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L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.
Department of Electronics and Communication Engineering

Date:03-05-2025

Models/ Prototyped Developed during A.Y. 2024-25

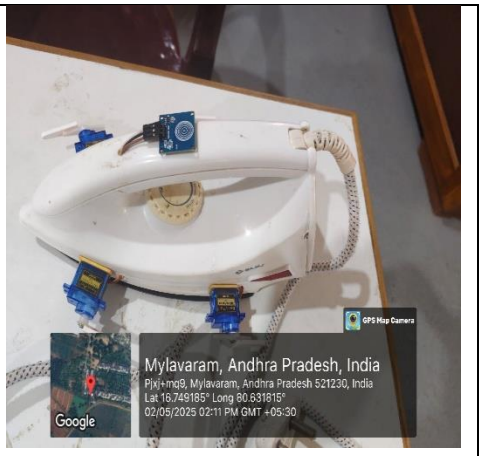
List of Models/ Prototypes Developed

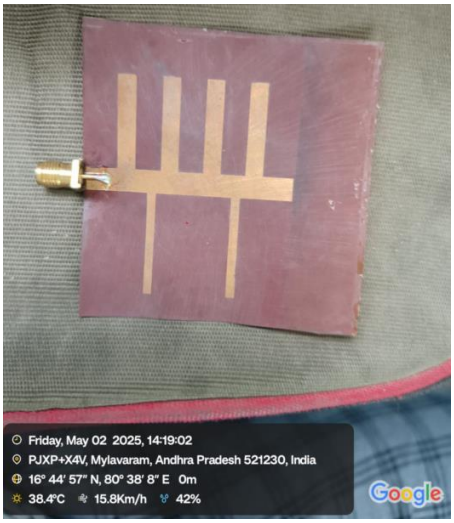
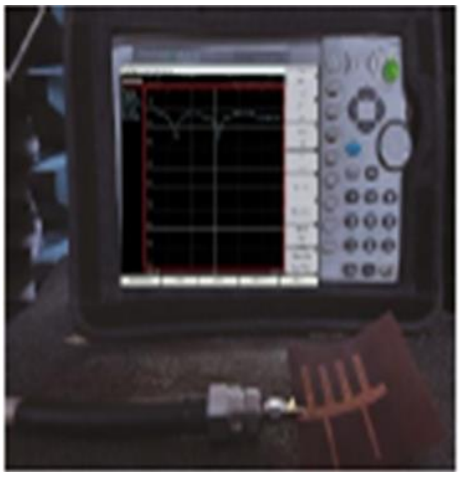
S.No	Model Developed
1.	Intelligent Aquatic Environment Management: A Real-Time IoT Framework for Monitoring Critical Water Quality Parameters.
2.	Smart Iron Box With Automatic Lifting Mechanism.
3.	A Compact Design of Single Band CPW-Fed Cascaded T–Shaped Flexible Patch Antenna for Wireless Communication.
4.	Advanced Dual-Axis Solar Tracking System with Environmental Monitoring and Energy Analytics.
5.	Design and Analysis of a Triple-band Stacked T-polyimide Antenna for WBAN Applications.
6.	Design of Asymmetric Stair-Case CPW -Fed Octagonal Patch Antenna for Wireless Communication.
7.	Circular Shaped Wearable Antenna For Biomedical Applications.
8.	Compact Comb Shaped Wearable Antenna For Biomedical Applications.
9.	Smart Irrigation System Using Deep Neural Networks.
10.	IOT-Based Soldier Safety System Leveraging Lora For Real-Time Monitoring.
11.	Anti theft system for ATM's using IOT technology.
12.	Health Monitoring System with Real-Time Data Visualization and Medicine Suggestions.
13.	Design and Analysis of Stripped Circular Patch UWB Antenna for WIFI/WIMAX/WLAN/ C Band Applications.
14.	Real Time Helmet Compliance and Triple Riding Violation Mornitoring System.
15.	Design and Analysis of Y-shaped Tri band Antenna with DGS for 5G Communication and modern X-band applications
16.	Design of a wearable and flexible microstrip patch antenna for the detection of breast cancer

Details of Models Developed

<table>
<tr><th>S.No</th><th>Details of Model / Prototype Developed</th><th>Model Photos</th></tr>
<tr><td>1</td><td colspan="2">Title of Project: Intelligent Aquatic Environment Management: A Real-Time IoT Framework for Monitoring Critical Water Quality Parameters
Guide/Supervisor Name : Dr.A.Narendra Babu
Student Name and Roll No : Ch.Meghana (21761A0402)
M.Anusha (21761A0463)
Sk.Shakeela (21761A0458)</td></tr>
<tr><td></td><td>The sustainability of aquatic plant cultivation hinges critically on the continuous monitoringof water quality parameters and dynamic environmental conditions. Traditional methods fortracking essential indicators—such as temperature, dissolved oxygen (DO), turbidity, pH, and Total Dissolved Solids (TDS)—often fall short in providing uninterrupted, real-timemonitoring and responsive feedback. This limitation is especially significant in fluid aquaticecosystems, where rapid fluctuations—such as sudden phytoplankton blooms or excessivefeed—can sharply deplete DO levels, particularly during night-time. To bridge this gap, wepresent the development of an intelligent, IoT-enabled water quality monitoring systemdesigned for precision aquaculture and hydroponics. The proposed system employs highaccuracysensors to capture real-time data on critical parameters, including DO (4–18 mg/L),pH (6.0–8.5), temperature (< 35°C), turbidity (< 5 NTU), and TDS (< 450 ppm). Bycontinuously analyzing these variables, the system ensures that they remain within optimalthresholds vital for sustainable aquatic growth. Beyond passive monitoring, the systemfeatures real-time alert mechanisms that trigger immediate notifications when any parameterdeviates from safe limits, enabling timely corrective action. This smart, automatedmonitoring framework enhances the efficiency, reliability, and sustainability of water-basedcultivation, reduces dependency on manual labor, and supports healthier aquatic ecosystemsthrough informed decision-making.</td><td> 

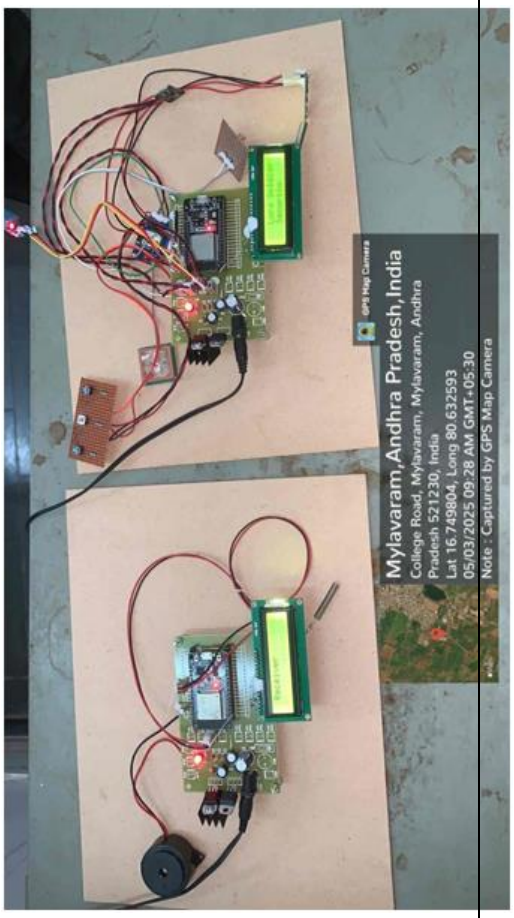
Fish Pond Monitoring System</td></tr>
<tr><td>2</td><td colspan="2">Title of Project : Smart Iron Box With Automatic Lifting Mechanism
Guide/Supervisor Name : Dr.A.Narendra Babu
Student Name and Roll No : Ch.Meghana (21761A04B5)
M.Anusha (22765A0414)
Sk.Shakeela (21761A0468)</td></tr>
<tr><td></td><td>The smart iron box is a next-generation appliance developed to enhance the ironing process with advanced automation, safety, and energy-saving features. Equipped with intelligent temperature control, the iron automatically adjusts heat levels based on fabric type, ensuring optimal care for delicate and heavy materials alike. An innovative touch-activated heating system</td><td></td></tr>
</table>

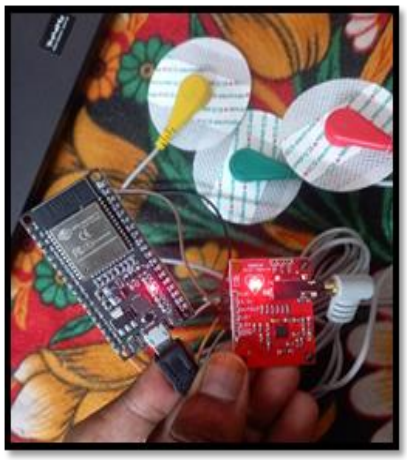
	powers the iron only when it is handled, while an automatic lifting mechanism raises the sole plate when idle, reducing the risk of accidental burns and conserving energy. Additionally, built-in motion sensing enables auto shut-off after prolonged inactivity, further enhancing safety. Development of an energy-efficient smart iron box with temperature control and automatic lifting features aims to address common challenges faced with traditional irons, such as energy waste and safety concerns. Designed with ergonomics and user experience in mind, this smart iron box offers a modern solution that caters to the needs of efficiency-driven, safety-conscious households, transforming traditional ironing into an intelligent, user-friendly experience.	 **Smart Iron Box Lifting**
3.	**Title of Project:**A Compact Design of Single Band CPW-Fed Cascaded T–Shaped Flexible Patch Antenna for Wireless Communication **Guide/Supervisor Name** **:** Dr. E.V.Krishna Rao **Student Name and Roll No** **:** Chereddy Priyanka (21761A04D9) P Venkata Rathnam (21761A04H0) Puchakayala Akhila (21761A04H3) Gurijala Jeevan (21761A04E5)	
	In this work, a compact and flexible microstrip patch antenna is proposed for wireless communication applications. A coplanar waveguide (CPW) feed is utilized to excite a monopole resonant patch. The antenna structure incorporates three cascaded T-shaped elements and is fabricated on a Kapton polyimide substrate. To achieve the desired radiation characteristics, a small circular slit with a radius of 4 mm is etched symmetrically on both sides of the feed line. The proposed antenna resonates at 11.7 GHz with a return loss of −31 dB. It achieves a wide impedance bandwidth of 330 MHz (11.62–11.95 GHz) and a peak gain of 3.91 dB. The antenna demonstratesuitability for wireless communication systems.	
4	**Title:** Advanced Dual-Axis Solar Tracking System with Environmental Monitoring and Energy Analytics **Guide/Supervisor Name** **:** Dr.K.Ravi Kumar **Student Name and Roll No** **:** Ch.Meghana (21761A0407) M.Anusha (21761A0428) Sk.Shakeela (21761A0454)	
	This work presents an advanced methodology for improving solar energy generation through a dual axis solar tracking system. The system utilizes an Arduino UNO microcontroller to achieve precise solar panel alignment by employing light-dependent resistors (LDRs) and servo motors. Additionally, environmental parameters such as temperature and humidity are continuously monitored to enhance system efficiency and reliability. A 16×2 LCD screen is used to display real-time data on solar energy generation, while the harvested energy is stored in a rechargeable battery to ensure	

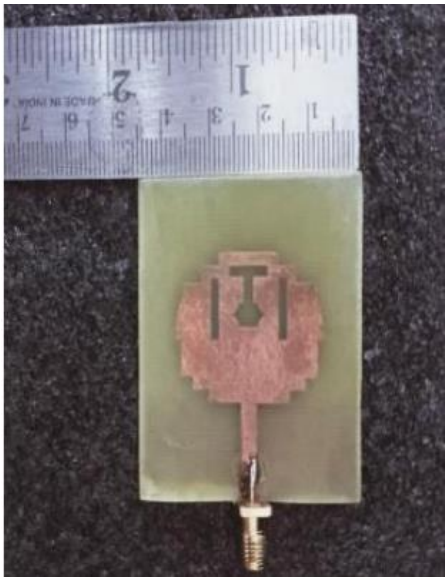
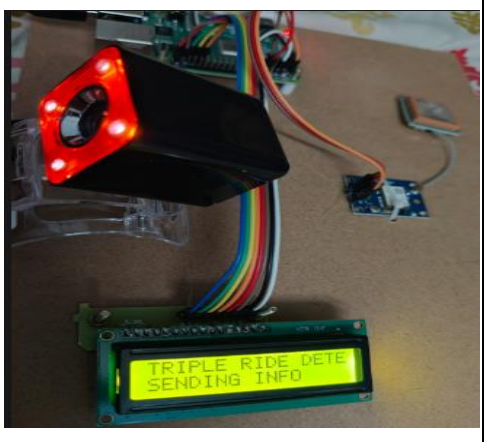
	sustainability. The system also incorporates data analytics, where energy generation statistics are collected, analyzed, and stored in a graphical format. This data not only facilitates forecasting of energy consumption patterns but also provides state and central governments with crucial insights for strategic planning of power budgets. By integrating real-time monitoring, automated solar tracking, and energy analytics, the proposed system demonstrates enhanced efficiency, improved data-driven decision-making, and a scalable approach for renewable energy management.	**Hardware Implementation**  **Solar Panel towards South**
5	**Title of Project:**Design and Analysis of a Triple-band Stacked T-polyimide Antenna for WBAN Applications **Guide/Supervisor Name** **:** Dr. K.Rani Rudrama **Student Name and Roll No** **:** V.T.N.Kalyan (21761A04I7) B.Shini (21761A04D3) M.Vamsi (21761A04G1)	
	A low-profile, flexible and wearable microstrip patch antenna is presented for Wireless Body Area Networks (WBANs) applications. Wearability is one of the latest developments in electronic devices leading to real-time monitoring of human vital signs like blood pressure, body temperature, and pulse rates using WBAN technology. A monopole antenna with a planar rectangular and six stacked T-shaped elements is positioned on the top side of the radiating patch. A partial ground structure is incorporated at the bottom of the patch to generate triple band characteristics. The antenna is maintained with compact dimensions are 65 × 65 × 0.1mm3. The antenna operates at tri-band frequencies, such as 2.7GHz, 2.5GHz, and 3.5GHz, to support 5G applications. At 2.45GHz, the directivity is 1.56dBi, the VSWRis1.13, thegain is 15.38, and the reflection coefficient (S11) of −26.91dB. The SAR value of 0.160W/kg satisfies with IEEE safety requirements for biomedical applications and is much below the allowed maximum of 1.6W/kg for 1 gram of tissue. This guarantees safe and effective operation in wearable and medical applications. The antenna has a thickness of 0.1mm and a relative permittivity of 3.5, provides flexibility and durability. The presentation includes the comparative analysis and the step-by-step design of the triple-band flexible antenna. Testing on a three-layer human phantom model made up of skin (2mm), fat (8mm), and muscle (23mm) demonstrated the antenna's performance in terms of gain, radiation patterns, VSWR, reflection coefficient (S11), and specific absorption rate (SAR). The parametric analysis, performance evaluation, simulation results, and iterative process of the antenna design are all presented in detail. Along with conclusions, comparisons to other designs, and useful	 **Antenna**  **Antenna off Body**

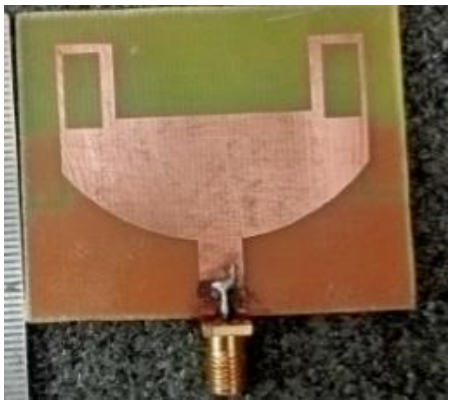
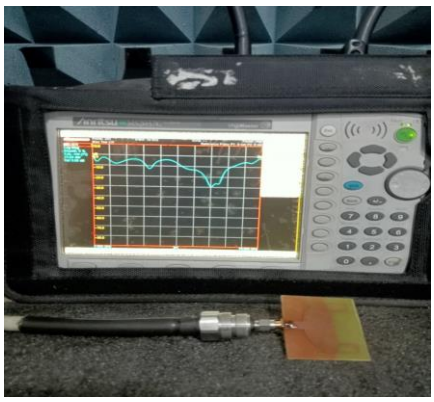
	estimations, the results and finalized antenna are presented. The accurate difference between measured and simulated performance indicates the antenna's reliability and efficiency, and its compact size increases flexibility in wide range of environments. The antenna was simulated using HFSS software, fabricated, and validated in an anechoic chamber and using a network analyzer.	
6	**Title of Project:**Design of Asymmetric Stair-Case CPW -Fed Octagonal Patch Antenna for Wireless Communication **Guide/Supervisor Name:** Dr.E V Krishna Rao **Student Name and Roll No :** P. Dhanalakshmi (21761A0441) SK. Parveen (21761A0453) S.V.N L.Siva Swamy (21761A0456) P. Paul Pranay (21761A0443)	
	In this work, the analysis and design of an asymmetric stair-case CPW-fed octagonal patch antenna is presented for wireless communications applications. An asymmetric stair-case CPW-fed octagonal patch antenna is fabricated on a 0.07 mm thick polyimide substrate to provide mechanical robustness as well as flexibility. The size of the compact antenna structure is 32 mm × 36 mm and the antenna includes an octagonal-shaped radiating element with an asymmetric stair-case shape to improve the impedance properties of the antenna. The Proposed antenna resonates at 3.25 GHz when simulated in free space, with an operating band of frequency from 3.043 GHz to 3.59 GHz and has a simulated impedance bandwidth is 547 MHz. A simulated gain of 2.33 dB is achieved. The antenna is tested where a reflection coefficient -23.3 dB is measured. The measured data yield a wide impedance bandwidth ranging from 2.01 GHz to 4.1 GHz and offering a bandwidth of approximately 2.09 GHz, a resonant frequency of 3.2 GHz. The designed CPW-fed asymmetric stair-case octagonal patch antenna shows wideband characteristics, gain stability, and miniaturization, and thus it is a potential candidate for integration into advanced wireless communication systems.	
7	**Title of Project:**Circular Shaped Wearable Antenna For Biomedical Applications **Guide/Supervisor Name:** Dr. P. Rakesh Kumar **Student Name and Roll No :** C Jayasri (21761A0407) M Raqib (21761A0428) C Vasu deva Reddy (21761A0454)	
	A circular-shaped wearable antenna optimized for operation within the Industrial, Scientific, and Medical (ISM) band, specifically at 2.4 GHz. The proposed antenna is fabricated using flexible and biocompatible materials to ensure comfort, safety, and reliable performance when worn on the human body. Electromagnetic simulations were conducted using HFSS software to optimize the antenna's parameters, achieving a compact profile with a low specific absorption rate	

	within safety limits. The dimensions of the antenna are 30*30mm^2.The thickness of the Polymide Substrate is 0.7mm with dielectric constant (ε_r) 1.7. The circular geometry was chosen to ensure omni directional radiation and ease of integration into wearable textiles	
8	**Title of Project:** Compact Comb Shaped Wearable Antenna For Biomedical Applications **Guide/Supervisor Name:** Dr. P.Rakesh Kumar **Student Name and Roll No :** A.Sathvika (21761A0404) T.Kavya (21761A0457) P.Venkata Vishnu Vardhan (21761A0440)	
	A compact comb shaped antenna is designed for bio medical applications operating at 2.4GHz.The antenna overall dimensions are 32x28 mm^2 fabricated on RT Duroid substrate with ε_r 2.2 with 0.8 mm thickness. The body placement analysis of the proposed antenna was performed using the human hand and leg phantom models, and the SAR was less than 1.6 w/kg (ranging from 0-0.361 W/kg on hand and 0-0.267 W/kg on leg phantoms respectively). The 3D radiation patterns gain for both hand and leg are 4.95dBi and 4.81dBi respectively	
9	**Title of Project:** Smart Irrigation System Using Deep Neural Networks **Guide/Supervisor Name :** Dr. Poornaiah Billa **Student Name and Roll No :** K.Himabindu (21761A04F5) B.Asifali (22765A0416) M.Rohitha (21761A04G2)	
	This work deals with a smart agriculture system that integrates deep learning, image analysis, and IoT-based environmental monitoring to detect plant leaf diseases and optimize irrigation in real time. At the core of the system is a Raspberry Pi equipped with a camera and various sensors. The camera captures live images of plant leaves, which are analyzed using Convolutional Neural Networks (CNNs) to identify signs of disease, such as discoloration, spots, or lesions. To achieve high accuracy with limited training data, the system leverages Transfer Learning with fine-tuned, pre-trained models such as Mobile Net, ResNet, and VGG16. These models are optimized to run locally on the Raspberry Pi, enabling real-time disease detection without depending on cloud infrastructure. Alongside image-based diagnosis, the system continuously monitors environmental parameters—including temperature, humidity, and soil pH—through IoT sensors. These readings inform an automated irrigation control mechanism that adjusts water delivery based on real-time soil and climate conditions, ensuring efficient resource use and healthy crop growth. When a disease is detected or environmental conditions fall outside optimal ranges, the system immediately alerts farmers via mobile applications, SMS, or a centralized IoT dashboard. Each	

	alert provides detailed information, including the type and severity of the issue, along with recommended actions. By combining intelligent disease detection, automated irrigation, and timely farmer notifications, this system offers a comprehensive solution for enhancing crop health, reducing manual intervention, and increasing agricultural productivity and healthier crop yield.	
10	**Title of Project:** IOT-Based Soldier Safety System Leveraging Lora For Real-Time Monitoring **Guide/Supervisor Name:** Dr . P. Lachi Reddy **Student Name and Roll No :** V. Venkata Nandini (21761A04J0) N. Ajay Naidu (22761A04G6) Y. Harshitha (21761A04J3)	
	The IoT-Based Soldier Safety System Leveraging LoRa for Real-Time Monitoring" aims to enhance real-time monitoring and safety of soldiers in the field through advanced wireless communication and IoT technologies. The system comprises two key units: a Transmitter (Tx) and a Receiver (Rx). The Tx unit is powered by an ESP32 microcontroller, which integrates vital sensors such as SpO2, heartbeat sensors, a vibration sensor, a GPS module for real-time location tracking, a keypad emergency button, an LCD display, a buzzer, and a LoRa transmitter module. The Rx unit consists of a LoRa receiver module, an LCD display, a buzzer, and IoT integration for remote monitoring. The keypad is used to verify the user, and data from the sensors on the Tx side, including critical health parameters and GPS coordinates, are continuously monitored. If any parameter crosses predefined threshold values, such as an increase in heart rate, a decrease in SpO2 levels, detection of a fall via the vibration sensor, or if the emergency button is pressed, an alert is triggered on both the Tx and Rx units via buzzers and LCD displays. Simultaneously, the alert, along with the soldier's real-time location, is transmitted to an IoT server for real-time notification to higher authorities. The ESP32 on the Tx side ensures efficient sensor data acquisition, GPS functionality, and seamless communication, while the Rx unit leverages ESP32 for robust IoT connectivity. This project offers a reliable, low-power, and long-range communication solution, ensuring timely responses during critical situations and improving overall soldier safety and operational efficiency.	
11	**Title of Project:** Anti theft system for ATM's using IOT technology **Guide/Supervisor Name:** M. Sivasankara Rao **Student Name and Roll No :** J.Indirapriyadharshini (21761A04E9) K.Venkata Krishna (22765A0420) K.Chandrika (22765A0419)	
	In this work presents the main objective of the system is to develop an embedded system which is used for ATM security applications. Automated teller machine (ATM) now days are extensively used all over the world for	

	withdrawal of cash. A unique card is issued for each user along with the unique code provided to him so that the person may do all his transactions personally without anyone getting known. we going to prevent ATM machine with wireless technology. To provide some security systems to prevent the crime if we notice any kind of theft. Hence the implementation of ATM crime prevention system is necessary. This system uses ESP32 controller based embedded system to process real time data collected using the IR and vibration sensor. Whenever robbery occurs vibration sensor is used here which senses vibration and sounds will occur from the buzzer and to the corresponding banked motor of the door automatically closes to easy catch the theft and sent thief image to the IOT server immediately. All input and out modules are interfaced to ESP32 Microcontroller which process input data and provide output with help of 5V regulated power supply	
12	**Title of Project:** Health Monitoring System with Real-Time Data Visualization and Medicine Suggestions **Guide/Supervisor Name:** Mr. Ch. Mallikarjuna Rao **Student Name and Roll No:** Sk. Khasimvali (21761A04H6) P. Naveen (21761A0428) K. Vamshi (21761A0454)	
	In many rural areas, the access of healthcare is limited due to lack of hospitals and medical facilities. This Health Monitoring System with Real-Time Data Visualization and Medicine Suggestions is used to minimize these issues by providing a good way to monitor health conditions remotely. This system continuously collects health data from the sensors and transmits it to custom webpage, where users can view real-time visualizations of their health status. Not only in rural areas it is very useful in Urban area too because the population in urban areas is too high where it takes hours of time to consult a doctor, where this system is very useful. The main feature of this system is it gives medicine suggestion when it needs, which means if a person could use the temperature sensor where the readings is too high in that time it provides medicines based on detected health conditions. This feature is particularly used in both urban and rural areas, where immediate medical assistance may not always be available. By taking real-time health monitoring with intelligent medicine recommendations, this system empowers individuals to proactively manage their health. It enhances early detection of potential health risks, provides crucial guidance, and improves healthcare accessibility, making it a valuable tool for both individuals and caregivers, especially in underserved regions.	 

13	**Title of Project:** Design and Analysis of Stripped Circular Patch UWB Antenna for WIFI/WIMAX/WLAN/ C Band Applications. **Guide/Supervisor Name:** CH. Mallikharjuna Rao **Student Name and Roll No :** B.Alekhya (21761A0405) A.Sai Adithya (21761A0401) L.Sai (21761A0427)	
	The requirement for high-speed wireless communication has made the development of efficient and wide antennas essential. The primary goals of this study are to develop and investigate a stripped circular patch ultra-wideband (UWB) antenna for WLAN, C Band, WiMax, and WiFi applications. The recommended antenna operates within a broad frequency range of 2.7 GHz to 12.7 GHz, ensuring seamless connections across multiple wireless protocols. A low-loss dielectric FR4 epoxy substrate improves signal transmission and minimizes energy loss. The antenna design utilizes ground plane enhancements, patch size optimization, and impedance matching techniques to achieve wideband functionality. By simulating the antenna, HFSS provides a comprehensive analysis of gain, radiation pattern, and return loss. The design ensures robust impedance matching, moderate peak gain, and improved efficiency, making it suitable for modern wireless systems. Additionally, the radiation pattern varies depending on the application. After the simulation, a Vector Network Analyzer (VNA) is used to build the antenna and confirm its operation. A comparison with existing UWB antennas shows how effective the proposed design is in terms of bandwidth, VSWR, gain, and return loss. The developed antenna offers a compact, reasonably priced, and highly effective solution for next-generation wireless communication systems.	
14	**Title of Project:** Real Time Helmet Compliance and Triple Riding Violation Mornitoring System. **Guide/Supervisor Name:** N.Dharmachari **Student Name and Roll No :** M.Chaitanya (22765A0406) D. Priyanka (21761A0413)	
	Road safety is a critical concern, particularly in regions with high two-wheeler usage. Non-compliance with helmet laws and instances of triple riding contribute significantly to road traffic accidents and fatalities. This project introduces a smart system leveraging advanced image processing and deep learning techniques to automate helmet detection and triple riding violation identification. Using real-time video feeds from cameras installed at roads or traffic signals, the system employs computer vision models trained on diverse datasets to: Detect whether riders and pillion passengers are wearing helmets. The proposed solution ensures high detection accuracy, scalability for integration with existing traffic surveillance infrastructure, and adaptability to varying	

	environmental conditions. This automated and unbiased monitoring system supports traffic authorities in enforcing road safety laws more effectively, ultimately contributing to reduced accident rates and safer roads. The system uses real-time video feeds from cameras and employs computer vision models to detect whether riders are wearing helmets and to identify instances of triple riding. This automated solution aims to provide high detection accuracy, scalability, and adaptability to various environmental conditions, supporting traffic authorities in enforcing road safety laws and reducing accidents.	
15	**Title of Project:** Design and Analysis of Y-shaped Tri band Antenna with DGS for 5G Communication and modern X-band applications **Guide/Supervisor Name:** Dr. B.Y.V.N.R.Swamy **Student Name and Roll No:** K.Venkata Krishna (21761A04F1) R.Hariprasad Raju (21761A04H4) N. Ganesh (21761A04G4)	
	This work introduces the design and performance analysis of a Y-shaped triband rectangular slot defected ground structure (DGS) patch antenna for 5G communication. The antenna is proposed with three main layers: a ground plane, a substrate, and a radiating patch. The substrate is FR4 Epoxy with a size of 50.5 × 41.21 × 1.5 mm, which provides a compact and efficient design. The defective ground structure is highly responsible for optimizing the antenna's overall performance in the form of better impedance matching, bandwidth, and radiation characteristics. To enhance tri-band performance, the shape of the patch has been varied in two geometries step by step: rectangular and square. The effect of each geometry variation is examined in terms of key performance parameters such as return loss, voltage standing wave ratio (VSWR), and impedance bandwidth. Large-scale simulations are performed to analyze the return loss characteristics of every patch variation, determining the best design configuration for stable tri-band operation. The results prove that the designed antenna sustains tri-band behavior in all design iterations, qualifying it as a potential candidate for 5G communication systems. The return loss values at every resonant frequency exhibit large signal reflection reduction, guaranteeing efficient radiation performance. In addition, analysis of VSWR validates that the antenna has values near unity over the required frequency bands, reflecting proper impedance matching. The suggested design allows effective multiband operation with a straightforward fabrication process, which makes it suitable for future 5G networks and other next generation wireless communication systems.	 
16	**Title of Project:** Design of a wearable and flexible microstrip patch antenna for the detection of breast cancer	

	Guide/Supervisor Name: Dr. B.Y.V.N.R.Swamy **Student Name and Roll No:** Simhadri Mohitha (21761A04C1) Vankalapati Sandhya (21761A04C4) Pedagamalla Jaya Krishna Teja (21761A04B4)	
	Breast cancer is one of the leading causes of mortality among women worldwide and early detection remains a critical factor in improving survival rates. Traditional diagnostic techniques such as mammography, ultrasound, MRI and though effective, are often expensive, non-portable and sometimes uncomfortable for patients. This research introduces the design and simulation of a wearable and flexible microstrip patch antenna tailored for non-invasive breast cancer detection using microwave imaging. The proposed antenna is fabricated using flexible and biocompatible substrates like Polydimethylsiloxane (PDMS) and Kapton, making it suitable for continuous wear and direct application on the skin. Its conformability to the curved surface of the breast allows for better signal coupling and improved tissue interaction. The antenna operates efficiently in the ISM band (2.4–2.5 GHz), which is known for safe and effective microwave imaging applications. The compact design integrates slot-loading and metamaterial-inspired structures, enhancing both bandwidth and gain without increasing size. Advanced simulation tools such as CST Microwave Studio and HFSS were employed to evaluate the antenna's performance under various conditions. The results showed significant changes in reflection coefficients and S-parameters in the presence of tumors, highlighting the antenna's sensitivity to dielectric variations within breast tissue. The proposed model also maintains a stable radiation pattern and high efficiency, even when bent or placed on a multilayer phantom. This antenna is envisioned as part of a wearable diagnostic system that can enable real-time, portable and affordable breast health monitoring, potentially transforming current diagnostic practices. Its lightweight, low-cost nature makes it ideal for use in rural and remote areas, where access to medical imaging is limited. The integration of this antenna into smart wearable devices could pave the way for next-generation, patient-centric cancer screening technologies.