Sunaina Singh

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My area of research is focused on designing wearable antenna systems and developing simulation-based optimization strategies for enhanced performance in WBAN(wireless Body Area network) applications

Education

University of Petroleum and Energy Studies **July 2022 - to date (Thesis submitted, August 2025)**
Ph.D (Electronic and Communication Engineering) *Dehradune, India*

Thesis Title: " ***DESIGN AND ANALYSIS OF FLEXIBLE WEARABLE ANTENNA FOR ISM-BAND Applications*** "

I.E.T, Dr. RML Avadh University **July. 2019 – June 2021**
M.Tech (Electronic and Communication Engineering) *Avodhya, Uttar Pradesh, India*

I.E.T,Dr. R.M.L. Avadh University **July. 2014 – June. 2018**
B.Tech (Electronic and Communication Engineering) *Avodhya, Uttar Pradesh, India*

Experience

University of Petroleum and Energy Studies, (QS World Ranking - 239) **July 2022 – Present**
Teaching Assistant, Department of Electrical and Electronics Engineering

- **Communication Systems**: Delivered lectures and tutorials on analog and digital modulation techniques, signal processing fundamentals, and wireless network protocols; Prepare lecture notes, lab exercises, and assessment materials. .
- **Digital Communication**:Delivered lectures and tutorials to B.Tech students on digital modulation schemes (e.g., PSK, QAM, FSK), pulse coding, channel coding, and error-control techniques; designed lab exercises and assessments to reinforce theory with practical simulations.
- **Microprocessor and Microcontroller**: Facilitated laboratory sessions on programming, interfacing, and applications of microprocessors and microcontrollers; guided undergraduate students on projects and experiments.
- **Basic Electrical and Electronics Lab**: Supervised hands-on experiments emphasizing fundamental concepts of electrical circuits, electronic components, instrumentation, and troubleshooting methods; provided mentoring to undergraduate students.
- Executed event management tasks involving coordination, timetable arrangements, and participant correspondence for the **International Conference on Intelligent Communication, Control, and Devices (ICICCD 2023 and 2024)**.

Technical Projects

Ph.D.

1. **Dual-Band Slotted Wearable Antenna with Integrated FSS for WBAN**
   (a) Antenna Design: Engineered a compact circular-slotted antenna on a flexible jeans substrate supporting dual-band operation at 2.45 GHz and 5.85 GHz for on-body networks
   (b) Performance Enhancement: Optimized ring-slot and U-shaped feed-line geometry to achieve peak gains of 6.1 dB (2.45 GHz) and 7.2 dB (5.85 GHz) with return losses of –31 dB and –26 dB.
   (c) Validated ultra-low SAR levels of 0.197 W/kg (2.45 GHz) and 0.6413 W/kg (5.85 GHz) (1 g average), ensuring compliance with FCC guidelines.
   (d) A Dual-Series Single-Parallel switched capacitor (DSSP – SC) eleven–level multilevel inverter.
   (e) : Demonstrated stable impedance bandwidth and radiation patterns under flat and conformal (50–70 mm bending radius) conditions via HFSS simulations and prototype measurements.
   (f) Fabricated a prototype and confirmed measurement–simulation agreement within 5 percent deviation, ensuring reliable on-body performance

2. **Conformal Dual-Band High-Gain Textile Antenna for WBAN Applications**
   (a) Designed a compact dual-band rectangular-slotted edge monopole wearable antenna on PDMS substrate for WBAN applications.
   (b) Integrated a double-square-loop FSS reflector array on identical PDMS substrates to suppress body scattering and enhance forward gain
3. **Achieved high peak gains of 7.48 dB at 2.45 GHz and 8.70 dB at 5.85 GHz with good return Loss**
   (a) Demonstrated continuous impedance bandwidth covering the ISM bands and stable S response under conformal bending
   (b) A Ensured ultra-low SAR compliance with maximum simulated values of 0.51 W/kg (2.45 GHz) and 0.61 W/kg (5.85 GHz) for 1 g of tissue
   (c) Validated design through CST simulations and prototype measurements, confirming measurement–simulation agreement and robust on-body performance.

M.Tech.

1. **Vibration Sensor Error Minimization in IoT Applications**
   (a) Developed a wavelet transform-based method to minimize synchronization errors in IoT-based vibration sensing.
   (b) Designed a frequency-domain correction approach to improve signal accuracy without time-domain reconstruction. CPSD-based peak detection for accurate modal frequency identification in sensor networks.
   (c) Proposed a custom synchronization protocol addressing both constant and linear time shifts in multi-node systems.
   (d) Evaluated the impact of humidity and substrate materials on frequency drift in wearable IoT sensors.
   (e) Embedded System using C Language.

B.Tech.

(a) **G.S.M Based Speed Tester on Highway(Major Project)**:
   i. Designed and developed a real-time vehicle speed monitoring system using GSM and IR sensor modules.
   ii. Implemented microcontroller-based logic to detect vehicle entry/exit times and compute speed over a fixed distance.
   iii. Integrated GSM communication module (SIM800/900) to automatically send alerts for vehicles exceeding speed limits.
   iv. Ensured system reliability through testing under different lighting and vehicle conditions, achieving accurate speed tracking.

(b) **L.P.G Leakage Detector(Minor Project)**

Patents

(a) **S. Singh** R. Mishra, "Wearable Antenna with Compact Dual-Band Monopole Design for Biomedical Applications at 2.45 GHz and 5.85 GHz". (published)

Publications

Journal Publications

(a) **S. Singh**, ; Mishra, R.; Kapoor, A.; Singh, S, 'A Comprehensive Review and Analysis of the Design Aspects,Structure, and Applications of Flexible Wearable Antennas," ***Telecom*** vol. 150, 2025, pp. 155768. (https://doi.org/10.3390/telecom601
(b) **S. Singh**, ; Mishra, R.;Conformal Dual-Band High-Gain Antenna for ISM bands with Low SAR on textile for Wireless BAN." ***Engineering Research Express (2025)*** (https://doi.org/10.1088/2631-8695/ade1a3).
(c) **S. Singh**, ; S.Singh;M.Sharma,;Role of Capsule Network Model in Brain Tumor Analysis and Detection: A Review." ***Intelligent Communication, Control and Devices(2025)*** (https://doi.org/10.1007/978-981-97-8329-866).

Conference Publications

(a) **S. Singh**, V. Dahima, A. Kapoor, R. Mishra and S. Singh. Optimizing Rectangular Microstrip Patch Antennas for High-Performance WiMAX Communication",2023 International Conference on Smart Devices (ICSD), Dehradun, India, 2024, pp. 1-4. (https://doi: 10.1109/ICSD60021.2024.10751350.)

(b) **S. Singh** V. Dahima, R. Mishra, A. Kapoor, A. Singh and V. L. Devi, "Pioneer Design of a Single-band U-slotted Patch Antenna Tailored for Enhanced Performance in WiMAX and WLAN Environments," 2024 Second International Conference on Microwave, Antenna and Communication (MAC), Dehradun, India, 2024, pp. 1-6. (https://doi: 10.1109/MAC61551.2024.10837556.)

(c) **S. Singh** S. Mittal and S. Singh, "Analysis and Forecasting of COVID-19 Pandemic Using ARIMA Model," 2023 3rd International Conference on Advances in Computing, Communication, Embedded and Secure Systems (ACCESS), Kalady, Ernakulam, India, 2023, pp. 143-148. (https://doi: 10.1109/ACCESS57397.2023.10199278.)

(d) **S. Singh** S Singh, V Dahima, R Mishra, S Singh, VL Devi, "Design and Performance Analysis of a Compact Wearable Antenna Integrated into FR4 Substrates for Enhanced Wireless Communication," 2024 4th Asian Conference on Innovation in Technology (ASIANCON), Pimari Chinchwad, India, 2024, pp. 1-5. (https://doi: 10.1109/ASIANCON62057.2024.10838049.)

(e) **S. Singh** S. Singh, M. Sharma, I. Bala, Arpita, "Early Intervention for Pneumonia: A Deep Learning-Driven Approach," 2025 7th International Conference on Signal Processing, Computing and Control (ISPCC), pp. 1-5. (https://doi: 10.1109/ISPCC66872.2025.11039531.)

(f) **S. Singh** S. Singh, Arpita, "MRI Image Classification and Analysis for Brain Tumor Diagnosis: A Review using DL Techniques, 2024 ,Parul International Conference on Engineering and Technology (PICET),pp. 1-5. (https://doi: 10.1109/PICET60765.2024.10716104)

Book Chapter

(a) **S. Singh** V.Dahima, R.Mishra,"Exploring the dynamics of microstrip antenna and radiation mechanism of dipole antennas, 2024,Practical antenna, Talyor Francis Groups,pp.32. (https://www.taylorfrancis.com/chapters/edit/10.1201/9781003470854-5)

(b) **S. Singh** S.Singh, S.Paanda, R.Kokkonda," Deep Learning-Based CNN Model for Classification and Prediction of Leaf Diseases,Advances in Data and Information Sciences ,Lecture Notes in Networks and Systems. (https://link.springer.com/chapter/10.1007/978-981-97-7360-2$_1$6)

Professional Training

(a) 6 Months Industrial Training in C Language from, CETPA infotech Pvt. Ltd., Lucknow.

(b) BSNL Faizabad Subject: "Industrial Training " Duration: Four Weeks.

(c) Industrial Training at UPPTCL, Lucknow (4 Weeks): Gained practical exposure in Transmission Line Distribution, focusing on power transmission systems, maintenance practices, grid operations, and distribution network management. June 2017.

Technical skills

- MATLAB/Simulink
- ANSYS HFSS
- CST
- Advance Design System(ADS)
- Python
- CoLAB

Languages

English: Advanced Reading, Writing and Speaking

Hindi: Native Language

References

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