

Executive Summary



Gaurab Banerjee
Professor, Indian Institute of Science

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:

In the first and second years of the fellowship, a radar-on-chip with one transmitter, three receivers and integrated PLL was designed and characterized, and its shortcomings were identified. This led to a revised design with a full I/Q architecture and an integrated frequency multiplier that supports dual-band (S/C) operation. The revised design, which was fabricated and characterized in the second and third years of the fellowship, is fully functional and meets our expectations. We have incubated a startup company, AagyaVision Pvt. Ltd., at SID, IISc 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 commercial product aligned with a specific application. This activity will have a significant research and development component that needs to be performed at IISc over the next two years and hence requires continued support from INAE through this fellowship.

The following papers were published during this period:

- 1 Easha and G. Banerjee, "Range-Doppler Estimation for Gait-Detection with FMCW Radars in a Simulated Indoor Scenario," 2022 IEEE Microwaves, Antennas, and Propagation Conference (MAPCON), Bangalore, India, 2022, pp. 1703-1708, doi: 10.1109/MAPCON56011.2022.10047534.
- 2 A. Kumar, E. Easha, D. Sarkar, and G. Banerjee, "A compact quasi-Yagi antenna for FMCW radar-on-chip-based through-wall imaging," International Journal of Microwave and Wireless Technologies, pp. 1–13, 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.