EMME Architecture, Approach, Development

Brief Notes as we Progress Forward

27.august.2022

Contact us to learn more. We are busy with everything but welcome your communications!

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Our Project Functional Components are divided into teams which involve researchers, students, and also our field operations - and our technology units.

PM Team (Project Management and Administration)

SI Team (Synthetic Intelligence: Logics, Algorithms and Computational Analytics)

DAQ Team (Data Acquisition: Monitoring, Sensing, Instrumental Analytics)

SAT Team (Space, Satellite Data Operations, CubeSat)

GSI Team (Geospatial Information and Intelligence)

EZ Team (Environment (climate change and impact) and Zoonotics (flora/fauna population-changes))

G Team (Genomics: genetics and mutation progression within target pathogens)

I Team (Informatics: data organization, assessment, correction, dataset management and security)

SIM Team (Simulation and Modeling)

EPI Team (Epidemiology)

AG Team (Agriculture)

W Team (Water: hydrology, supply, quality, pollution)

IM Team (Internal Medicine: Neuro-Cardio-Autoimmune-Inflammation and non-infectious disease)
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ID Team (Infectious Disease Medicine)

PH Team (Public Health)

EAD Team (Education, Apprenticeship, Dissemination)

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Within the computational work in EMME, we are integrating four important things:

♦ Parallel Distributed Processing (including the use of many mobile and wi-fi computational units within the context of the following)

♦ Network Computing (on-demand, as-available resources, e.g., the BOINC model)

♦ Modeling and Simulation (including the generation of large amounts of simulated environmental and ecological data - look-alikes and almost-likes - using GAN and other algorithms)

♦ Social Networking and Communicating (engaging the general and total population using socially attractive and proactive methods)

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There is a huge amount of data out there, already and ongoing, but the challenge is in the integration and unification of data streams and its analysis to point out what can be best compared to the classic problem of finding the needle in the haystack....

EMME is identifying specific geo-regions that stand out as being worthwhile to monitor with close attention. We are still at the beginning stage of learning where to look, in which “haystacks” to expect that there can be which kinds of “needles” and how to develop appropriate algorithms for the different types of “haystacks” and “needles”. This is about ecosystems and we can learn fast what we need from a few partners who are specialists. However, based upon the existing published literature and the work done worldwide over the past 30 years especially, much of it triggered by the global experiences with such diseases and their epidemics such as HIV, Ebola, Influenza, and now COVID-19, we do have a good headstart.

Task: identify the best ways to do such geo-specific monitoring that will be new and different in addition to whatever is already known and being done. Method: The “newer” things to consider will be the types of sensors and detectors that can be employed using people just going around from place to place and also using drones, both airborne (UAV) and water (ASV). Tools: These include order-of-magnitude and broader-spectrum forms of spectroscopy that are now practical in terms of portability, use requirements, and cost for implementation. The use of such spectroscopic tools as photoacoustics, MEMS, CEBIT, and cascaded laser technologies, along with SIMOA (single-molecule analytics), combined with photographic and synthetic aperture radar, will provide a powerful, usable, economic and low-error method for answering the questions we face in this project. We also emphasize the power of the computational inference engines, the synthetic intelligence components. We can infer a lot for what we want to know, by using data about different species of flora and fauna that are not

carriers (vectors) of disease organisms, per se, but good indicators that we sure ought to look in specific locations and look for specific convergences and other relations.

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We are designing and implementing a CubeSat satellite for launch into Earth orbit, and this unit will provide a new class of spectroscopic data pertaining to changes within both wild and cultivated vegetation in specific target regions which are deemed to be significant "watch" zones for changes relating to pathogen and vector behavioral changes that can indicate future risks of epidemic and pandemic level disease within human, animal and agricultural species.

We will have more to say about this soon. This will also be Tanzania's first CubeSat and first scientific satellite, and very importantly, it is going to produce a lot of New data that is good for both Africa and the World.

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We are integrating into EMME such technologies as the IntelAgros device, for intelligent control and knowledge acquisition in smart farming. The IntelAgros unit is a compact and network-expandable device that controls irrigation and the administration of fertilizers and pesticides (through the irrigation water) to an open-ended, expandable region of a garden plot or a farm sector.

Power is supplied by an optimized controller that can select the proper balance from any of the following available electricity supplies:

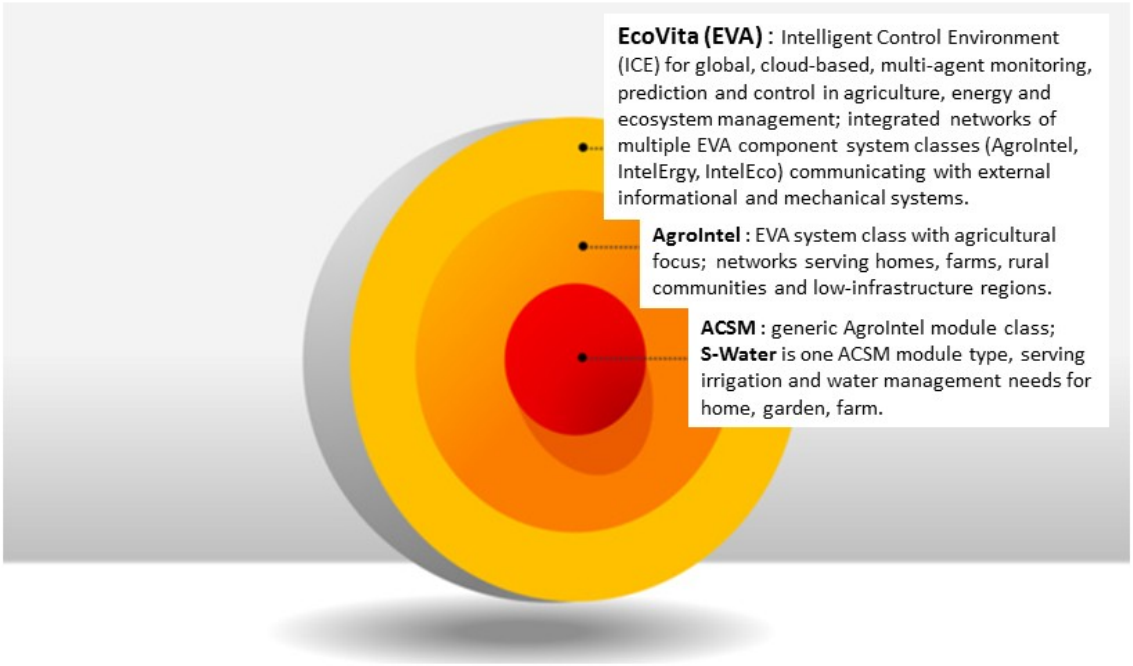
Standard grid	Battery
Solar panel (a component of most units)	Wind generator
Hydroelectric generator	Hydrogen fuel cell

The unit has the following capabilities:

- capacity for ethernet, wi-fi and Bluetooth communications and control
- controllable through a mobile phone app or via an application on a standard computer
- capable of serving as a node in an open-ended MANET for large-scale and long-distance internet connectivity without use of cables, routers or cellular telecommunications network
- ability to serve as a node in a private or public network computing architecture, enabling its processors and memory to be employed in a diversity of computationally-intensive applications (e.g., BOINC model).

AgriBrain is the name of the open, extensible, "agricultural internet" network that is comprised of such IoT and AIoT units as IntelAgros, working also to provide part of the data streams for analysis within EMME. AgriBrain, as a network of IoT devices that "grow" on farms and across rural areas, aids in both data collection and information dissemination. It is a two-way highway for addressing precisely the challenges of living in, and raising food in, a world undergoing universal extremes and other changes in climate, environment, ecosystems, and affecting all species, including those of pathogenic potential. We think of AgriBrain as being the "collective brain of agriculture on planet Earth". Yes.

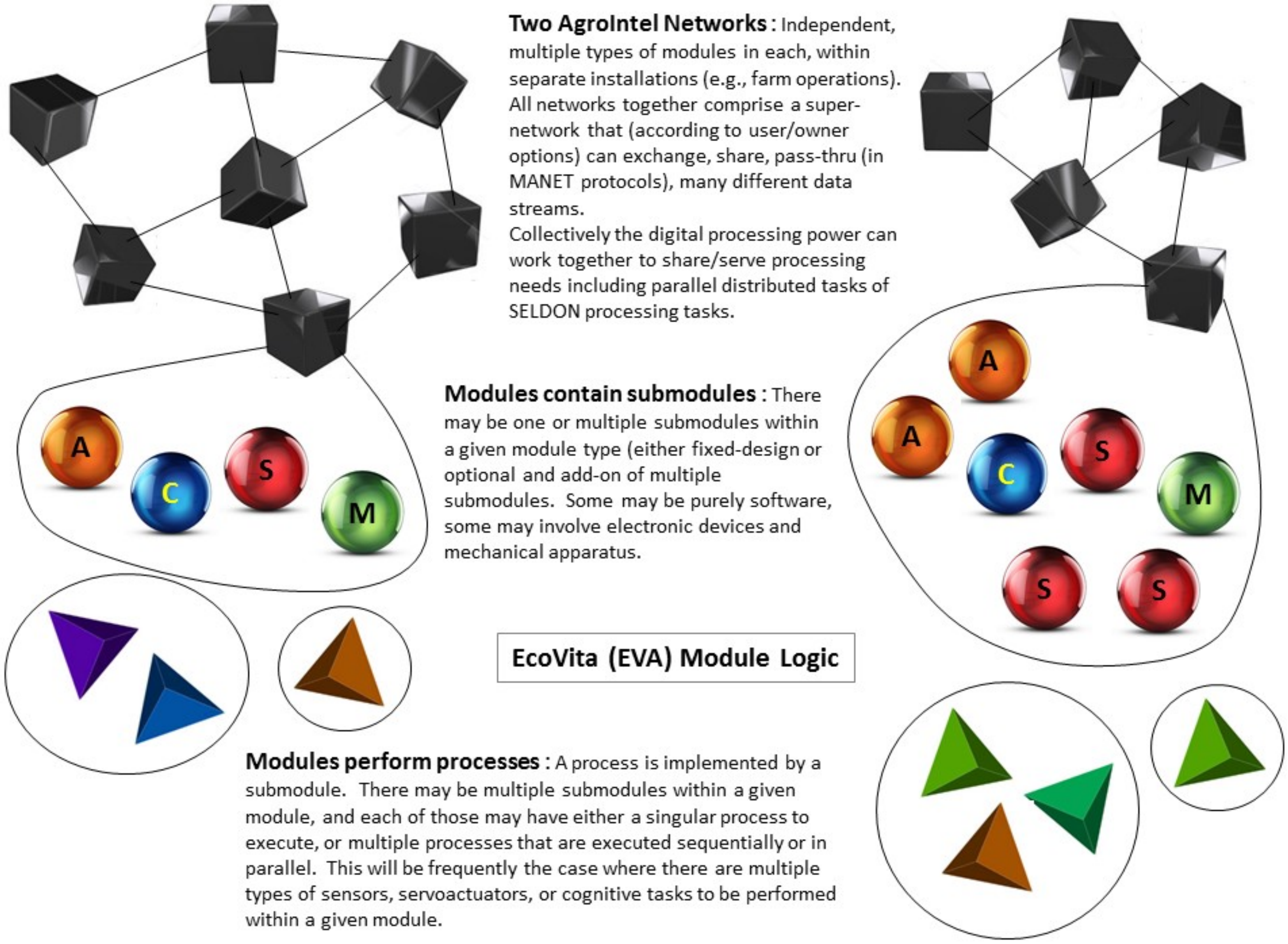
Architectural background to IntelAgros and AgriBrain is illustrated by the following graphics done during previous research (2017-2020).



EcoVita (EVA) is a class-based architecture for networks that provide informational and mechanical control functions using modules that contain four functional submodules: Acquisition, Cognition, Servoactivation, Communication. Each module instance has specific tasks, some that are network-shared, reconfigurable and reassignable among other modules.

In addition to its assigned specific class and instance tasks, each module can serve in a MIMD parallel processing network (CHANT, Banyan CSP) providing multi-directional data throughput and segmented-task processing using BOINC-type distributed network computing with load balancing across the local network and potentially the global EVA network.

EVA operates, as a background set of computational tasks, the data mining, analysis, pattern recognition, and learning that constitutes the SELDON Prediction Engine (forecasting environmental, climate-related, energy, agriculture outcomes).



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EMME is integrating existing (and new) mechanisms for "pre"-epidemiological tracing and tracking. (This means: trying to trace and track indicators of risk and potential for various new "flash-fire" epidemics). Certain conditions of people including their lifestyle, their other prevalent diseases, their diets, can be pointers to where we should have a high-alert watch for the new "M&M" phenomena.

Public health education is essential, starting with and using youth, students pre-university, the general public – and of course, with some incentives for them (thus our attention and focus upon internet, apps, also games and contests and prizes). This is where we bring in OASIS and the whole social-community-network of "COMEET" (communicate, collaborate, meet and make, educate, entertain and play, and trade) experiences with a "metaverse" type environment (something else in which we are involved).

Public information and dissemination of hygiene knowledge in basic and attractive methods is not only a goal of this project but a requirement for it to succeed. Within EMME we are employing the "Terra" social media environment as an Oasis-World (derived from the OASIS architecture) that is a web "metaverse" – but one that is fundamentally different from many commercial offerings in this genre, because of being personalized and health-wellness-focused rather than as a vehicle for generating
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advertising revenue. With "Terra" serving EMME, and making use of the AgriBrain network spread across many small and large farms in particularly rural and non-urbanized regions of the planet, we can literally reach the millions of people who need to be “enlisted” into both public health and hygiene practices and environmental observation and reporting.

A spike of reports, regardless of predictable errors and even deliberate pseudo-facts, regarding changes in species activities, both flora and fauna, can provide our analytical algorithms and our team members with exactly the right trigger-alerts for activating the next steps which may be action involving human observers or robotic sensors or purely data analysis in a new perspective.

The biggest and best way to address the task of learning Early about new “M&M” is to have thousands and millions of “eyes” working for us as part of the “team”. We can do that if we can engage and energize People as we are doing now with EMME.

People are the essence of EMME. We the people are the ones at risk from pandemics that can destroy food production and create famines, or generate pandemics that decimate the population through disease directly. Drugs and medicine can help but these are in response to something and the "something" that EMME is addressing is what can come upon us suddenly and with little or no advance notice.

People are The Preventive Cure and People are at the Heart of what EMME is - More than just "yet another academic research project".