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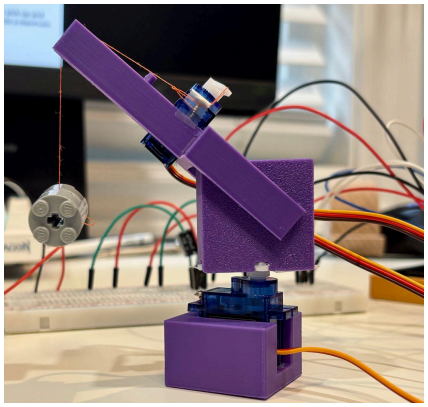
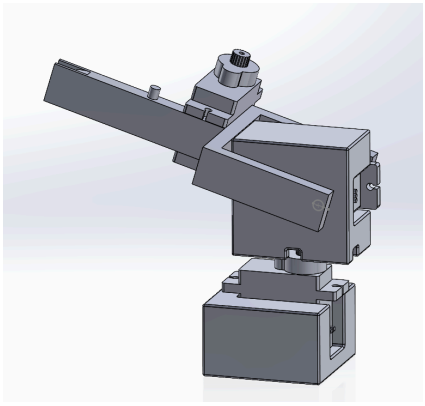
Three Degree-of-Freedom Robotic Crane Arm



```
analog.y = readAnalogAxisLevel(A_Y_PIN) - A_Y_COR;
analog.button.pressed = isAnalogButtonPressed(A_B_PIN);

//BASE SERVO
if(analog.x < 120 || analog.x > -120) { //to limit double
  if(analog.y > 125) { //left movement
    if(posBase < 179) {
      posBase = posBase + 2;
    }
    base.write(posBase);
  }
  if(analog.y < -125) { //right movement
    if(posBase > 1) {
      posBase = posBase - 2;
    }
    base.write(posBase);
  }
}

//ARM SERVO
if(analog.y < 120 || analog.y > -120) { //to limit double
  if(analog.x > 125) { //upward movement
```



A 3-DOF robotic arm with custom 3D-printed components. User controllable via analog joystick with an intuitive crane-like control scheme.

About the Project

Process

- Designed full component assembly from scratch in SolidWorks, fitting parts to SG90 micro servos
- Used an Arduino Mega microcontroller to coordinate multi-axis motion and user input from the analog joystick
- Programmed input to motion logic in C++

Results

- Joystick control scheme vastly simplifies the interaction between the user and crane arm
- Rotation limits & software constraints prevent binding and keep operation stable

Resources

- Source Code: https://github.com/pierson-lee/JoystickRobotArm
- Video Demo: https://www.youtube.com/watch?v=CRqb28LxTqg

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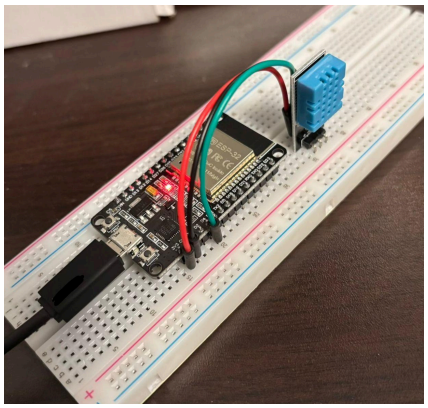
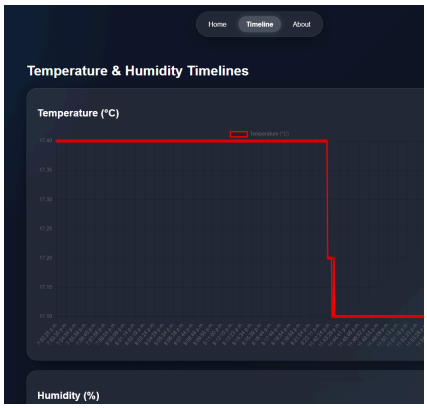
3D Printer Room Climate System



```
//establish the current temp/humidity variables
let currentHumidity = null;
let currentTemp = null;

//this function retrieves the data and displays it on
async function loadData() {
  const res = await fetch("/data"); //grabs the data t
  const data = await res.json(); //format the data fro
  updateAmbientGlow(data.humidity);

  //putting values to the variables defined earlier
  currentHumidity = data.humidity;
  currentTemp = data.temperature;

  //display the values in the panels
  document.getElementById("temp").innerText =
    currentTemp + " °C";
  document.getElementById("hum").innerText =
    currentHumidity + " %";

  updateFilamentCheck(); //runs this function after ev
}

//this function interprets the data for printing condi
```



A room climate sensor system that sends automated alerts to a user dashboard.

About the Project

Process

- Used an ESP32 and DHT11 humiture sensor for the physical sensor system, wall-powered via Micro-USB
- Integrated a Node.js and Express.js backend, implementing ngrok tunneling to enable wireless data transmission between the ESP32 and dashboard
- Programmed a web dashboard to convert raw sensor data into user-readable information. Also programmed logic to automatically test climate information against ideal filament printing conditions

Results

- Dashboard delivers accurate reports on 3D-printing readiness based on filament type, humidity, and temperature
- Sensor readings from the data pipeline are stored and used to create historical graphs for user trend analysis

Resources

- Source Code: https://github.com/pierson-lee/3D-Printer-Room-Climate-System
- Video Demo: https://www.youtube.com/watch?v=cFxoUsjgsX4

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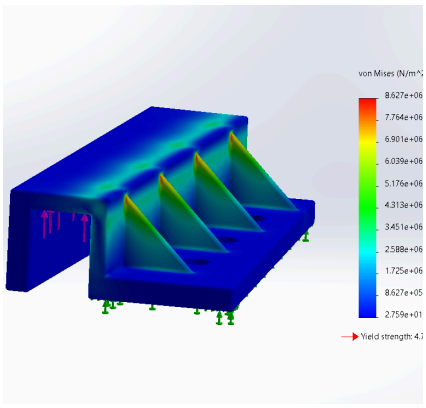
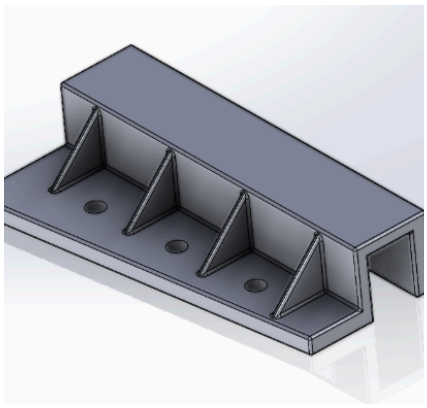
BMW E46 Front Bumper Mount Holder



Low-modification, bolt-on bumper mount holders for a BMW E46.

About the Project

Process

- Mount holders were modelled in SolidWorks based off of dimensions taken from actual car bumper
- Defined custom PETG material properties, like strength and yield criteria, within SolidWorks Simulation FEA. Simulated stress distributions and deformation under loads up to 150 N (~34 lbs) per holder
- Conducted physical stress tests on 3D-printed prototypes to determine optimizable areas. Improved part strength through thickness, infill, and gussets

Results

- Final mount holder performance far exceeds the total bumper weight of ~30 lbs
- Application method of the holders requires the least amount of vehicle modification compared to any other existing non-OEM repair solution

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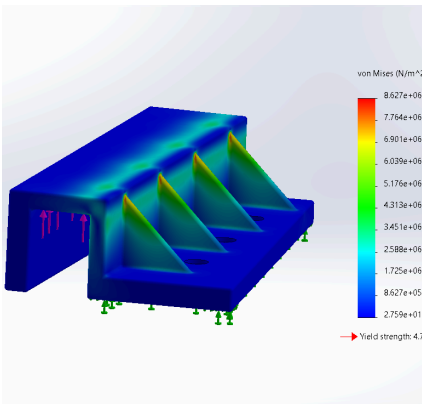
Custom BBS Wheel Center Cap and Lock Set



Waffle style center caps for BBS RC 090/035/038 wheels, threading directly onto wheels via a custom locking mechanism.

About the Project

Process

- Designed locking mechanism and cap pattern in SolidWorks
- Performed impact testing on 3D-printed prototypes to locate areas that required strengthening
- Utilized iterative 3D printing to ensure OEM-like fit of the caps to the wheels
- Sanded and primed caps to achieve a smooth, high-quality finish

Results

- Final design is 3x more durable compared to initial prototypes (determined through stress testing)
- Locking mechanism requires no hardware and makes cap installation easier compared to other market options