



Mobile TinyML Platform

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Problem

A whopping 37% of the world population has never used the internet [1] and 13% of the world population does not have access to electricity [2]. Reliance of internet for developing tinyML applications remains detrimental to the goal of democratizing tinyML technology to the masses and making it available to masses including population with no technical knowledge and internet connection.

Approach Novelty

Building sustainable tinyML use cases for austere environments requires a tinyML Platform capable of performing in-field AI training, model customization, validation and device updates with no cloud and no internet connectivity. Novelty of our "mobile tinyML Platform" is that it eliminates the need for internet connection and high-end compute making it perfect to users without no tinyML knowledge or internet connectivity. AITS has developed mobile tinyML platform with indigenous software stack to develop tinyML applications as shown in the picture below

Use Case: Predictive Maintenance

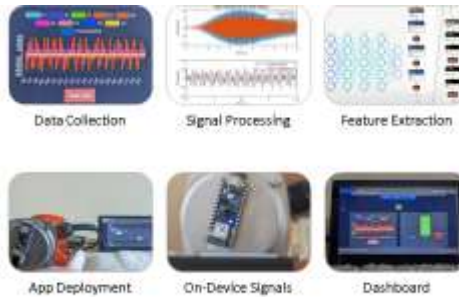


Predictive maintenance is a proactive maintenance technique that uses real-time asset data collected through sensors, historical performance data, and advanced analytics to forecast when a vibration bearing machine like pump or motor is operating in a condition close to its failing point. Using this technology, AITS has developed a streamlined approach to implement deep learning based predictive maintenance algorithms directly on the edge devices with in-field data to deploy capability. This allows users to bring autonomy to the edge devices and enable low power use cases even without network connectivity.

Features

Mobile tinyML User Platform has been built AutoML and tinyML compiler [3] technologies and consists of following features:

- In-field Development:** Sensor data is captured in the field using a mobile tablet with USB/BLE connection. The acquired data is incorporated in a custom sensor app deployed on a sensor board.
- No Cloud, No Internet:** The app runs entirely on device.
- In-Field Monitor:** Sensor board LED and mobile app is used to detect and monitor abnormal and incessant operational issues.
- Low Energy:** Both the mobile tablet and sensor board run on batteries. Sensor board has no power-hungry WI-FI or cellular connectivity modules.



Results & Significance

This inexpensive tinyML platform running on mobile tablet for users with no technical knowledge has ability to truly democratize tinyML as a technology in remote areas where internet is still a luxury. These internet limited areas include industries like space, farming, shipping, and countries like Belarus, Burma, Cuba Sri Lanka, Ethiopia and Uzbekistan etc. This is important because tinyML has the potential to significantly impact underdeveloped societies and poor economies, and it is crucial that a wide range of voices and perspectives are included in its development. Some benefits of democratizing tinyML development include:

- Increasing the diversity of perspectives and ideas, leading to more creative and innovative tinyML solutions.
- Promoting equity and inclusivity by giving non-tech people like middle schoolers and housewives access to the tools and resources needed to participate in tinyML development.
- Reducing the potential for bias in tinyML systems by ensuring that a diverse group of people are involved in their development.
- Promoting collaboration and cooperation among different groups and organizations, leading to more effective and efficient development of tinyML applications.

Other Apps on TinyML Platform

There are over 140 applications that are already available online on mobile TinyML platform at <https://cainvas.ai-tech.systems/>. The versatile mobile TinyML platform is being used to develop apps for remote locations in several verticals including:

- [Smart Industrial IoT](#)
- [Smart Aviation](#)
- [Smart Farming](#)
- [Smart Transportation and Logistics](#)
- [Smart Security](#)
- [Smart Oil and Gas](#)
- [Smart Environment](#)
- [Smart Space](#)
- [Smart Home](#)
- [Smart City](#)
- [Smart Retail](#)
- [Smart Energy](#)
- [Smart Auto](#)
- [Smart Society](#)
- [Smart Finance](#)
- [Smart Health](#)

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- deepC: vendor independent deep learning library, compiler and inference framework microcomputers and microcontrollers. Rohit Sharma et al, Published online at: <https://github.com/ai-techsystems/deepC/>
- cainvas: vendor independent tinyML user platform, AI Technology & Systems, <http://cainvas.ai-tech.systems/>

Acknowledgement

This product presented here was developed in collaboration with and support from Department of Defense under an SBIR awarded contract.



Watch Predictive Maintenance Demo at <https://youtu.be/qJViTnsrZpE>