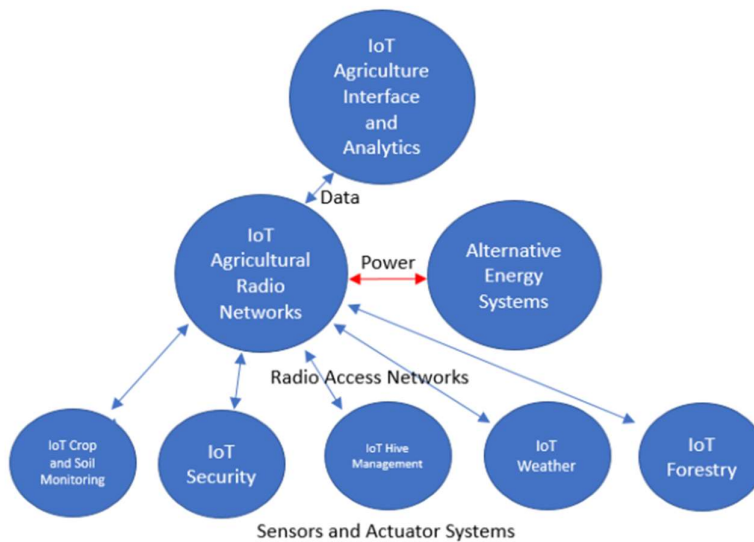


Projects List

1. Agricultural Internet of Things

Background: Agricultural IoT is one of the most promising and potentially important areas of the IoT market. It is also an excellent method to study the IoT ecosystem while making important contributions to a field of research that is critical to the world, that of food and raw materials production. Purdue's CIT Department has had several successful projects in this area, and there are numerous companies and organizations in Central Indiana (such as WHIN) putting large amount of resources into Ag IoT systems.

Overall Project: The plan is to extend our already designed, implemented and tested agriculture sensor and radio network into several different areas to build a "Farm of the Future", where a farmer can monitor and track many of the aspects of Indiana agriculture, that may be spread over a vast geographic area, from any location via a smartphone application. Emphasis will be placed on the user interface and analytics that can quickly update the farmer on specific information that he needs to manage any of the diverse systems he may have in place. Note: this is not a theoretical exercise, as we will completely build out and implement this infrastructure at an Indiana farm, south or Lafayette.



Each of the following is a specific project, from a particular specific sector/topic that will need a project team:

1. Soil conditions: The mainstay of farming, being able to get important information about moisture, temperature, pH, and other factors over a large geographic area is critical to successful yields.
2. Weather information: As important as soil conditions, knowing the weather outlook can make or break a year's crop.
3. Alternative energy: Many areas of agricultural land in Indiana does not have access to electrical power. An alternate power supply consisting of monitored solar, wind and generator power will be implemented and evaluated.
4. Radio Networks: There are numerous LPWAN networks that we will continue to

implement and evaluate. One interesting area of research that will be addressed is using the amateur radio (HAM) frequencies as a no-cost network backbone.

5. Other specific IoT segments to be integrated into an overall Ag IoT system:

- a. Security: Monitoring resources and residences.
- b. "IoT of Bees": A recent area of interest that is receiving a lot of attention due to pathogens and other problems is the monitoring of Bee Hives. Without bees to pollinate plants, many crops could not be grown.
- c. Forestry: The timber industry brings about number of specific challenges, especially in the areas of sensor life and radio propagation.
- D. Human detection and area density.

Project Sponsor: Bowline LLC and several other pending agricultural and technology companies.

2. UAV ground detection and tracking system

Develop software to fly over a group of moving, mobile objects using a small class one UAV and detect and potentially track objects on the ground. This application is desired for agriculture to find herds of cattle in large spaces, forestry to find animal groups in large spaces and in the security area as a potential anti-terrorism application that can find moving groups of people then return a GPS point where a cluster of them will occur.

Skills: Basic understanding of robots or UAV's or physical system interfaces to sensors and software. Basic understanding of development board systems such as Raspberry Pi. Basic programming experience with a programming language such as Java, C/C++ or Python. A desire to learn about deployment real physical systems.

Project Sponsor: Eric Matson

3. Control System Deployment for the Waggle Stack Sensor Project (Argonne National Laboratory)

Employment of the Waggle Stack sensor platform in urban or developed areas is easily managed due to the availability of power and Wi-Fi. When deploying the Waggle Stack to a remote, non-urban environment where power, internet or safety systems exist, the challenge becomes powering the system, remaining operational, connected and safe to environmental conditions or events.

To solve this problem, we will implement a self-organizing, autonomous power generation, control and management system deriving power from solar and wind. Because of potential for extreme conditions such as winter cold, summer heat, and exposure to fire and other natural events, we built in climate control to guard against deviations in temperature that would force the system to a non-operational state. The main goal of this system is to provide continuous power and remain operational 24 x 7 x 365, regardless of the environmental conditions. A secondary goal is to integrate seamlessly into a natural environment with minimal disruption.

The designed system will power the Waggle Stack as an autonomous node allowing for the collection of environment data. The system will also provide operational data to monitor the operational status to determine if maintenance is required. Two nodes were developed, one high power and the other low power. Ends of the spectrum were tested with the idea that the more efficient, smaller and inexpensive the system can be, will provide a less invasive environmental impact and make it easier to deploy.

We will build the system and deploy it to a rural area about 10 miles south of Purdue on a rural farm.

* Preferred skills

- Basic knowledge of design
- Basic knowledge of electronics and sensors
- Basic knowledge of programming in C/C++ or Java

Mentor: Pete Beckman and Raj Sankaran, Argonne National Labs.

Purdue Mentor: Eric Matson

4. Site Development for Briggs Dynamics

A shooting/training range out in Fowler (www.briggscoredynamics.com) operated by a former Ranger and GRS contractor with a wealth of knowledge in these areas, is in need of technical help to redesign his website. He has normally done the development himself but lacks the technical skill to go to the next level.

The work will mostly be technical, but also a bit of design work, all within the WP framework (WP plugins, some custom HTML/CSS and php). This will create significant improvements for the business public face given significant improvements made on the backend and front-facing of the website. (Perfect for a little Scrum project).

Technical contact: Robert Bott robb8002@gmail.com