

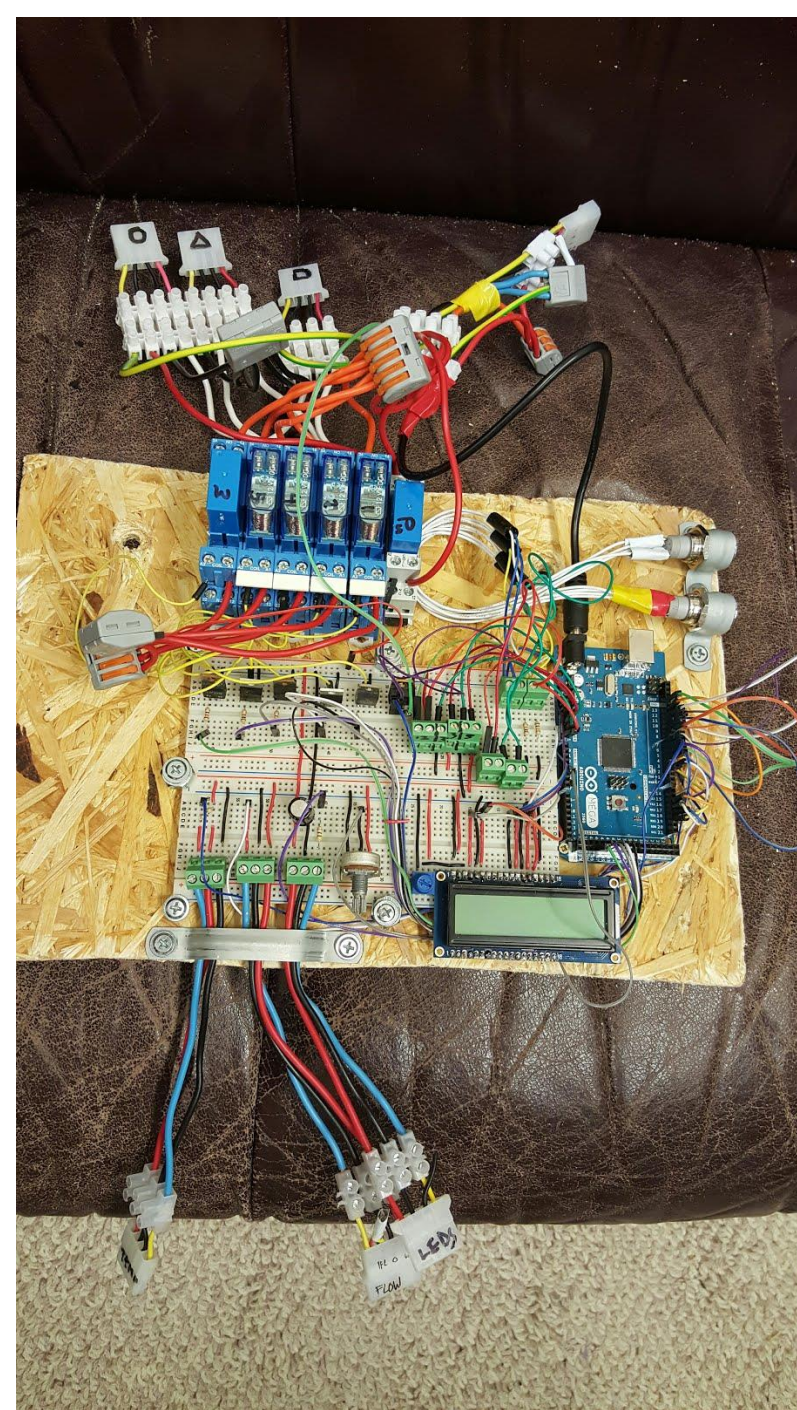
showerloop

the water recycling shower system



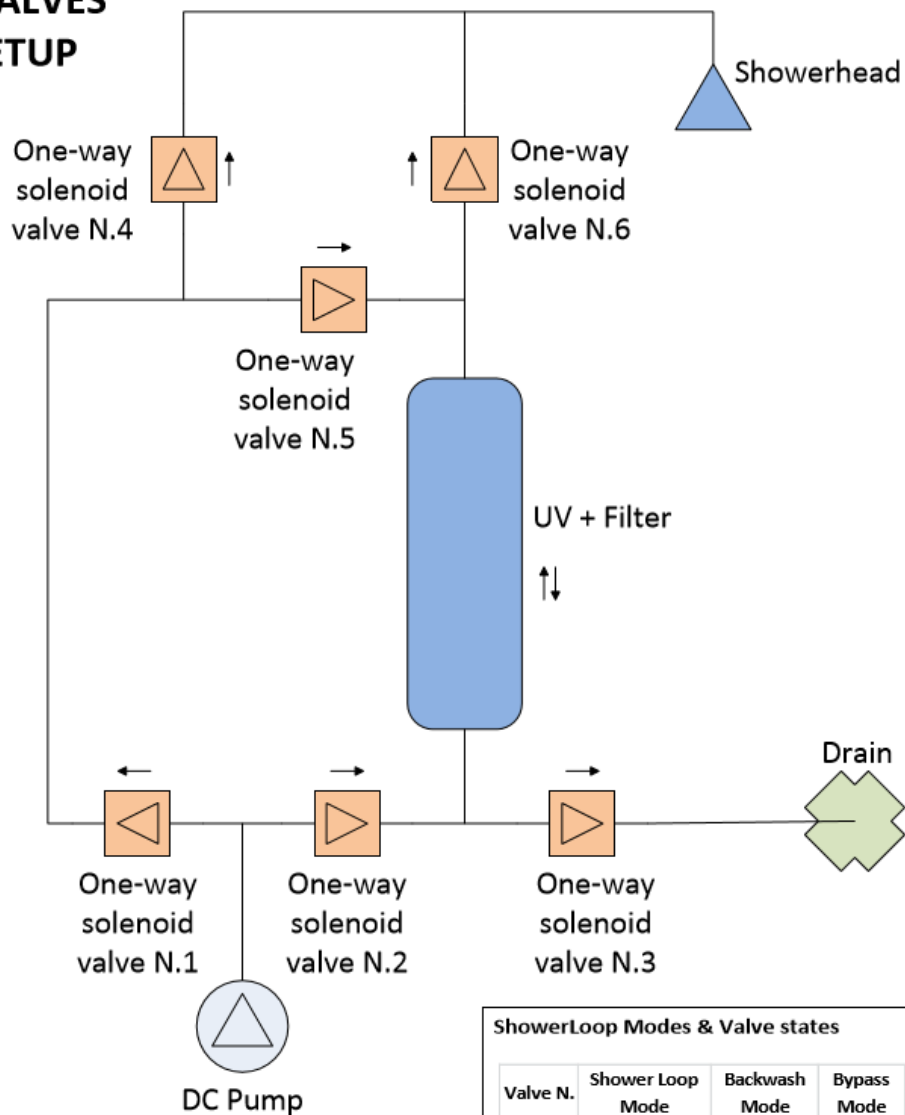
showerloop

- Water recycling shower system
- Uses UV and activated carbon filters
- Water circulated by a dc pump
- Has a controller for controlling water flow and other components
- Has various modes: shower mode, bypass mode, backwash mode



the controller for water recycling shower system

6-VALVES SETUP



ShowerLoop Modes & Valve states

Valve N.	Shower Loop Mode	Backwash Mode	Bypass Mode
1	closed	open	open
2	open	closed	closed
3	closed	open	closed
4	closed	closed	open
5	closed	open	closed
6	open	closed	closed

controller tasks

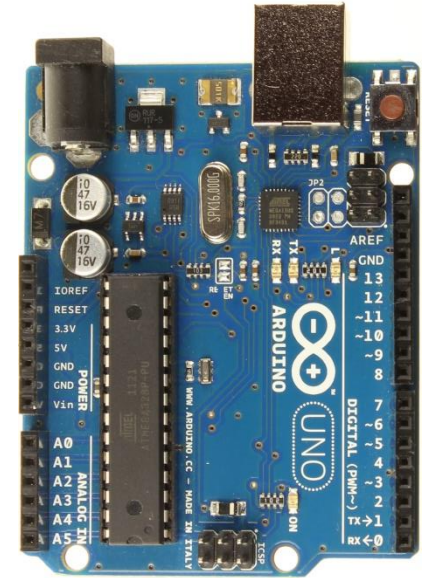
- Allow mode selection
- Open correct valves
- Turn pump on/off
- Gather data for display

components

- Microcontroller: Arduino (Mega or Uno)
- Valves: solenoid or motorized
- DC pump: 12V or 24V
- Key electronic components: relays, transistors (ex. TIP-120, MOSFET)
- Potentiometer (knob for mode selection)
- LCD display (for showing data)
- Buttons (on/off)
- Additional components (various sensors)

microcontroller

- Takes user input and controls the system
- Open source
- Easy to learn



Arduino Uno

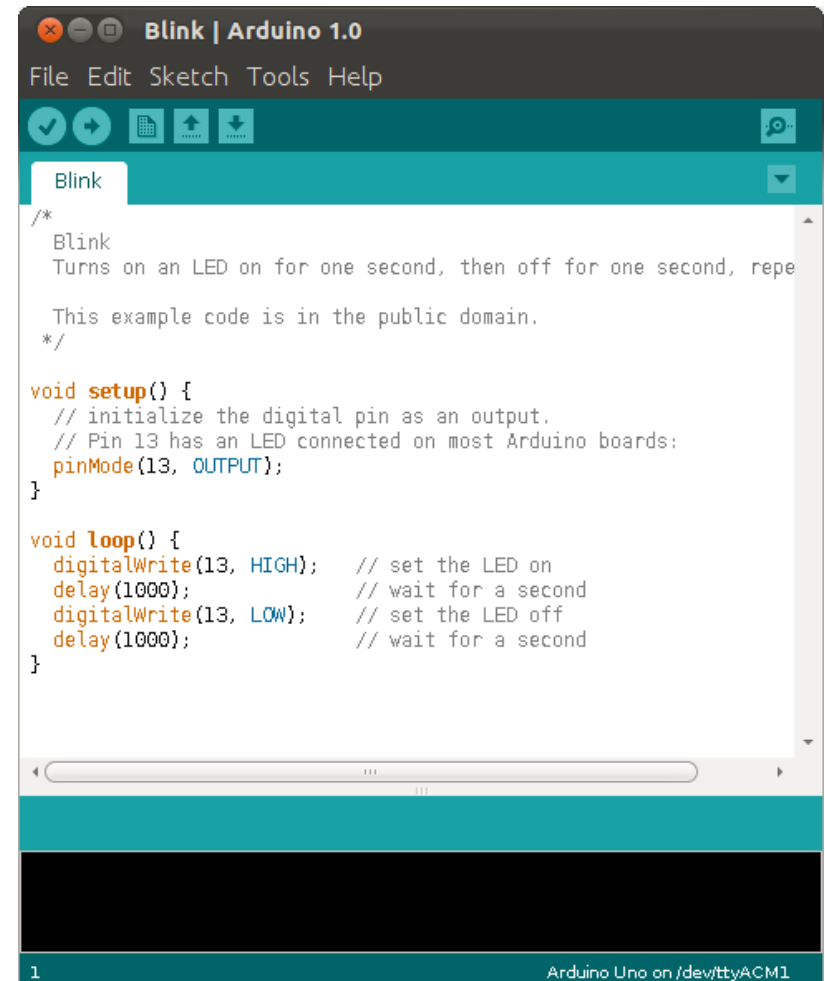
- Clock speed: 16MHz
- Digital I/O pins: 14
- Analog input pins: 6
- Flash Memory: 32 KB

Arduino Mega

- Clock speed: 16MHz
- Digital I/O pins: 54
- Analog input pins: 16
- Flash Memory: 256 KB

code

- Free integrated development environment (IDE) available
- Programming made simple, lots of easy examples
- Introduce, initialize and loop

A screenshot of the Arduino IDE interface. The window title is "Blink | Arduino 1.0". The menu bar includes "File", "Edit", "Sketch", "Tools", and "Help". Below the menu bar is a toolbar with icons for saving, undo, redo, and uploading. The main editor area shows the code for the "Blink" sketch. The code includes a multi-line comment describing the sketch, a `void setup()` function that initializes pin 13 as an output, and a `void loop()` function that turns the LED on for one second and off for one second. The status bar at the bottom shows "1" on the left and "Arduino Uno on /dev/ttyACM1" on the right.

```
Blink | Arduino 1.0
File Edit Sketch Tools Help

Blink
/*
 * Blink
 * Turns on an LED on for one second, then off for one second, repeatedly.
 *
 * This example code is in the public domain.
 */

void setup() {
  // initialize the digital pin as an output.
  // Pin 13 has an LED connected on most Arduino boards:
  pinMode(13, OUTPUT);
}

void loop() {
  digitalWrite(13, HIGH); // set the LED on
  delay(1000);            // wait for a second
  digitalWrite(13, LOW);  // set the LED off
  delay(1000);            // wait for a second
}

1 Arduino Uno on /dev/ttyACM1
```

valves and pump

Motorized valves vs. Solenoid valves

- Price
- Speed
- Power consumption

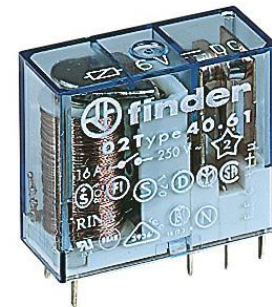
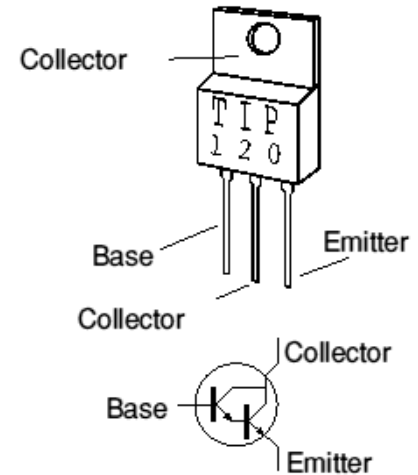
12V pump vs. 24V pump

- Price
- Water pressure
- Power consumption

Additional electronic components needed to drive from microcontroller

electronics: transistors and relays

- Transistor to drive high power devices (3pins: base,collector,emitter)
- Relays for controlling a isolated circuit with a low-power signal



user interface

Potentiometer (10K ohm)

- Voltage divider, provides variable resistance
- Uses analog signal (value from 0 to 1023)
- For mode selection

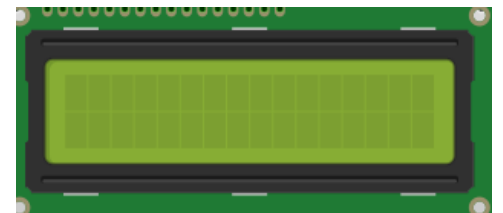


Buttons

- Available partially water proof
- To turn system on/off

LCD display

- Classic 16x2 (16 characters wide, 2 rows) good enough
- To show data



additional components

- **Flow meter:** measure how much water has flown through the shower and display result on the LCD screen
- **Temperature sensor:** use temperature sensor to measure water temperature and display data on the LCD screen
- **Addressable leds:** measure temperature, read temperature value in the code and do something with the leds accordingly (ex. if hot, turn red leds, if cold, blue) -> use your imagination

useful sites

- Showerloop: <http://showerloop.org/>
- Components + examples: <http://www.adafruit.com/>
- Arduino homepage + learning: <https://www.arduino.cc/>

shower @ loop

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