# Project Name:

AGRASP (Autogenerated, Generalizable, Remote Actuation & Sensing of a Process)

or

GRASS (Generalizable, Remote Actuation & Sensing System)

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EECS 149 Project Charter, Fall, 2018

## Project Goal:

To create a system that allows for remote sensing, actuation, and control of processes that is generalizable across application areas.

Further elaborated, this translates into the following subgoals:

- Designing a communication interface between process-level microcontrollers and a mobile phone using, for example, WiFi connection, GSM, websites, etc.
- Implementing feedback control at the process-level to maintain a desired property of a system that can be supervised/controlled by a mobile phone .
- Making the architecture unified (i.e. compatible across diverse application areas)
- Creating a viable UI that can work with all three application areas

## Inspiration

SCADA (Supervisory Control & Data Acquisition) is a framework used to supervise industrial production processes at various factories. (Refer to Appendix (1,2) for details.) We decided to expand the concept by:

(1) Adding a networking aspect for 'remote' supervision

(2) Applying the principle to diverse application areas such as smart homes, hydroponics, etc.

## Application Areas:

To fulfill the value proposition, we then further divide the project into three futuristic application areas that are predicted to have a core impact on the economy of tomorrow. We intend to implement our system in each of the three domains below.

1) Industry 4.0/Smart Manufacturing
    - ❏ Remote control of a Kobuki Robot [mimics movement of a package transfer robot throughout a storage facility; user has access to a 'digital twin' of environment, not included in demonstration]

2) Smart Homes
    - ❏ Automated heatpan that can follow the behavior of a specific heat curve. (Thermal sensor/actuator)
3) Automated/'Smart' Agriculture
   In order to properly monitor and control an agricultural system, several combinations of sensors and actuators can be used:
    - ❏ A soil moisture sensor and a watering system to ensure the plant is properly watered
    - ❏ A temperature and humidity sensor as well as a heater and a humidifier to control the environment of the plant. The humidifier would be controlled using control signals (on/off) received from a microcontroller based on closed loop feedback. (Refer to Appendix for more details)
    - ❏ A light sensor and a grow light in order to give the plant enough light to grow even in poorly lit areas.

## Project Resources:

- ➢ Microcontrollers (General)
- ➢ Thermal Sensor/Heatpan (Automated Heatpan)
- ➢ Webcam/actuated door lock (Security Cam )
- ➢ pH Sensor
- ➢ Smoke Detector
- ➢ Kobuki Robot
- ➢ Pressure Sensor
- ➢ Website Domain
- ➢ ESP32 microcontroller boards (WiFi capable)
- ➢ Raspberry Pi (Server)
- ➢ Soil moisture sensor/ water pump
- ➢ Temperature/humidity sensors/actuators
- ➢ Light sensor/ grow light

## Project Schedule:

- October 19: Project Charter
- October 26: Choice of platform finalized after discussion with GSIs
- October 30 (Milestone 1): Sense accelerometer values from Buckler, transmit via networking capability of ESP8266, receive at Amazon EC2 Cloud Instance, and display on screen.
- November 2: Network infrastructure built
- November 9: Network and process design finished
- November 13: Milestone 2
- November 16: Barebones network architecture completion

- November 23: Finalization of each of the applications
- November 30: Integration testing of the entire system
- December 10: Demonstration video made, slides prepared
- December 11: Final Presentation
- December 14: Final report and video turned in

## Risk and Feasibility:

Although the goal of our project is to implement network architecture that seamlessly generates user interface with a variety of plants (sensors/actuators), our plants should not be trivial to control/create. The network infrastructure may be difficult to set up on campus due to network restrictions.

## Link to the project GitHub repository:
https://github.com/adityagi1/eecs149-proj

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## Reach Goals:

**We have thought of some reach goals in case our original goals are met within the timeframe of the project:**

- ❏ Sensing and (modifying?) a pH level in a simple chemical
- ❏ Remotely supervising a simple step in a photolithography module in microfabrication
- ❏ Security Cam: Video camera that automatically opens doors when household members arrive at front door. (Optical sensor, translational actuator)
- ❏ Smoke detection to notify production engineers when a process is on fire/dangerous.

## Links/Resources:


(1) https://en.wikipedia.org/wiki/SCADA
(2) https://www.allaboutcircuits.com/technical-articles/an-introduction-to-scada-systems/
(3) https://www.wesg.ca/2013/03/automate-a-basic-humidifier-with-an-arduino-relay-and-simple-sensors/