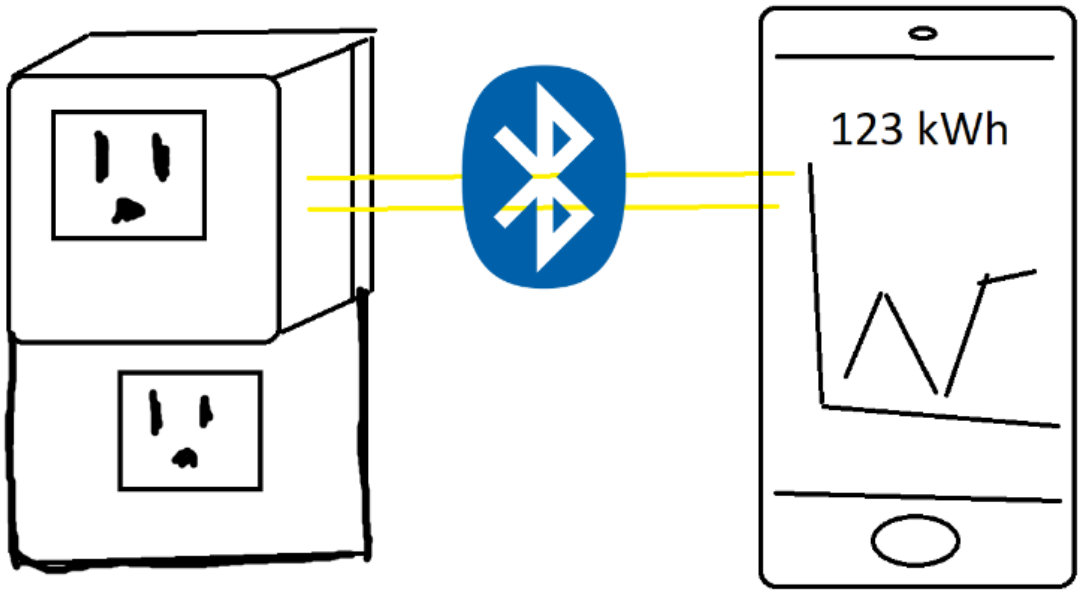
1. **Introduction**

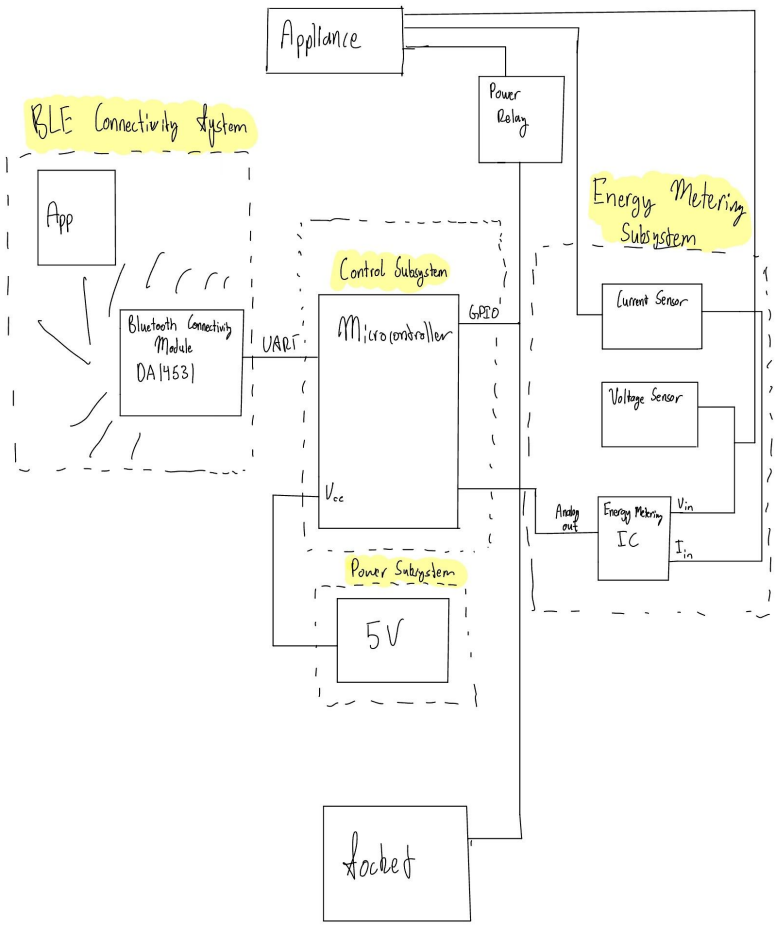
- **Problem:** As a technologically modern world, we have a lot of home devices that are consistently reliant on a lot of energy. However, we tend to overuse these devices, thus leading to dangerously high energy usage. An average of 34% percent of electricity at the household is wasted. This problem would become more apparent to users if they were able to visualize and track their energy consumption for home devices.
- **Solution:** The solution for this problem would be to have a smart home energy monitor. This monitor would track energy consumption for the connected device over a period of time. There would be a microcontroller to process the values from the sensors and handle communication. An app would be made to display the results and send notifications to users if a certain device is consuming dangerously high amounts of power.
- **Visual Aid:** A pictorial representation of your project that puts your solution in context. Include other external systems relevant to your project (e.g. if your solution connects to a phone via Bluetooth, draw a dotted line between your device and the phone). Note that this is not a block diagram and should explain how the solution is used, not a breakdown of inner components.



- **High-level requirements list:**
    i. A physical device that can handle a load of up to 250 Volts and 20 Amps as this is the maximum household socket output in most regions around the world.
    ii. We have an application that is able to fetch data wirelessly that is visually appealing and easy to understand for the customer. This reach should be around 100 meters as this is the normal bluetooth range.

iii. We aim for an accuracy of +- 5%. The standard we will be referencing is IEEE-Standard 1459-2010. This standard defines terms, concepts, and test methods for the measurement of electric power quantities.

2. **Design**
   - **Block Diagram:** Break your design down into blocks and assign these blocks into subsystems. Label voltages and data connections. Your microcontroller can live in multiple subsystems if you wish, as in the example below.
     Sample block diagram for electric longboard + remote



   - **Subsystem Overview:**
     i. Microcontroller: Manage functionality and interactions of all other subsystems.
     ii. Power Relay: Takes care of turning devices on and off. Essentially used to control the power supply to the connected devices.

iii. Sensors: The necessary sensors are a current sensor, a voltage sensor, and a temperature sensor that will connect to microcontroller to use the data
iv. Energy Metering IC: This IC interacts with the current and voltage sensors to accurately measure the energy consumption of devices connected to the socket.
v. Bluetooth Connectivity Module: Helps facilitate transfer of sensor data to app via Bluetooth.

- **Subsystem Requirements:**
  i. Microcontroller: We will use this to handle data from sensors to be analyzed and output a signal to the power relay to turn on or off the appliance. It will also output to the bluetooth module the relevant data and get user input.
  ii. Power Relay: Will receive input from the microcontroller whether the power relay should allow the the appliance to receive voltage and current from the wall socket or not
  iii. Sensors: The necessary sensors are a current sensor, a voltage sensor, and a temperature sensor. The current sensor measures the current flowing through the socket's outlet, which will be used for power consumption calculations. The voltage sensor measures the voltage level of the power supply, which will be used for power consumption calculations. The temperature sensor helps users monitor the temperature around the socket, which helps alert users if they need to adjust connected devices.
  iv. Energy Metering IC: This IC interacts with the current and voltage sensors to use the data to feed active energy, apparent energy and reactive energy to the microcontroller to use the data.
  v. Bluetooth Connectivity Module: Will get fed data from microcontroller to output to user application. It will also input data from user app to send to microcontroller so control out power relay
- **Tolerance Analysis:** Identify an aspect of your design that poses a risk to successful completion of the project. Demonstrate the feasibility of this component through mathematical analysis or simulation.
  i. Each IC or component's tolerance, such as resistance, must be carefully tracked. Cumulative imprecision can lead to potential hazards if one component's output exceeds another's limit. Additionally, it can result in inaccuracies in energy consumption reporting.

3. **Ethics and Safety**
   - Safety Issue: Dealing with high voltage will require us to take extra precautions during testing and building of our appliance
     i. Work on circuit when not plugged in
     ii. Sources are grounded when dealing with live wires
     iii. Have someone with you during lab work
   - Safety Issue: Handling different tools in the lab

i. Never be in the lab alone
ii. Follow tool handling procedures