

Michigan State University
College of Engineering; Dept. of Electrical and Computer Eng.
ECE 480 Capstone Design Course Project Charter

Sponsoring Company/ Organization: MSU Dept. of Electrical and Computer Eng.

Contact Information:

Name: Professor Andrew Mason

E-Mail: mason@msu.edu

Phone and Best Time of Day to Call: 517-355-6502, 9am-5pm Mon-Wed

Background Information:

Business Case:

- Need a model sensor-based platform to develop and test embedded systems in ECE courses.

Project Intellectual Property Considerations:

- Will the student Design Team be required to sign a Non-Disclosure Agreement?
 - o NO
- Will the Design Team be able to post their work on the course web site?
 - o YES
- Will the student Design Team be working with technology contained in pending patents not yet granted?
 - o NO
- Can the electronic design be shown, but the embedded software protected?
 - o ??

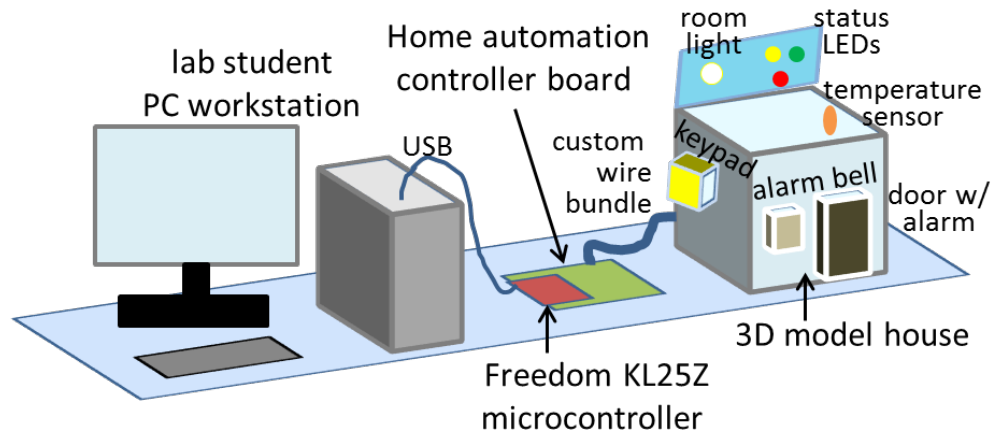
Opportunity Statement:

- What **clearly defined Customer Problem** you hope to solve with this project?
 - o Embedded systems lab experiments need to interface with model (or real) hardware platforms. We need a new hardware platform that is interesting to students.
 - o This design can be completed in a 13 week working semester with students.
- Does this problem exist now, or in the future?
 - o We are ready now for this system to begin developing labs for the future.
- Who is the customer?
 - o Who makes the buying decision?
 - Andrew Mason
 - o Who will the ECE 480 Design Team deliver their project to at the end of the semester?
 - Andrew Mason

- o Describe the benefit to the end Customer for this project.
 - Hardware platform suitable for development of embedded systems lab projects.

Deliverables:

- Describe what is to be delivered at the end of the semester.
 - o Ideally the final project will be a functional “ready for end use” home automation model platform consisting of (see illustration below):
 - A benchtop-sized 2D or 3D physical model of a home that holds the following sensors and actuators
 - Example home security and automation sensors like
 - door/window open sensor
 - motion sensors (possibly capable of distinguishing large objects (people) from small objects (pets))
 - temperature sensor (indicates if HVAC is working)
 - water level sensor (indicates water leaks)
 - fire alarm
 - clap-sound detector
 - keypad for user system control
 - Example actuators (outputs) like
 - lights (e.g. motion activated lights)
 - audio alarm
 - visual alarm (strobe)
 - controllable 110VAC plug (to control anything plugged in)
 - status display (LEDs, LCD screen, or Bluetooth to smartphone app)
 - A home automation controller board consisting of
 - a Freedom KL25Z microcontroller (that could be programmed in lab experiments to define sensor/actuator response algorithms); some test algorithm can be implemented to demonstrate functionality of the model platform
 - bread-boarded analog interfaces for all sensors and actuators that enable them to be read on microcontroller inputs (sensors) or controlled by microcontroller outputs (actuators)
 - power supply and any necessary transformers
 - (optional) battery backup capability
 - USB interface to PC capable of sending email for periodic status update or to report an alarm



Concept illustration of a model home automation platform for embedded systems lab experiments.

Goals:

- Describe what success will look like at the end of the semester.
 - A home automation model system composed of a controller board and multiple sensors and actuators from the examples above whose functionality can be demonstrated by manually tripping sensors that in-turn (through software on the controller board) activate actuators.

Scope:

- The focus should be on creating a close loop system with at least 2 sensors, at least 2 actuators, and the necessary analog interfaces. The design team should not expand to too many sensors or actuators at the cost of not completing the controller board.
- A physical model of a house to hold the sensors is highly desired, but if necessary they can be mounted on any framework that allows their functions (e.g. door open sensor) to be demonstrated.
- We can provide several Freedom KL25Z microcontroller boards.

Constraints:

- List all constraints on the project team.
 - Must build controller board around the Freedom KL25Z microcontroller for compatibility with existing and expected embedded systems lab projects.
 - Entire model must fit compactly on a lab bench (ideally taking about ½ of a standard benchtop).

Project Team: (Completed once semester begins)

Name	Responsibility

Faculty Advisor: (Assigned by ECE Dept . based on project requirements)
