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Orientation - Call for Design Contest

10th IEEE International Symposium on Smart Electronic Systems (IEEE-iSES)

16-18 December 2024, New Delhi, India

SRA-SAIL

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Call for Design Contest

- **Theme** – Edge AI on STM32
- **Introduction:**
 - Machine learning and AI have become an integral part of human life. From the smartphones in our pockets to massive datacenters that silently influence our day-to-day life, intelligent algorithms are constantly shaping and enhancing our experiences. Most devices around us are either generating data that fuels further learning or are actively using AI to enhance our lives.
 - This design contest seeks to harness the transformative power of AI and machine learning in fields vital to the future of human experience. The entire contest can be bifurcated into two major parts:
 - **Data Generation and Understanding:** The first part focuses on innovative methods to collect and interpret complex datasets using the STM32 platform. Consider, for example, using advanced sensors to capture human vital signs and measuring eye fatigue for next-generation health monitoring or designing systems that meticulously track energy consumption patterns for optimized resource management.
 - **Model Generation:** The second part invites the creation of cutting-edge machine learning models within the fields of human vital sign monitoring, energy management, human activity recognition, robotics, smart things, and audio and contextual awareness. These models could revolutionize healthcare, sustainability, personal assistance, and countless other domains. The focus of this contest is to leverage the STM32 platform for efficient data collection and inference generation, enabling the development of cutting-edge AI-on-the-edge applications within the contest's focus fields.



Area of Design

- **Theme** – Edge AI on STM32
- **Area of Design:** Ideas invited in areas of (but not limited to):
 - Wellness and Healthcare
 - Energy Management
 - Human Activity Recognition
 - Robotics
 - Smart Things
 - Energy Harvesting



Contest Timeline and Submission Instructions

- **Theme** – Edge AI on STM32
- **Contest Timeline and Submission Instructions:**
 - **Important Dates**
 - Launch: 17th June 2024
 - Last date to receive idea: 7th July 2024
 - Orientation session: 20th June and 25th June 2024, from 7:30 pm to 8:30 pm
 - Orientation Link: <https://shorturl.at/ZfLzX>
 - *Selected idea* announcement and board shipping: 12th July 2024
 - Last day of implemented idea submission: 7th November 2024
 - **Submission**
 - This is a team event, and each team can have up to three students.
 - Submit your design idea in the provided template (including figures, references and page limit for each section) to the following link: <https://edas.info/newPaper.php?c=32396&track=124814>



Example Problem Statement

- **Theme** – Edge AI on STM32
- **Example Idea: Context aware time-of-the-day tracking**
 - To build a multi-modal model for detecting context (like market, library, or bus) and time of day. For this, first collect synchronized data from various sensors like an accelerometer, gyroscope, microphone, and light sensor.
 - After preprocessing the data, extract meaningful features from each sensor's readings – analyzing movement patterns, ambient noise and specific sounds, as well as light levels. Using this feature set, train a supervised learning model (such as a decision tree, SVM, or neural network) on labeled data representing each context at different times of day.
 - Carefully evaluate and cross-validate for improving model's accuracy. For deployment on an embedded system like an STM32 device, optimize the model for memory and computational efficiency using techniques like quantization (using STM32Cube.AI developer cloud), all within the context of STM32CubeMX for code generation and sensor integration.



Getting Started

- **Theme – Edge AI on STM32**
- **Overview – Tell us about the idea!**
 - (Minimum font size: 10pt, Times New Roman font. Max two pages including tables, diagram, references (if any))
- **Intended Application – Can your idea make an impact?**
 - (Describe a potential application or field of application. What are some of the existing applications which closely match your idea? Max one page):
- **Datasets – How do you plan to collect data for your application?**
 - (What dataset will you utilize for this project? Will you leverage a relevant benchmark dataset or curate a custom dataset tailored to the specific requirements of this application? Max half page):
- **Benefits and Value addition – What makes your idea supercharged?**
 - (What makes your idea stand out from the crowd? These are the unique features that make your implementation a game-changer compared to the competition. Think of them as your idea's "X-factor" that sets it apart and delivers incredible value. Max one page)
- **Team Details (Ideal team size – 3 student members max.)**
 - (List your team members' names, contact information, and email addresses. Include the name of your university/college and your shipping address. That's all we need!!)



Resources

- **Theme** – Edge AI on STM32
- **Hardware Resources**
 - Primary platform: **NUCLEO-H753ZI** (<https://www.st.com/en/evaluation-tools/nucleo-h753zi.html>)
 - Optional components: (To be finalized based on the merit of the ideas)
 - i. B-CAMS-OMV (<https://www.st.com/en/evaluation-tools/b-cams-omv.html>)
 - ii. X-NUCLEO-IKS01A3 ([X-NUCLEO-IKS01A3 - Motion MEMS and environmental sensor expansion board for STM32 Nucleo - STMicroelectronics](#))
 - iii. X-NUCLEO-53L8A1 ([X-NUCLEO-53L8A1 - Time-of-Flight expansion board based on the VL53L8 series for STM32 Nucleo - STMicroelectronics](#))
 - iv. X-NUCLEO-6283A1 ([X-NUCLEO-6283A1 - 6-channel ambient light sensor, with flicker extraction expansion board based on VD6283 for STM32 Nucleo - STMicroelectronics](#))



Resources

- **Theme** – Edge AI on STM32
- **Software Resources**
 - STM32CubeIDE ([STM32CubeIDE - Integrated Development Environment for STM32 - STMicroelectronics](#))
 - STM32CubeMX ([STM32CubeMX - STM32Cube initialization code generator - STMicroelectronics](#))
 - X-CUBE-AI ([X-CUBE-AI - AI expansion pack for STM32CubeMX - STMicroelectronics](#))
 - X-CUBE-MEMS1 ([X-CUBE-MEMS1 - Sensor and motion algorithm software expansion for STM32Cube - STMicroelectronics](#))
 - X-CUBE-ALS ([X-CUBE-ALS - Ambient light sensors \(ALS\) software expansion for STM32Cube - STMicroelectronics](#))
 - X-CUBE-TOF1 ([X-CUBE-TOF1 - Time-of-Flight sensors software expansion for STM32Cube - STMicroelectronics](#))
 - X-CUBE-MEMSMIC1 ([X-CUBE-MEMSMIC1 - Analog and digital MEMS microphone acquisition and processing software expansion for STM32Cube - STMicroelectronics](#))
 - STM32Cube.AI Developer Cloud ([STM32Cube.AI Developer Cloud - STMicroelectronics - STM32 AI](#))
 - STM32 Model Zoo – Comprehensive suite of tools for deploying pretrained models on STM32 platforms, enabling audio event detection, human activity recognition, image classification, and object detection, utilizing custom datasets and optimized models. Compatibility with Python 3.9/3.10, TensorFlow 2.8.3, and seamless integration with STM32Cube.AI developer cloud. ([GitHub - STMicroelectronics/stm32ai-modelzoo: AI Model Zoo for STM32 devices](#))



Questions?

For any queries send an email to following address
with IEEE-iSES Design Contest 2024 as subject
tech.connect@st.com

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