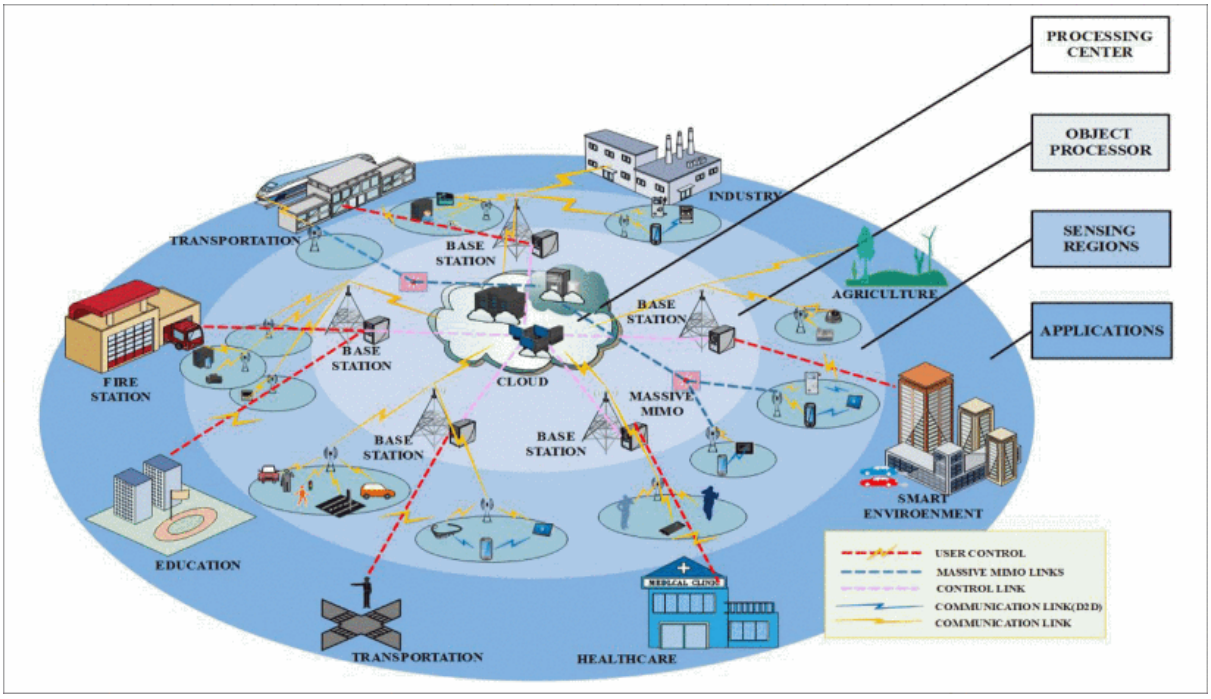
VALLURUPALLI NAGESWARA RAO VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
An Autonomous, ISO 9001:2015 & QS I-Gauge Diamond Rated Institute, Accredited by NAAC with 'A++' Grade
NBA Accreditation for B.Tech. CE, EEE, ME, ECE, CSE, EIE, IT Programmes
Approved by AICTE, New Delhi, Affiliated to JNTUH, NIRF 135th Rank in Engineering Category
Recognized as "College with Potential for Excellence" by UGC
Vignana Jyothi Nagar, Pragathi Nagar, Nizampet (S.O), Hyderabad – 500 090, TS, India.
Telephone No: 040-2304 2758/59/60, Fax: 040-23042761
E-mail: postbox@vnrvjiet.ac.in, Website: www.vnrvjiet.ac.in

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Centre for 5G-IoT

The Center for 5G-IoT is dedicated to advancing research and innovation in the realm of Internet of Things (IoT). Leveraging cutting-edge communication technologies such as 5G and Artificial Intelligence (AI), it aims to spearhead breakthroughs in IoT development.

The 5G-IoT Lab focuses on stimulating and facilitating research and innovation in the Internet of Things (IoT). The IoT is generating more and more data that researchers can use. Through a continuous data flow, streaming data, it is possible to train certain machine-learning models optimally and continuously. The 5G becomes a latest communication technique to take up several use cases like Agriculture, Medical, Smart city, Smart house etc.



5G I-IoT is the convergence of the Internet, intelligence, and electronic devices, all routed through the 5G network. This paradigm connects IoT devices and sensors to a cloud processing center, where the sensory data is gathered and analyzed using AI. This analysis is then funnelled to end-users who are requesting the information in industries such as transportation, agriculture, and healthcare. With these data-insights, users will be able to make informed decisions relevant to their field of work.

Using intelligent algorithms like reinforcement learning allows the network to independently optimize itself and provide insights into the data being gathered. This allows the network to detect abnormalities. For instance, it can understand that a larger number of cars on the road implies worsening traffic conditions or a visibly distressed crop may imply animal interference.

Activities Planned

The 5G-IoT Lab offers facilities, expertise and a relevant network for researchers, companies, start-ups and students to develop and test 5G, IoT and edge applications based on the latest (wireless) technology, container technology and a streaming platform. Researchers will have a facility to use machine learning techniques in implementing technologies and also application. Primary research is centred to the following.

- IoT Systems and Applications: Developing smart devices, sensor networks, and IoT platforms.
- 5G and beyond Communication Models: Exploring next-gen communication protocols, cybersecurity, and data privacy in IoT networks.
- Deep Learning Algorithms: Advancing AI and machine learning models, focusing on neural networks, predictive analytics, and data processing.

Areas of Research Focussed

Internet of things: To provide research platform for the automation of different use-cases like agriculture, biomedical, smart city, smart houses, retail, transportation services, railways, and defence.

5G Cellular Networks: 5G and beyond Communication Models: Exploring next-gen communication protocols, improve spectral efficiency and Energy efficiency. Providing data security, and data privacy in IoT networks.

UAV & Drones: This project focuses on solving various issues related to networking in UAV's including data transfer at higher rates, low power instrumentation and operating for different use cases.

- Surveillance and data network: Application of low power processing like traffic control, intruder detection etc.
- Agriculture and disaster Management: Higher end image capturing (hyperspectral) for agriculture, disaster management and hide outs.

VANETs: This project focuses on solving various research issues pertaining to VANETs e.g. vehicular communication, V2G operations etc.

Signal processing and visualisation: Research area focus on Signal processing and visualisation of data related to IoT, 5G cellular network and VANET. It will cover the following areas.

Digital signal processing: Wireless communication and cognitive radio with the application of artificial intelligence.

Image processing: Image processing, video coding techniques, video processing, Computer vision with application in robotics, Generative AI, wireless communication.

Speech processing: Speech Signal Processing and Recognition (with emphasis on Indian Languages), Speaker and Language Identification, Translators.

Brain Computer Interface: The research focus is on studying, analyzing and developing new algorithms to classify EEG brain signals.

Computing platforms: This research will focus on the development of low power miniaturised devices for ubiquitous computing. FPGA ASIC development.

Facilities available

Focus Area: Internet of Things

Available Equipment

Research Equipment	Purpose
NETSIM	➢ Design new protocols and technologies, as well as evaluate changes to existing ones. ➢ Test and demonstrate designs in realistic scenarios. ➢ Optimize protocol and application performance. ➢ Study the effect of real devices and transmit live traffic using NetSim Emulator. Emulator combines the real and virtual worlds to create scenarios that cannot be achieved in a lab environment.
Embedded GPU	➢ **High Computational Power**: GPUs provide immense parallel processing capabilities, essential for handling complex computations and large datasets common in research. ➢ **Efficiency in Deep Learning and AI**: GPUs are particularly well-suited for training deep learning models due to their ability to perform multiple calculations simultaneously, significantly speeding up the learning process. ➢ **Big Data Processing**: In research involving big data, GPUs can process and analyze vast amounts of data much faster than traditional CPUs, making them invaluable for data-intensive tasks.
PCB Prototyping machine	➢ Rapid Prototyping and Design Testing: PCB prototyping machines allow for quick fabrication of printed circuit boards directly from digital designs. ➢ Precision and Customization: These machines offer high precision in creating PCBs, essential for accurately realizing complex circuit designs. ➢ Cost-Effectiveness for Small Batches.
AI Boards	➢ NVIDIA® Jetson Nano™ Developer Kit is a small, powerful computer that lets you run multiple neural networks in parallel for applications like image classification, object detection, segmentation, and speech processing.

Focus Area: 5G and Cellular Networks

Available equipment

Research Equipment	Purpose
Spectrum Analyser	Used for RF and audio signal analysis. Interference identification and signal integrity checks.
Microwave Field Analyser	Its purpose is to analyze, measure, and characterize microwave fields in various applications. Here are some of its primary purposes
Function Generator	Various waveform generator. Used for testing and trouble shooting.
SDR Kit	RTL-SDR dongle and Hack RF one for SDR related development work.

Focus Area: Signal Processing and Visualisation

Available Equipment

Research Equipment	Purpose
MP 45 DAQ box, physiological sounds micro phone	➢ It is a physiological Data Acquisition system used to collect data like EEG, EOG. The collected data is used for further data analysis and disease diagnosis.
TMS320C6713	➢ The TMS320C6713 DSP Starter Kit (DSK) developed jointly with Spectrum Digital is a low-cost development platform designed to speed the development of high precision applications based on TI´s TMS320C6000 floating point DSP generation. The kit uses USB communications for true plug-and-play functionality.
MATLAB	➢ Analyze data ➢ Develop algorithms ➢ Create models and applications
Drone	➢ For real time data acquisition

Focus areas: Computation Platform

Available Equipment

Research Equipment	Purpose
Synopsys front-end and back-end university bundle	➢ To design and verify the functionality of Full custom ICs ➢ Practice various aspects of digital design, verification, synthesis, place and route, and other crucial steps in the chip design process. ➢ In the front-end design, RTL (Register Transfer Level) design, verification, and synthesis can be done. ➢ The back-end design involves tasks related to physical design, such as place and route, timing analysis, and physical verification can be done.
FPGA kits: ➢ Spartan 3E ➢ Anvyl, Spartan 605 ➢ Zync board 7000 ➢ XUP V5 ➢ Atlys Spartan6 ➢ Zync video and image kit ➢ Aitex-7 ➢ Zed board	All these FPGA kits are required for Digital Logic Prototyping, Hardware Acceleration, Embedded Systems Development, Rapid Prototyping for ASICs, Testing and Verification, IoT (Internet of Things) Development and to develop High-Performance Computing and signal processing applications.

Ongoing research

I. Implementation of OFDM using GNU using Radio with HackRF one and RTL SDR

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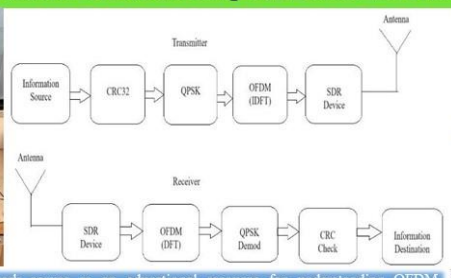
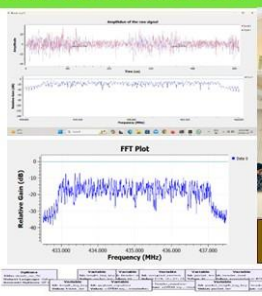
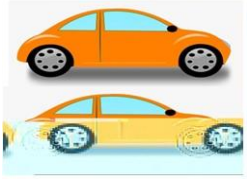
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Creating Social Impact as a Student of ECE Through B.Tech Project

Implementation of OFDM using GNU Radio with HackRF One and RTL SDR

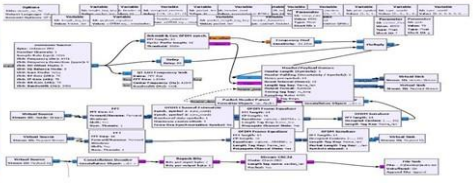






➢The work serves as an educational resource for understanding OFDM principles and GNU Radio usage but also provides a practical platform for experimenting with SDR technology in real-world communication scenarios. OFDM (Orthogonal Frequency Division Multiplexing) signal transmission has been successfully implemented to accommodate three distinct types of input data: textual, audio, and image

➢By integrating the capabilities of HackRF One and RTL-SDR, two prominent SDR platforms renowned for their wide frequency coverage and programmability, we aim to create a comprehensive platform for OFDM experimentation



II. Design and implementation of GNSS receiver in Zynq SoC

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Design and implementation of GNSS receiver in Zynq SoC

Objectives:

- To design and develop a Global Navigation Satellite System on latest FPGA.
- To design the GNSS receiver with low power dissipation.
- To design the GNSS receiver with low latency and low cost

Funded by: Ananth Technologies Ltd

Grant: Rs. 8 Lakhs

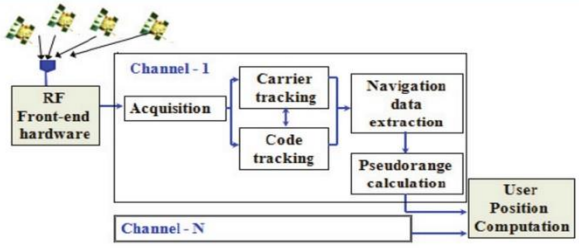
Duration: 12 Months

Research Group:

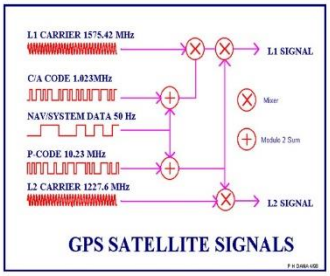
- Dr. Y. Padma Sai, Professor- ECE
- Dr. S. Rajendra Prasad, Professor.-ECE
- Dr. P. Kishore, Associate Professor.-ECE

Outcomes:

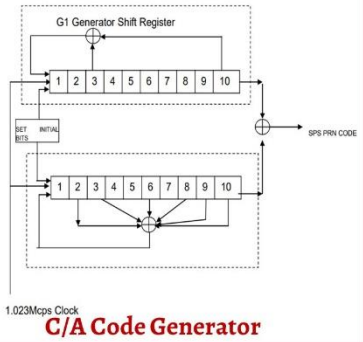
- IP Core of the developed GNSS receiver
- Complete RTL code for implementing the GNSS receiver.
- Testing and validation results



GPS Receiver



GPS SATELLITE SIGNALS



C/A Code Generator

III. Design and Development of Knowledge based expert system to assist farmers for maintenance of Agricultural field using aerial data acquisition

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Design and Development of Knowledge based expert system to assist farmers for maintenance of Agricultural field using aerial data acquisition

Objectives:

- To acquire visual data of agriculture field using drone
- To extract the significant parameters from the visuals
- To build an machine learning based expert system to monitor the crop, thus give the quality yield and also aid the farmer.

Funded by: TSCOST – DST

Grant: Rs. 4 Lakhs

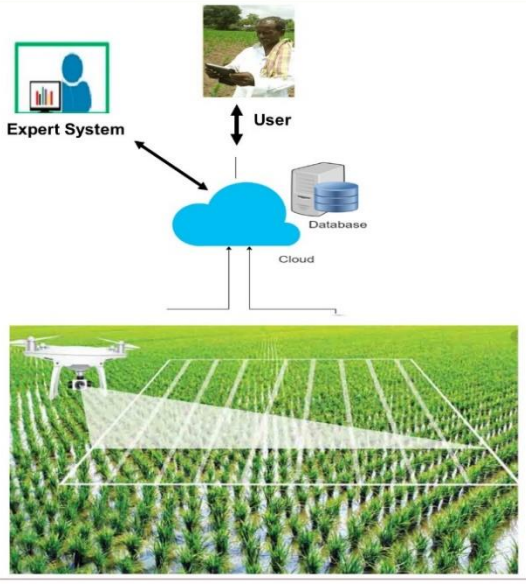
Duration: 12 Months

Research Group:

- Dr. Lam. Padma Sree, Prof. - ECE
- Mrs. N. Dhanalakshmi, Assoc. Prof – ECE

Outcomes:

- A product with better knowledge platform at farmer level for taking appropriate farm management decisions and also appropriate agricultural practices.
- Publications on advances in eminence and profitable harvesting.



IV. Design and Development of Night Vision Imaging LIDAR and Laser-3D Imaging System for Homeland security and other Surveillance applications in Defense

Estd. 1995

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Design and Development of Night Vision Imaging LIDAR and Laser-3D Imaging System for Homeland security and other Surveillance applications in Defense

Objectives:

- To development of a proto model of the Long Range Night Vision Imaging LIDAR (NVIL) System for military and surveillance applications
- To development of a proto model of the 3-D LIDAR Imaging system for Short range military and surveillance applications
- To development of algorithms for classification of 3-D point cloud data obtained from LIDAR.

Funded by: ER & IPR, DRDO

Grant: Rs. 71.28 Lakhs

Duration: 36 Months

Research Group:

- Dr. G. Ramesh Chandra, Professor-CSE
- Dr. M. Satyanarayana, Adj. Faculty-ECE
- Dr. Y. Chalapathi Rao, Assoc. Prof.- ECE
- Dr. L. Srinivasa Rao, Asst. Prof.- Physics

Outcomes:

- A system with night surveillance and 3-D Imaging LIDAR system for target identification
- Technology transfer to industry
- Publications and patents on efficient night surveillance and 3-D Imaging LIDAR