Creating an irrigation system for your home garden is a wonderful idea that can save time, conserve water, and ensure your plants are well-watered. Here's a step-by-step guide to help you design and implement a basic irrigation system:

Step 1: Assess Your Garden's Needs

1. **Map Your Garden**: Draw a layout of your garden, noting the different zones and types of plants. Different plants have different water needs.
2. **Determine Water Requirements**: Identify how much water each plant type requires and how frequently they need to be watered.

Step 2: Choose an Irrigation System Type

1. **Drip Irrigation**: Ideal for water efficiency and direct watering to the roots. Great for vegetable gardens and flower beds.
2. **Sprinkler System**: Suitable for lawns and larger areas with uniform watering needs.
3. **Soaker Hoses**: Easy to install and good for garden beds.

Step 3: Gather Materials

For a basic drip irrigation system, you will need:

- Main supply tubing (1/2 inch or 3/4 inch)
- Drip emitters or micro-sprinklers
- Tubing connectors (tees, elbows, end caps)
- Pressure regulator
- Filter
- Timer (optional but recommended for automation)
- Stakes to secure the tubing

Step 4: Install the System

1. **Connect to Water Supply**:
    - Attach a backflow preventer, filter, and pressure regulator to your outdoor faucet.
    - Connect the main supply tubing to the pressure regulator.
2. **Lay Out the Main Tubing**:
    - Run the main tubing along your garden beds, securing it with stakes.
3. **Branch Off with Smaller Tubing**:
    - Use connectors to branch off smaller tubing to individual plants or rows of plants.
    - Install drip emitters or micro-sprinklers at the base of each plant.
4. **Test the System**:
    - Turn on the water to check for leaks and ensure all emitters are working properly.
    - Adjust the emitters if necessary to ensure even water distribution.
5. **Automate with a Timer**:
    - Install a timer on your faucet to automate watering schedules, ensuring consistent watering even when you're not around.

Step 5: Maintain the System

1. **Regularly Check for Clogs**: Clean the filter and check emitters for clogs.
2. **Adjust as Needed**: Modify the layout and emitter placement as your garden grows and changes.

Additional Tips

- **Mulching**: Use mulch around plants to retain moisture and reduce evaporation.
- **Seasonal Adjustments**: Adjust the watering schedule based on the season and weather conditions.
- **Rain Sensors**: Consider adding a rain sensor to prevent overwatering during rainy periods.

Example Setup

1. **Small Vegetable Garden**:
    - Main supply tubing runs along the perimeter.
    - Drip emitters spaced every 12 inches along rows of vegetables.
    - Timer set to water early in the morning.
2. **Flower Beds**:
    - Soaker hoses snaked through flower beds.
    - Connected to a timer with a rain sensor.

By following these steps, you can create an efficient and effective irrigation system that will make garden maintenance easier for your parents.

Absolutely! Integrating an Arduino or STM32 microcontroller can add a lot of flexibility and intelligence to your irrigation system. Here's a step-by-step guide on how to set up an automated irrigation system using an Arduino or STM32 microcontroller, complete with data display on an app.

Step 1: Gather Materials

For an Arduino-based system:

- Arduino (e.g., Arduino Uno or Mega)
- Soil moisture sensors
- Relay modules or solenoid valves
- Water pump (if needed)
- LCD display or OLED display (optional)
- Wi-Fi module (e.g., ESP8266 or ESP32)
- Jumper wires and breadboard
- Power supply (appropriate for your solenoid valves and sensors)

For an STM32-based system, the components will be similar, but you'll use the STM32 microcontroller instead of the Arduino.

Step 2: Connect the Hardware

1. **Soil Moisture Sensors**:
   - Connect the VCC and GND pins of the soil moisture sensors to the 5V and GND pins of the Arduino.
   - Connect the signal output of the soil moisture sensors to the analog input pins on the Arduino.
2. **Relay Module/Solenoid Valves**:
   - Connect the IN pins of the relay modules to the digital output pins on the Arduino.
   - Connect the relay modules to the solenoid valves or water pump, ensuring they are powered appropriately.
3. **Wi-Fi Module**:
   - Connect the Wi-Fi module (e.g., ESP8266) to the appropriate pins on the Arduino. Typically, you'll need RX, TX, VCC, and GND connections.

Step 3: Write the Arduino Code

Step 4: Set Up the App

You can use a service like Blynk or Firebase to create a mobile app interface for your irrigation system. Here's a brief outline using Blynk:

1. **Install Blynk App**: Download and install the Blynk app from the App Store or Google Play.
2. **Create a New Project**: Create a new project and select your hardware model (e.g., ESP8266).
3. **Add Widgets**: Add widgets to display soil moisture levels and control the relay.
4. **Get Auth Token**: Copy the Auth Token from the Blynk app and add it to your Arduino code:

Step 5: Test and Calibrate

1. **Upload the Code**: Upload the Arduino code to your board.
2. **Test the System**: Place the soil moisture sensors in your garden and test the system to ensure it waters the plants when needed.
3. **Calibrate the Thresholds**: Adjust the moisture thresholds based on the specific needs of your plants.

Step 6: Monitor and Adjust

Use the Blynk app to monitor soil moisture levels and manually control the irrigation system if needed. You can also set up notifications for low soil moisture levels.

By following these steps, you can create a smart irrigation system that automates watering and provides real-time data to an app.