**Fermentabot 2.0 - Artisan Food Innovation Via Biochemical Data**

The Fermentabot is an adaptation of the Food Computer environment, which uses climatic conditions sensed by an array of sensors and controlled according to Climate Recipes to grow plants and control the phenotype they express. Fermentations are communities of microbes living in and consuming a substrate within a particular environment; their population dynamics, metabolisms, and therefore flavor expressed as phenotype depend heavily on environmental conditions such as temperature, humidity, oxygen and CO2 concentration, pH, and salinity.

The goal of this experimentation has been to expand the range of uses for locally available ingredients, and to enlarge the palette of flavors available for composing dishes—since microbial metabolism converts molecules that have no flavor into molecules that do, fermentation becomes a flavor-creation tool.

**The Fermentabot 2.0 System Breakdown:**

* The Open Ag Brain Box, common to all OpenAg Food Computers. The brain box connects to all sensors and actuators and controls the climate inside a Food Computer according to climate recipes. The brain box will incorporate a photon controller for data logging and a google sheets interface
* The Fermentabot housing, which holds the mixtures which are being fermented, and encloses a controlled atmosphere around them, as well as the sensors and actuators that connect to the brain box. The housing will use an insulated food storage box which holds standard-sized 2.5” deep pans (hotel pans or Gastronorms) with controlled heating, cooling, and humidity.
* Fermentation Climate Recipes, the necessary environmental conditions to achieve a particular flavor profile, specifying ingredient composition, pre-processing steps, and microbes to be cultured.

**System Specifications (For Growing Koji):**

*Mechanical System*

1. Housing and storage - insulated food storage box and perforated food pans/cotton cloth
2. An “Environmental Chamber” that can be attached/removed from the catering box and contains all the mechanical actuators.
3. Air circulation heating/cooling system
   1. 12V Peltier Cooler
   2. 12V heating element
   3. Low-voltage equipment-cooling fan
4. Humidification system
   1. External humidification cartridge
   2. Miniature ultrasonic fogging technology
5. Optional: air/water filters

*Electrical/Software System*

1. Hardware
   1. Brain Box 2.0 (developed by OpenAg for PFC\_EDU)
   2. Control of climate (temperature, humidity, atmospheric gas composition)
2. Sensing
   1. Primary: Air temperature, air humidity, substrate temperature (x2),
   2. Secondary: air O2, air CO2, pH
3. Software
   1. Notifications and interaction on a web-based UX for step-by-step recipe instructions
   2. Data logging and wifi
   3. Simple GUI for writing climate recipes
   4. Select climate controls based on climate recipes for fermentation types
   5. Develop datasets on koji fermentation, collecting environmental data in fermentabot and auxiliary datasets on enzyme activity, protein and starch turnover, microbiome, and volatiles, for multiple grain types
   6. Use fermentation data to produce climate recipes that can be selected by the user for substrate, flavor, and enzyme expression