

Executive Summary



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1. Title of the Project: Design, development and commercialization of radar-on-chip technology.
2. Date of Start of the Project: October 1, 2020
3. Aims and Objectives: Design and prototyping of radars-on-chip leading to commercialization with start-up company incubation and transfer-of-technology (ToT). The proposed milestones are:
 - i. *Years 1 and 2*: Design and fabrication of multiple chips incorporating indigenous radar-on-chip technology. Prototype development.
 - ii. *Year 3*: Field Trials of Product-prototype. Design-iterations
 - iii. *Years 4 and 5*: Technology transfer, Startup-Incubation, Commercialization.
4. Significant achievements:

After two chip fabrication runs, our radar-on-chip design is fully functional and meets expectations. We have incubated a startup company, AAGYAVISION Pvt. Ltd., to commercialize this technology. AAGYAVISION has developed a minimum viable prototype (MVP) called *Ananta*, that can support multiple strategic and civilian applications with certain modifications to the base design. While we have been successful in developing the radar-on-chip technology at IISc, the MVP in collaboration with AAGYAVISION, and in performing initial field trials, the challenge that lies ahead of us now, is in converting the prototype to a commercially viable product aligned with a specific application. We have also fabricated a test-chip ARSLRES1 to explore new concepts in radar PLL design, transmitter design, Built-in-Self-Test (BIST) and biomedical systems. The following papers were published during this period:

1. Shrivastava and G. Banerjee, "Analog Probe Module (APM) for Enhanced IC Observability: From Concept to Application", IEEE Trans. VLSI Systems, Accepted.
2. E. Easha, A. Khot and G. Banerjee, "Hybrid Waveform Based Chirp Demarcation in FMCW Radar Systems", 2024 Asia-Pacific Microwave Conference, Bali, Indonesia, November 17 - 20, 2024 (Accepted).
3. S. Lakhote, E. Easha and G. Banerjee, "A Dual-Slope BlueFMCW Radar for Simultaneous Mitigation Against Close-in DRFM and Frequency Domain Spoofing Attacks", 2024 IEEE International Symposium on Circuits & Systems, Singapore, May 19-22, 2024.
4. E. Easha and G. Banerjee, "Advancing In-Home Gait Monitoring: a Feasibility Study of Upper Limb Swing Analysis Using FMCW Radar", 2024 IEEE International Symposium on Circuits & Systems, Singapore, May 19-22, 2024.
5. Y. Chandrakapure, A. Kumar, E. Easha, D. Sarkar and G. Banerjee, "Time-Modulated Metasurface for Spoofing Doppler Radar", IEEE Microwave, Antennas, and Propagation Conference (MAPCON), Ahmedabad, India, December 2023.
6. O. Sriraman and G. Banerjee, "X-Band GaN Power Amplifier for Weather Radar Applications", IEEE Microwave, Antennas, and Propagation Conference (MAPCON), Ahmedabad, India, December 2023.

5. Concluding remarks

We gratefully acknowledge the financial assistance provided by the INAE through the Kalam Fellowship, which has supported us with many key aspects of the ongoing radar-on-chip development work at IISc. Our ongoing activities in research and development require continued support from INAE through this fellowship.