

STAR

System for **T**racking **A**nimals using **R**adars

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Energy and Environment

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CONTENTS

- A discussion on the current methods on the monitoring of animals in Wildlife reserves/sanctuaries and zoos
- Introduction to contactless methods using radars
 - FMCW
- Methodology of STAR
 - Hardware used and features
 - Use of MATLAB

PROBLEM STATEMENT

- Extinction of over 18 species of wild animals in the last century
- Despite efforts taken through wildlife reserves and sanctuaries, poaching remains to be a threat
- Locating and monitoring the movement and vitals of the animals in reserves are challenging

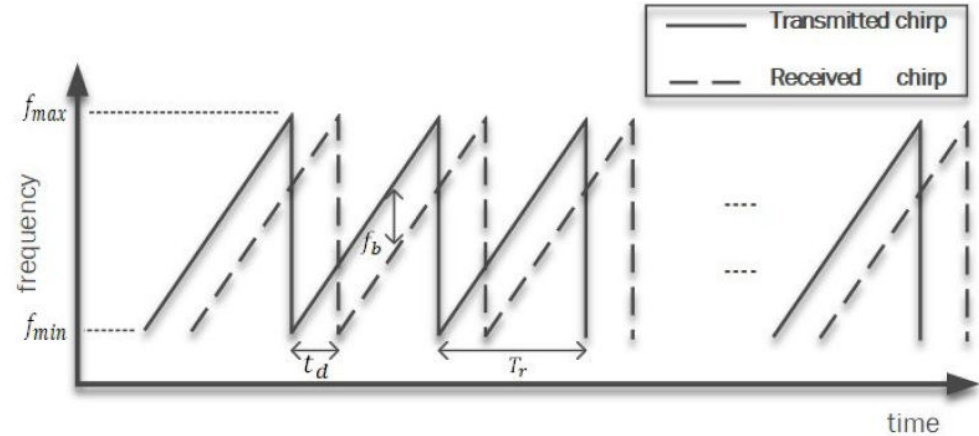
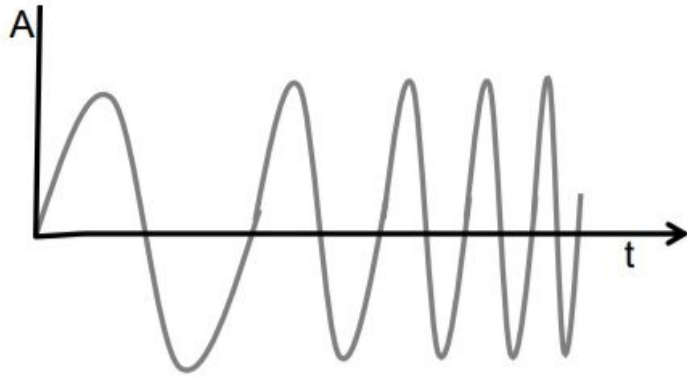
CURRENT METHODS

- Existing methods involve use of cameras, which prove to be disadvantageous because of their limited field of vision and range, and poor performance in harsh weather conditions.
- While microchip implants that use may help track the different animals of the same species, it cannot actively locate or track the vitals of said animals.
- GPS devices are also not the best option as they are susceptible to damage and are sometimes too large to be implanted into animals.

OBJECTIVES OF STAR

- The main objectives of this project are to:
 - Detect and measure vital signs of animals.
 - Tracking both animal and human movements to prevent poaching and hunting in wildlife sanctuaries.
- This will be accomplished using FMCW Radar.

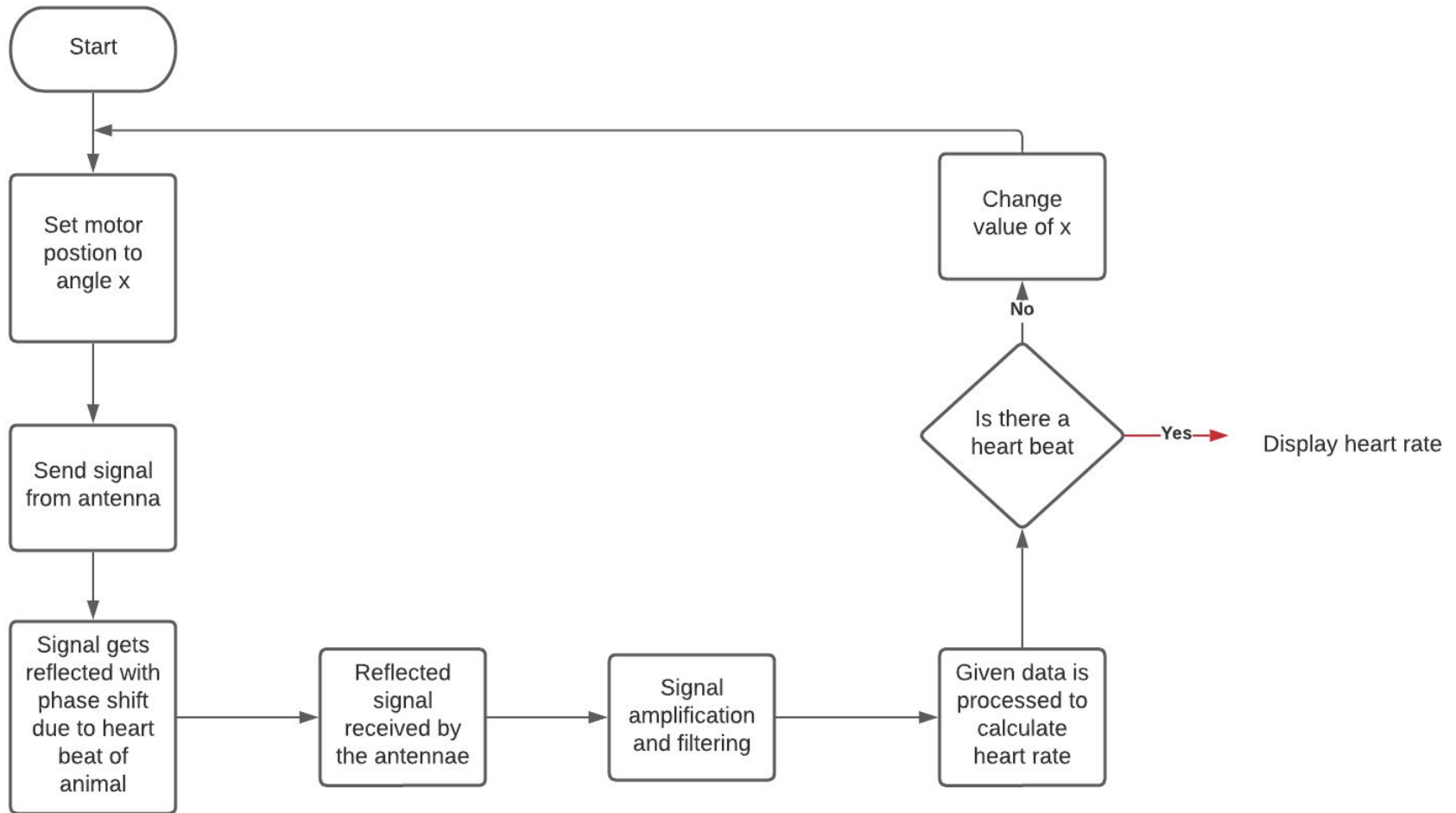
FMCW RADARS



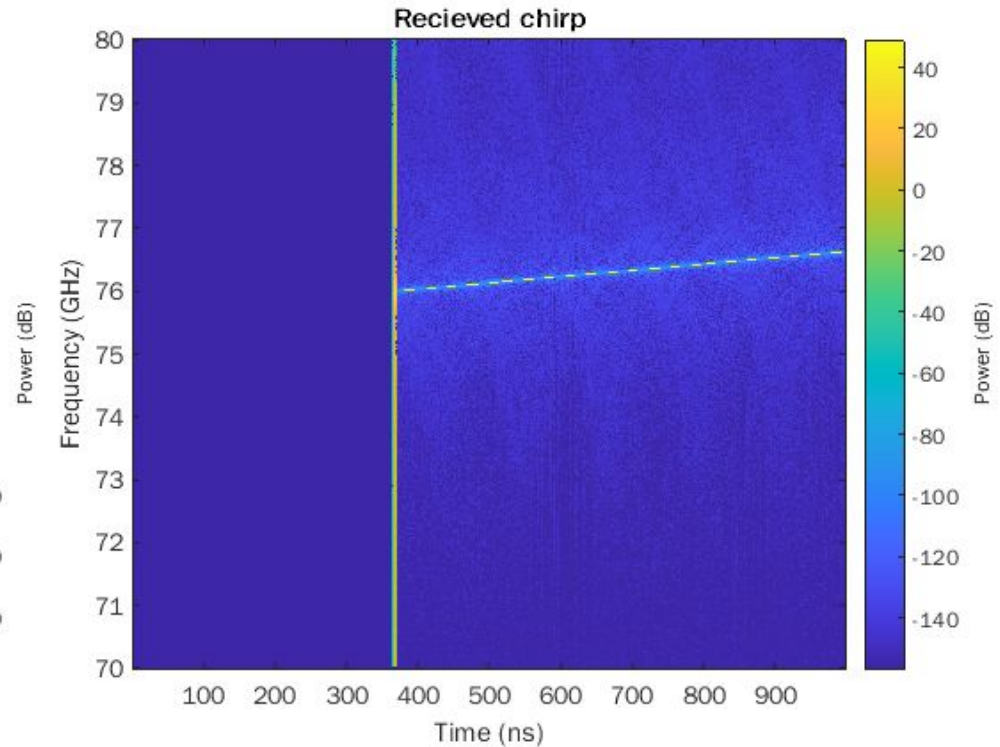
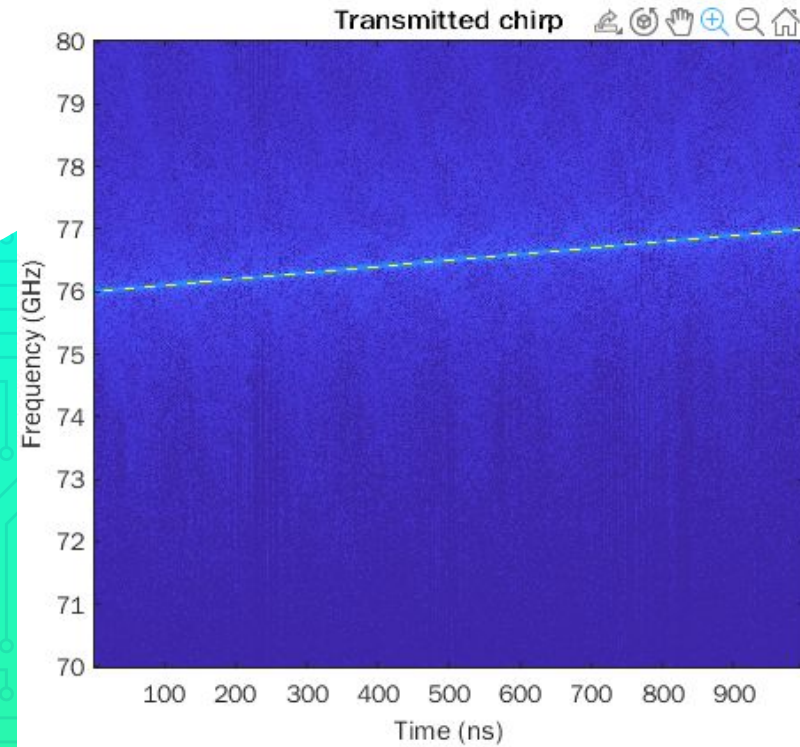
$$s(t) = A_t \exp \left(j(2\pi f_{min}t + \pi Kt^2) \right), \quad 0 < t < T_r,$$



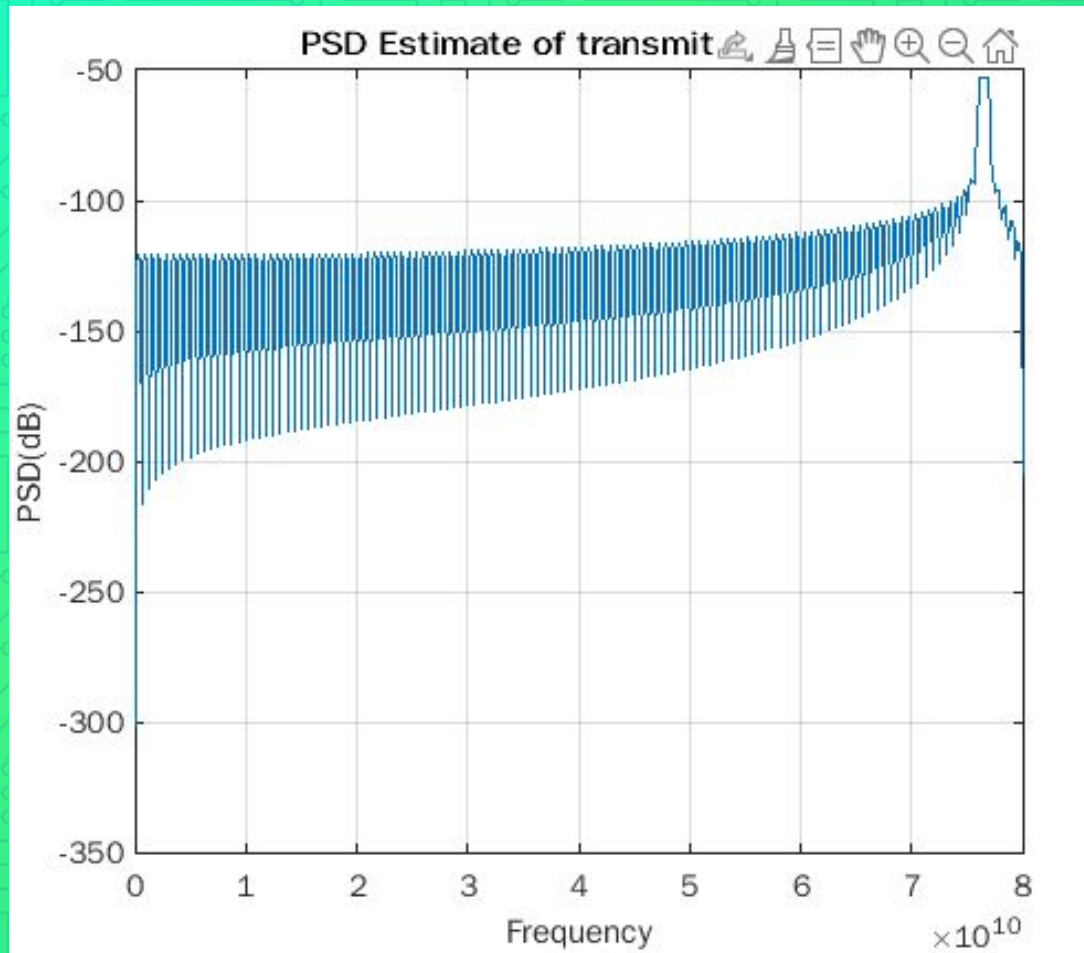
FLOWCHART

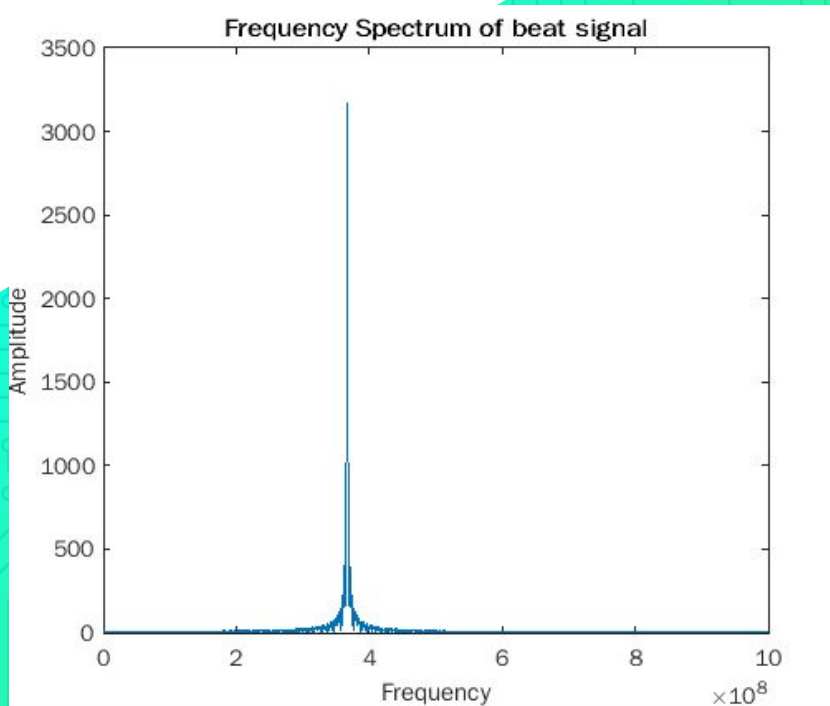


SIMULATION



SIMULATION



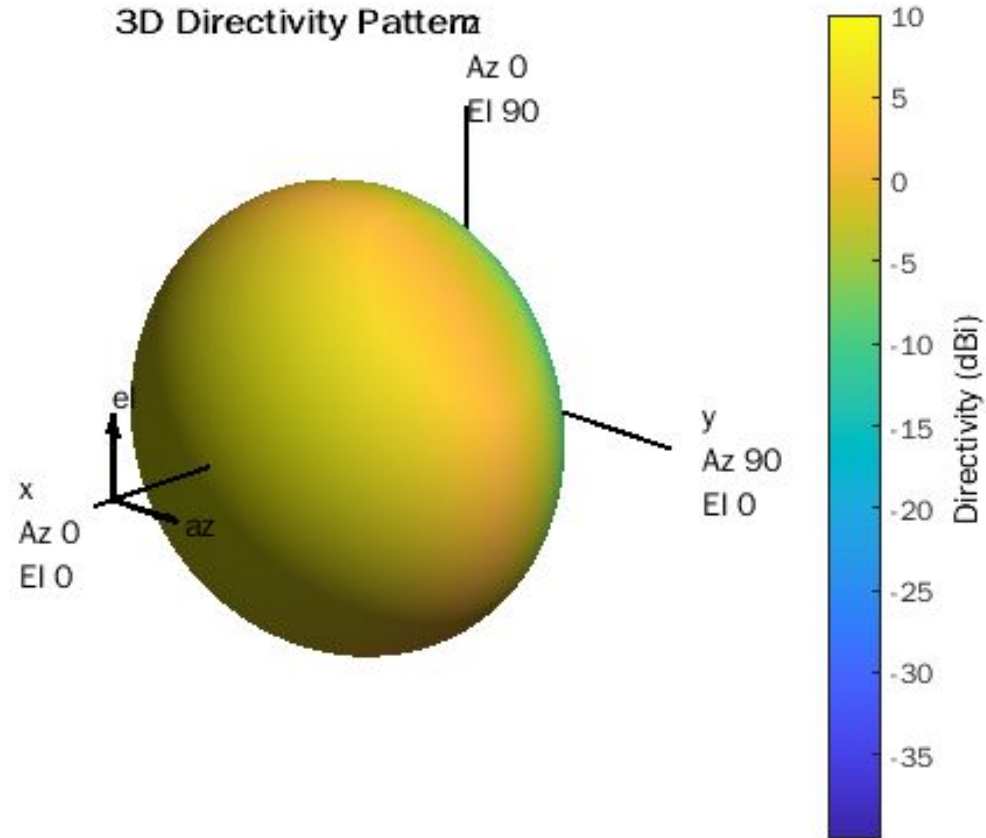


```
f_beat = 367000000
```

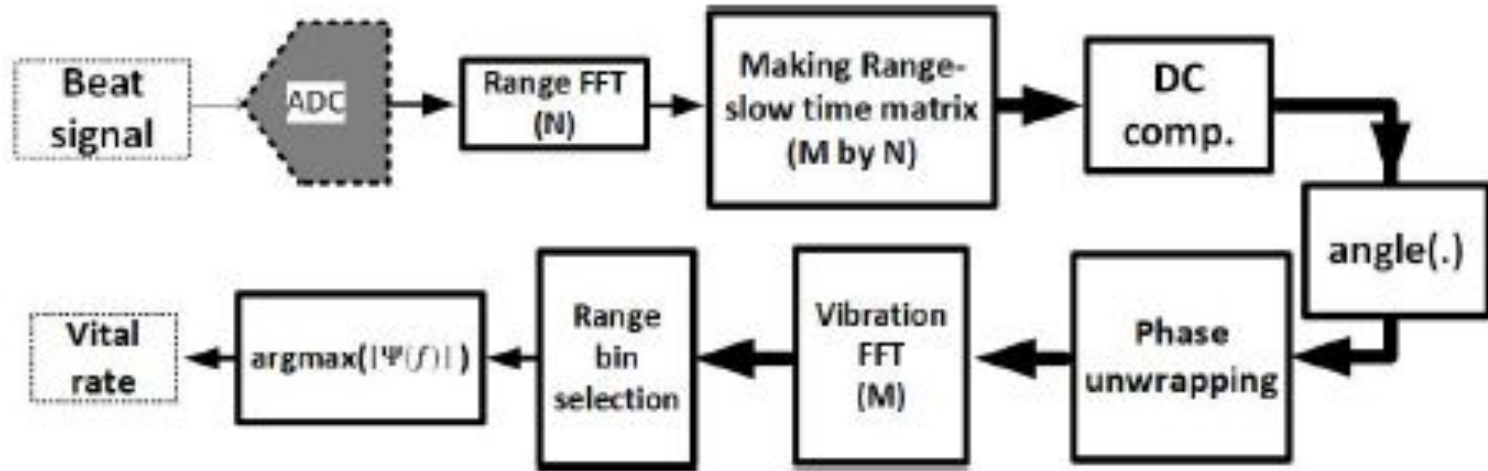
```
r = beat2range(f_beat,K,c) %range
```

```
r = 55.0500
```

SIMULATION - Antenna Radiation Pattern



PROPOSED ALGORITHM FOR DETECTING VITAL SIGNS



Simulation - Further Plans

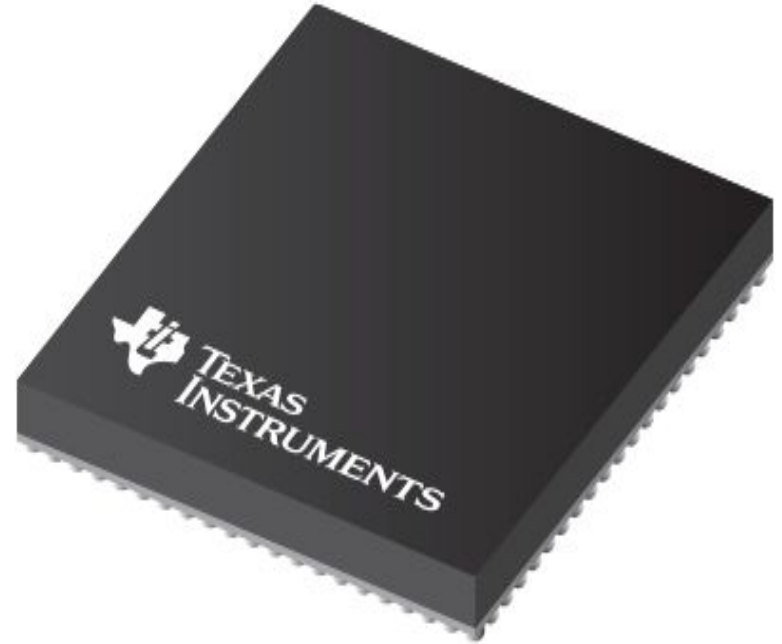
- Implement Velocity Estimation for a single target.
- Implement Range and Velocity estimation for multiple targets.
- Model Respiration and heartbeat along with environmental noise and detect the same using the proposed algorithm.

HARDWARE

1. Radar Sensor Chip - AWR1843
2. Antenna
3. CAN-FD transceiver-TCAN1042HGVDRQ1
4. XDS110 based JTAG emulation with a serial port-(TM4C1294NCPDT)

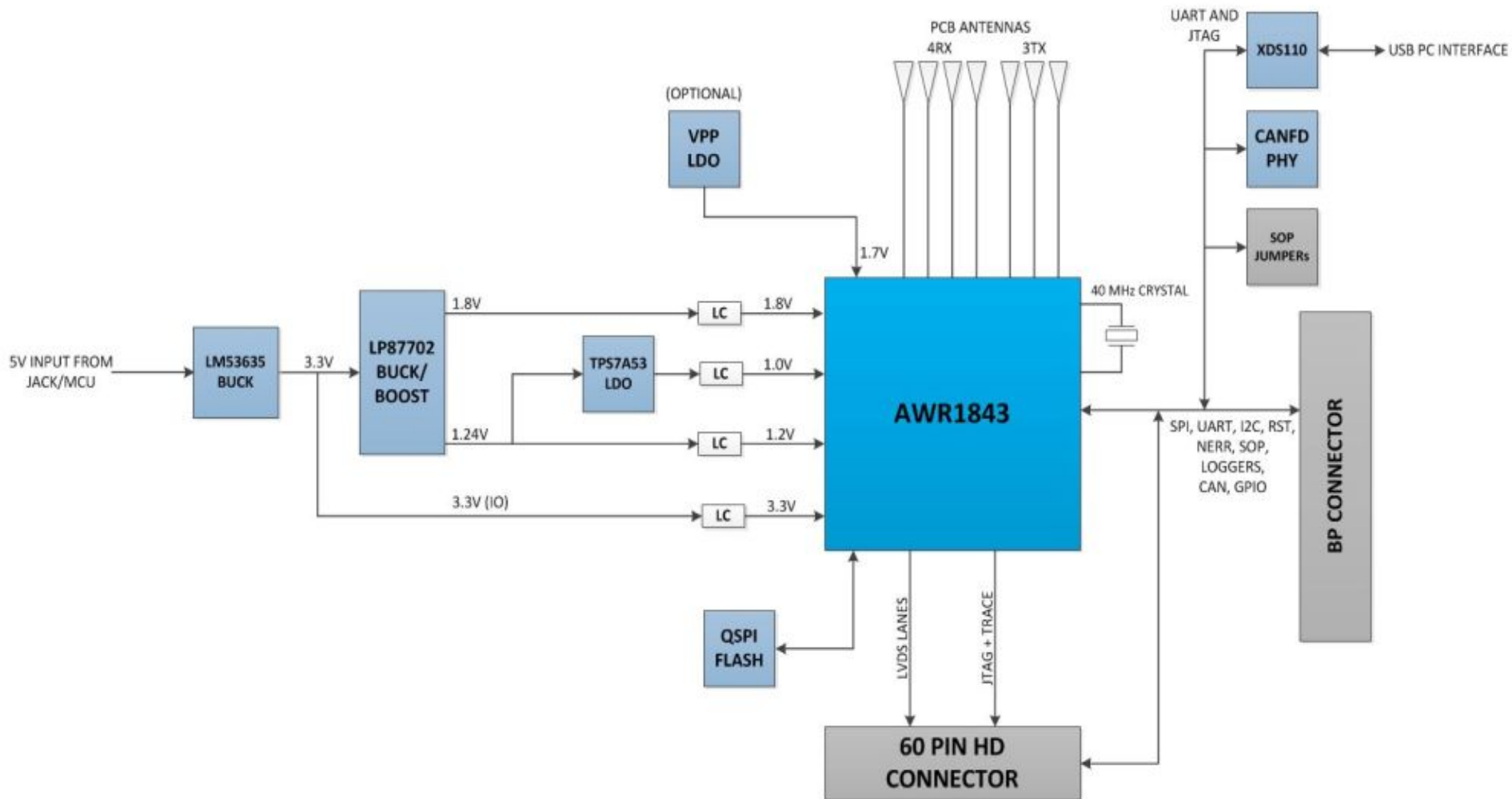
Radar Sensor Chip - AWR1843

- mmWave radar sensor - 76-81GHz
- Single-chip, Low-power – Achieved through RFCMOS technology
- Integrated processing – Removes the need for an external processor in the system
- Scalable Portfolio – SW re-use across Automotive & Industrial platforms, regardless of band
- Imaging Radar – Lidar-like performance at the right price point





SCHEMATIC



ESTIMATED COST

Fabrication Components

(material, joints, etc.)

- INR 2500

Radar Sensor Chip + PCB +

Components

- INR 20,000

Power supply

- INR 1500

Estimated Cost - INR 24,000

WHAT'S NEXT?

- Solid platform on MATLAB for testing the proposed algorithm.
- Testing the hardware using humans for detecting vital signs.
- This project can also be extended to multiple other applications