ACUMEN™ AI on the Edge

For Industrial and Government Applications

Overview

Artificial Intelligence (AI), is intelligence demonstrated by machines. In computer science, AI research is defined as the study of "intelligent agents." This is any device that perceives its environment and takes actions that maximize its chance of successfully achieving its mission. An example would a manufacturing quality inspection system that scans finished products and removes items with defects.

There are several Industrial and Government programs and initiatives which involve AI.

AI is being reviewed by US Customs and Border Protection for the The Vehicle Face System which monitors people crossing the border.

NASA used AI to help develop an antenna that was very small, light, and consumes little power, while also being strong and robust. AI was used because it can develop these types of designs more quickly than people.

In Dubai, the Abu Dhabi Police are experiencing an increase in pedestrians. They are reviewing the use of AI systems to monitor crossings at intersections to make them safer for the public.

With AI, commercial and government users can:

- Increase productivity and improve quality
- Provide for better public safety
- Protect borders from threats, illegal entry, and contraband
- Optimize operational efficiency

Using AI for Remote and Mobile, Industrially and Government Applications

In general, there are multiple challenges to deploying AI. Many involve the effectiveness and performance of the installed AI application.

- Is it properly capturing, filtering and parsing the data.
- Does the application react and behave as it has been taught.
- How can performance and latency be improved.
- Can it be easily managed and are parameters simple to adjust.

These challenges are common for all AI applications: military, research, government, commercial, etc.

But there are additional challenges when deploying AI on remote and mobile equipment. Including applications such as:

- Railway and pipeline inspection
- Autonomous mining
- Emergency medical response
- Law enforcement
- Farming and forestry, crop management and harvesting
- Oil and gas exploration
- Fire, smoke, and dangerous chemical detection and suppression
- Border patrol and customs
- Marine vessel and structure inspection
- Transportation vehicle: stress monitoring, fuel consumption optimization, and pre-emptive maintenance

These types of applications and systems do not operate in safe and controlled environments, such as a data-center, which is secured, cooled, and has ample power. They operate in the field under unpredictable and less than optimum conditions. In addition to the general challenges of deploying AI, AI systems in the field have more challenges that need to be overcome.

- **Data storage and transmission security:** One of the largest challenges facing both government and commercial organizations, is cyber-security. In a recent report titled "Economic Impact of Cybercrime — No Slowing Down," McAfee and the Center for Strategic and International Studies (CSIS) revealed that cybercrime cost the world between $445 and $608 billion in 2017. Cyber-attacks pose a serious threat to AI systems since these systems are often involved in mission-critical or mission-relevant information gathering and decision making to protect public safety or maintain critical infrastructures such as power and communication. Moreover, these systems may be collecting data that is extremely valuable and/or sensitive. The type and content of stored and transmitted data from remote and mobile AI systems require the highest levels of security.

- **Restricted bandwidth:** Mobile and remote AI systems don't have the luxury of high link speeds. The data captured, especially on a remote system with multiple inputs, is often many magnitudes higher than what the link can transmit.

- **Harsh environments:** Unlike commercial AI applications, remote and / or mobile AI systems need to operate flawlessly regardless of the environment. Temperatures can range from as low as -40℃ c to nearly 85℃, with humidity from 5% to 95%, and in high and low altitudes. Systems also need to survive physical shocks, drops, and never-ending vibration which would normally damage or completely destroy standard commercial systems.

- **Restricted space, cooling, power, and low weight:** Remote and mobile AI deployments do not have the benefits of operating is a commercial facility. Space is a restricted, cooling is limited or none-existent, and power is usually provided by a battery, small generator, or other limited power supply. Systems also need to be lightweight since they may be hand-carried or on small aircraft and other ROVs and UAVs.

- **Limited data storage capacity:** Remote and mobile AI systems have limited capacity to store data and perform operations. Yet the latest AI systems can be equipped with up to 16 high definition cameras. This requires a large amount of storage capacity which is difficult to achieve in a small mobile and remote system.

Why does BiTMICRO® ACUMEN™ Ruggedized Supercompute AI Platform offer a superior platform for mobile and remote, industrial and government AI applications?

ACUMEN Ruggedized Supercompute AI Platform offers a powerful, rugged, compact, high speed, power-efficient, and secure platform for AI including data and image acquisition, parsing, filtering, and transmission.

Extremely Secure: ACUMEN™ AI Platform is fully integrated with BiTMICRO RAMPART™ Distributed End-to-End Embedded Cyber Security. RAMPART Distributed Cyber Security delivers end-to-end AES-256 encryption. RAMPART Distributed Cyber Security creates the most advanced, distributed, and seamless, secure data storage and data transmission environment for remote ACUMEN AI platforms. Regardless of how or where the ACUMEN AI platform is deployed, sensitive data created, stored, processed, enriched or sent by ACUMEN AI platform will be safeguarded by RAMPART Distributed Cyber Security AES-256 encryption, while it is stored and while it is being transmitted to another location.

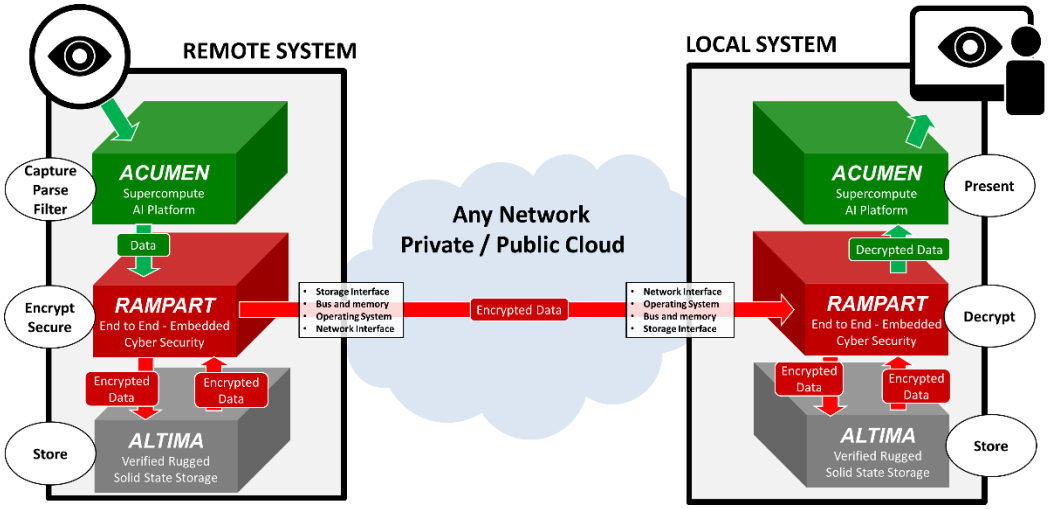
Efficient Bandwidth Use: BiTMICRO ACUMEN AI platform supports up to 16 inputs which can encode and decode 4K resolution videos with a 60Hz refresh rate. A combination of powerful CPUs, GPUs, and accelerators allows ACUMEN AI platform to acquire high-quality images and, thru deep learning applications, allows images to be quickly analyzed, filtered, parsed and encoded. By only sending data that is mission-relevant, transmission bandwidth requirements are greatly reduced.

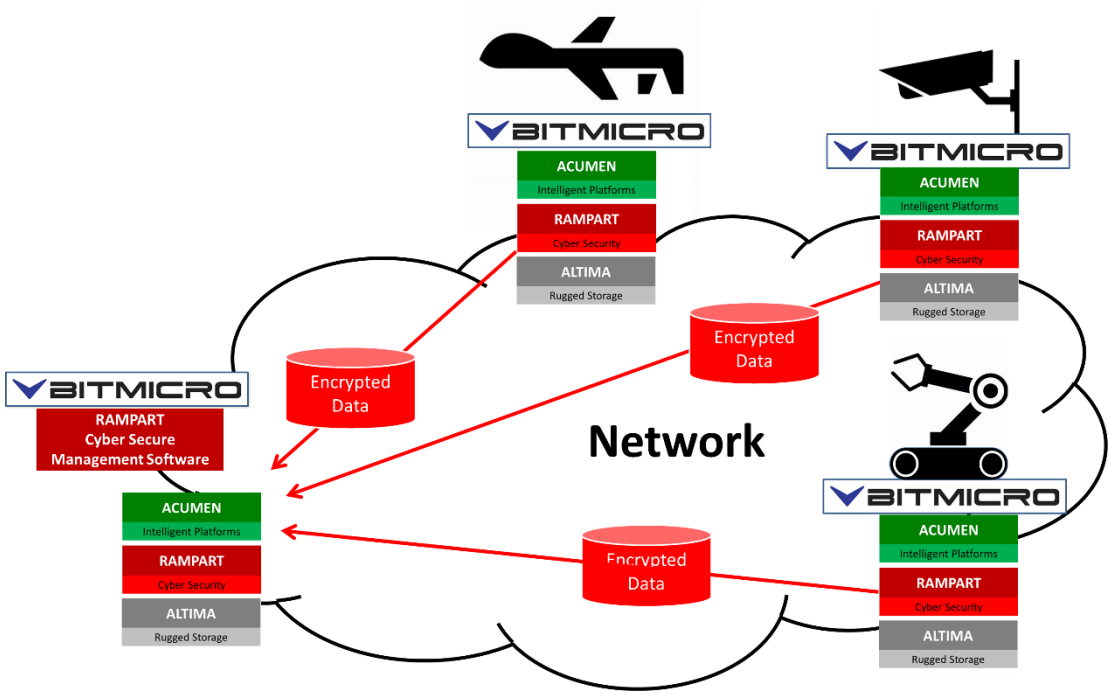
Military Grade Ruggedness: ACUMEN AI platform is designed to the highest standards. It can withstand extreme temperature ranges of -40°C to 85°C, humidity nearing 95%, and a wide range of altitudes. Shock has been tested to exceed 140 G and vibration is rated for 5 Grms at 10-500 Hz. BiTMICRO manufacturing process ensures that every device is specified rugged.

SWaP: ACUMEN AI platform is a low SWaP (Size, Weight, and Power), portable and rugged platform for remote and mobile AI, supercomputing, or data recording applications. Power requirements range from as low as 35w depending on the configuration, application, and amount of RAMPART solid-state storage capacity required. The compact 105mm x 105mm footprint is ideal for smaller systems. System height depends on storage requirements. Weight, including industrial casing, varies from 60oz and up depending on configuration.

Large Storage Capacity: ACUMEN AI platform, through RAMPART Distributed Cyber Security, utilized BiTMICRO ALTIMA solid-state storage. Up to 16TBs of storage capacity is available to address the requirements of even the most data-intensive AI applications. ACUMEN AI platform supports a wide range of NAND types including SLC, SLC Mode over 3D TLC NAND, MLC Mode over 3D TLC NAND, 3D TLC NAND. ALTIMA solid-state storage is time-tested and verified rugged to reliably store and protect sensitive data.

Figure 1: Flow chart showing how the remote and mobile ACUMEN AI platform functions and is supported by RAMPART cyber security and ALTIMA solid-state storage for secure and reliable data shortage and transmission





Conclusion

Artificial Intelligence provides commercial and government organizations with clear advantages.

In addition to the traditional challenges of deploying AI, remote and / or mobile applications have additional challenges including security, bandwidth, ruggedness, low SWaP, and capacity.

ACUMEN AI platform offers a powerful, rugged, compact, high speed, power-efficient, and secure solution for organizations deploying remote and/or mobile AI applications.

ACUMEN AI platform delivers security, performance, ruggedness, efficiency, and capacity. ACUMEN “AI on the Edge” AI platform overcomes the unique challenges facing AI deployments on remote and / or mobile systems.