

Alexa Integration with Perpetual Motion Machine

In my capstone project, I integrated Alexa functionality into our perpetual motion machine, enabling users to control the machine by simply asking Alexa to turn it on or off. This is an interesting problem as we have to incorporate another embedded system into our final project, bridging the gap between a polished product and our own creation. The ability to control an arduino using Alexa can allow a user to automate many aspects of their lives, from turning on/off lights to any thing that the user can design and create.

Summary of design challenges:

- Have the Alexa interact with the code on the arduino
- Need to stop balls from rolling/allow them to roll
- Need to turn the machine off/power it back on

Approach Taken:

To enable Alexa interaction with the arduino, I used the Arduino Cloud for programming. I created two cloud variables—one to manage the servo blocking the funnel and another for controlling a buzzer in a fellow student's capstone. To ensure compatibility with the cloud variables and functions, I edited our existing code. These cloud functions and variables are accessible by both the arduino and Alexa, allowing Alexa to manipulate them for controlling the perpetual motion machine.

I further refined the code to operate the servo, opening and closing it based on variable values, and to activate or deactivate the buzzer. An essential design consideration was modifying the code to detach or reattach the interrupt associated with the machine's sensor and electromagnet based on the on/off state. This adjustment guarantees that the sensor stops detecting a ball bearing when the machine is in the off state.

Next, I needed to find a way to stop the ball bearings from rolling or allow them to roll. This was accomplished by mounting a servo to the machine. To actually reach the funnel hole, I connected an allen key to the servo arm using a rubber band. The rubberband allowed for slight flexibility of the allen key, which would allow it to sit correctly in the hole and prevent issues if a ball was in the way while the servo closed its arm. To power the servo, I connected the ground and power wires to the arduino's ground and 5v pin. Additionally, I connected the signal wire to pin 10, allowing the arduino to transmit a PWM signal to control the servo.

With the code and hardware in place, the next step was to establish a connection between the arduino and Alexa. I achieved this by installing the arduino skill through the Alexa app. I was then able to connect the arduino to Alexa like any other smart device. Once the devices were successfully linked, I was able to ask Alexa to turn on and off the machine, and turn on and off the buzzer music.



