Executive Summary

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1. Title of the Project: Design for Secure Indigenous Spiking Neural Network Chip with OTP Memory on 180nm CMOS for Voice Recognition

2. Date of Start of the Project: October 1, 2022

3. Aims and Objectives: We will design a spiking neural network using one-time programmable memory (OTPM). The OTPM will enable secure storage of the model, enabling a tamper-proof and secure neural network. Voice recognition and related authentication through neural networks is a critical security feature.

4. Significant achievements (not more than 500 words to include List of patents, publications, prototype, deployment etc)

   In this project, we are developing a neural network based on the first indigenously developed semiconductor memory successfully adopted for manufacturing in a 180nm CMOS line at SCL Chandigarh. The OTP memory provides security & privacy as they have the following properties

   1. It is tamperproof as re-write can be disabled.
   2. The stored data cannot be externally read as external read is disabled.

3. Side channel attack is challenging as the data is stored in atomic defects (as opposed to charges or magnetic states that emit field lines for remote detection).

The technology is presently deployed at the 180nm CMOS line at SCL Chandigarh. Thus, the design IP developed can be translated into mass production easily. The project provides indigenous manufacturing-level control of Neural networks as the entire materials to circuits are indigenous and at manufacturing readiness.

Such neural network use cases are ubiquitous in terms of edge computing. The spiking network is able to perform various time series classifications from any sensor data – accelerometer, audio, visual, etc. These networks based on spiking neural networks have low energy due to sparse spike encoding. Thus, personal or local sensors related to security in low-power applications are a use case target.

5. Concluding remarks

This project enables design development for a critical national capability in neural network chip for edge computing with completely indigenous design and manufacturing. Significant progress has been made in 2 years with excellent momentum towards successful completion.