<center>**Homework no. 1**</center>

<center>**Energy management in smart homes**</center>

<center>**Axinte Calin-Cristian, Puscasu Bogdan**</center>

There are several energy management solutions for a smart home. Here are a few examples:

Smart thermostats: can learn your temperature preferences and adjust the heating or cooling automatically. They can also be controlled remotely through a smartphone app, so you can adjust the temperature even when you're not at home.

Energy monitoring systems: can track your energy consumption in real-time and provide insights on where you're using the most energy. This can help you identify areas where you can reduce energy usage and save money.

Smart lighting: allows you to control your lights remotely through a smartphone app or voice commands. You can also set schedules or use motion sensors to automatically turn off lights when no one is in the room.

Smart appliances: refrigerators, washing machines, and dishwashers, are now available in smart versions. These devices can be controlled remotely and can optimize their energy usage to save you money.

Energy management in a smart home is achieved through the use of various sensors, devices, and software programs that work together to optimize energy usage and reduce waste.

These programs can analyze data from the sensors to identify patterns and make predictions about energy usage. This data can be used to optimize the home's energy usage, reduce waste, and save money.

Smart home systems can be integrated with other systems, such as **solar panels** and **energy storage systems**, to further optimize energy usage. For example, excess energy generated by solar panels can be stored in batteries and released when needed, reducing the home's reliance on the grid and saving money on energy bills.
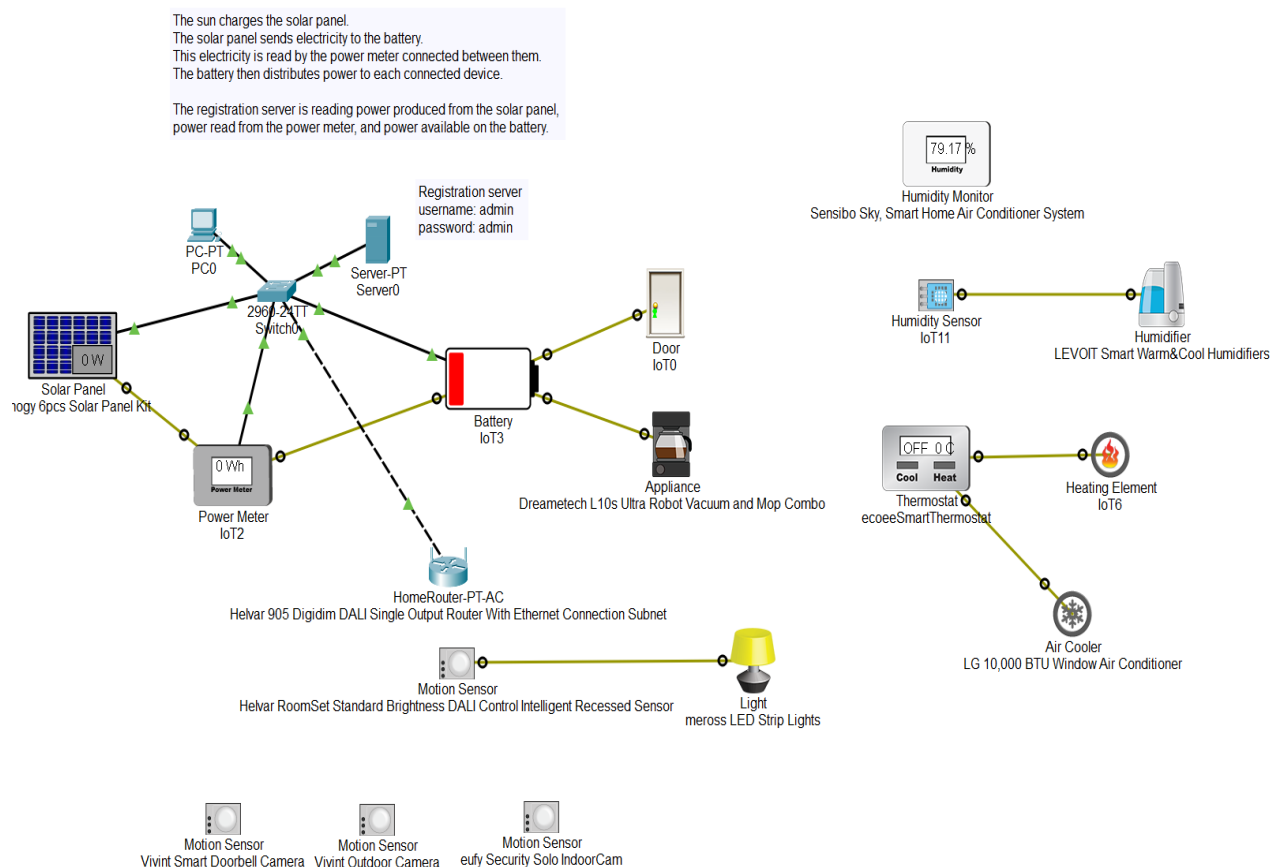
Software can be programmed to automatically charge energy storage systems during off-peak times when energy is cheaper, and release stored energy during peak demand times to reduce reliance on grid power. It can also be used to automatically adjust the home's energy usage based on the energy generated by solar panels and stored in energy storage systems.

Smart home software can provide real-time monitoring and control of energy usage, allowing homeowners to adjust as needed to optimize energy usage and reduce waste.

Examples of components and costs (excel page):

IOT_HW1

Cisco Packet Tracer:

The sun charges the solar panel.
The solar panel sends electricity to the battery.
This electricity is read by the power meter connected between them.
The battery then distributes power to each connected device.

The registration server is reading power produced from the solar panel, power read from the power meter, and power available on the battery.
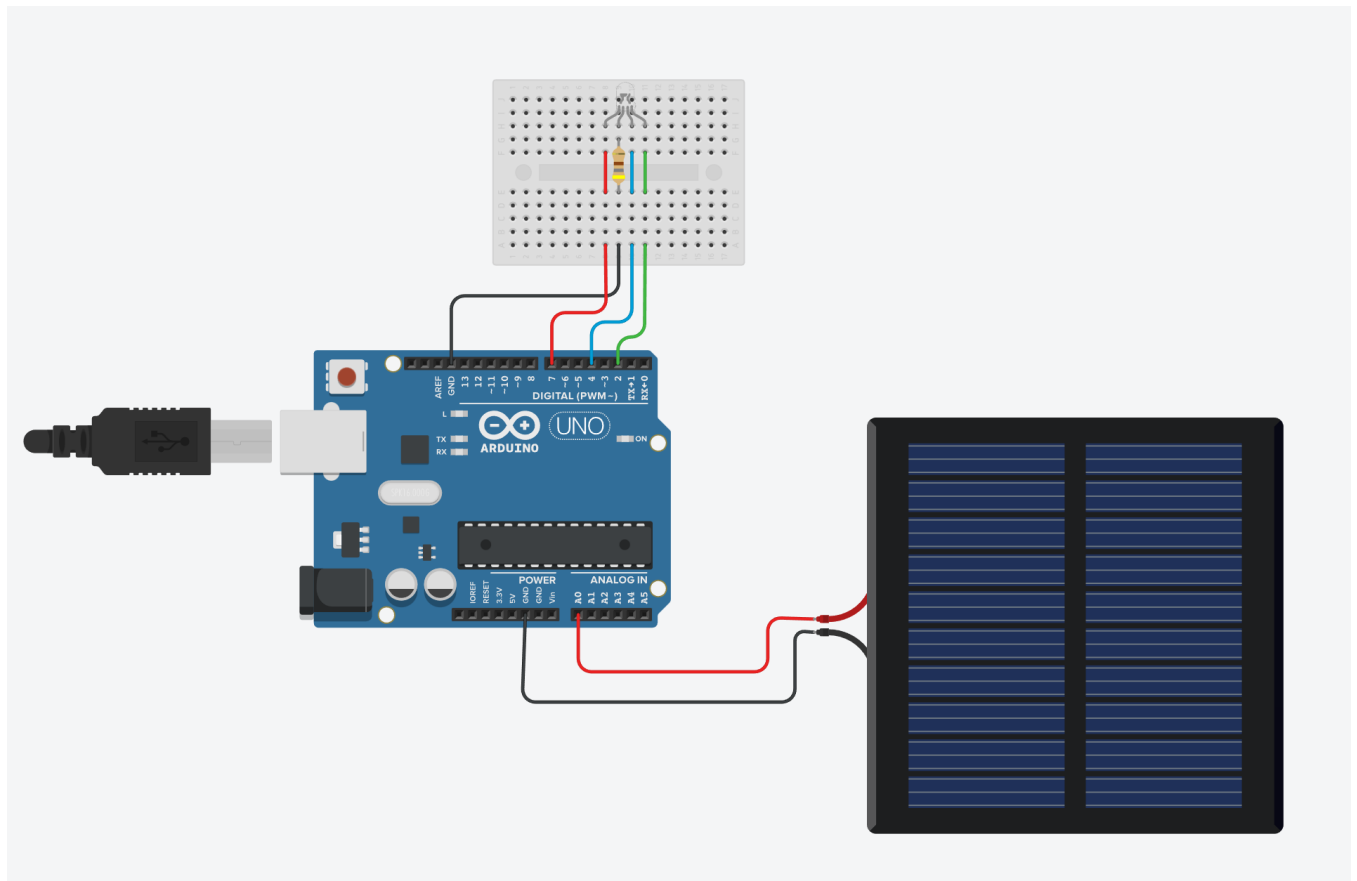
Functionalities:

We modeled an energy management system which includes solar panels and batteries. These components are connected to sensors and a central management system which monitors how the energy is used. The battery is further connected to the various smart objects in the house.

The solar energy is stored in the battery when it is not needed, and based on the implemented software it can be saved for later use, for example when the sun is down, or other power sources are unavailable.

The power meter connected to the solar panel and battery monitors the energy that is produced, and the data is stored in the server.

Some of the sensors/objects are communicating with the server via Wi-Fi.

TinkerCad:

Functionalities:

The system calculates how much solar energy it receives, and based on that the rgb led changes color. Based on the minimum, maximum and current energy value, the data is normalised to be between (0, 1).

If the power is between (0, 0.34) the led turns red, between (0.34, 0.67) it turns blue and otherwise it turns green.