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