

## Web Interface for Perpetual Motion Machine

As the final project for Embedded Systems, my group made the illusion of a perpetual motion machine using an Arduino, ball bearing, inductive sensor, track, and electromagnet. An image is attached below. For my capstone component, I implemented a web interface that was able to control parameters of the machine from any web-connected device.

### Design Challenges

It's difficult to implement reliable WiFi communication on the Arduino. I also had to integrate with a third party system that could host the variables I read and modify. For this project in particular, it's important that the timing of the electromagnet is extremely precise, so I also had to design the code structure in a way that would prevent request timeouts from affecting the normal operation of the machine.

### Approach

I used Google Firebase to store my variables and the WiFi101 library on the arduino to complete GET requests. This created an issue - the REST API that Firebase provides allows only for HTTPS requests, but the WiFi101 library is set up by default to make HTTP requests. I searched through the documentation for a way to force WiFi101 to use an SSL connection, and it turns out there's a separate way to connect to a server if an HTTPS connection is desired. My web interface was relatively simple - it consists of a vanilla HTML file with a javascript function that runs on form submission. The function reads what values are put in the fields, and sends a PUT request to Firebase to modify the variables. On the Arduino, the variables are updated once per loop. Because the electromagnet fires on timing determined by an interrupt routine, the possible hangs as a result of using WiFi do not affect the base operation of the machine.

### Image

