Name: [redacted]	**Major: EE**

Smart Popcorn Maker

I. Problem Statement

Low cost popcorn makers blow hot air through popcorn kernels, heating the kernel until it pops. The popped kernel is then blown out of the machine and into some container placed under the machine's output. It is common for the container to overflow, which results in popcorn being blown out of the container. Some user manuals warn the user to be ready to switch containers during a batch [1], and many distributor photos show popcorn overflowing out of the container [2].

This overflow leads to waste and requires the user to spend time cleaning up. To combat the overflow problem, the user must keep continuous watch over the machine, careful to stop it at just the right time. If the user stops the machine too late popcorn is wasted and clean up is required. If the user stops the machine too soon less popcorn is produced, which decreases efficiency.

II. Existing Solutions

A commonly used solution is to incorporate some sort of container into the popcorn machine itself, as in the case of [3]. This prevents popcorn from spilling out when the external container is full. There are two drawbacks to this incorporated container approach.

First, the size is increased. The incorporated container makes the machine take up more space on the countertop, and requires more storage space [1], [4]. This is not satisfactory for a kitchen appliance as space is limited.

Second, the incorporated container is not as user friendly. In order to retrieve the popcorn, the container must be detached [4]. This takes up the user's time and requires the container to be emptied between batches. It also adds another component that must be cleaned and kept track of.

III. Proposed Solution

The proposed solution is to have the popcorn machine start filling the users container as usual and then stop itself at just the right time so that the container is full, but not overflowing. This would allow the machine to be left alone during operation and prevent overflow. By integrating WiFi, the user will be notified through an alert on their phone when the container is full. By tracking the average time needed to fill a certain container, an estimated time to completion could be provided to the user, letting them know how much free time they have before their attention is needed.

Popcorn height level will be determined by using a distance sensor mounted on the machine above the container [5]. The system will be controlled with a small board computer, such as a raspberry pi, which has a built in WiFi controller and GPIO pins that will be used to control the machine with a power switch relay [6], [7].

IV. References

[1] *Hot Air Popper INSTRUCTIONS*, Presto, Eau Claire, WI, USA, Accessed on: Sept. 4, 2020. [online]. Available: https://www.gopresto.com/uploads/downloads/instructions/0486001.pdf#page=2&zoom=160,-141,375

[2] “SLENPET 3 Minutes Fast Table Popcorn Popper.” Amazon.com, https://www.amazon.com/dp/B088ZVSRGP?tag=disneyxp-20&linkCode=ogi&th=1 (accessed Sept. 4, 2020).

[3] “West Bend 82505 Crazy Electric Hot Oil Popcorn Popper.” Amazon.com, https://www.amazon.com/82505-Electric-Popcorn-Stirring-Convenient/dp/B00KL8SM92/ref=sr_1_4?dchild=1&keywords=popcorn+maker&qid=1599246287&sr=8-4 (accessed Sept. 4, 2020).

[4] *STIR CRAZY CORN POPPER Instruction Manual*, WestBend, West Bend, WI, USA, Accessed on: Sept. 4, 2020. [online]. Available: https://images-na.ssl-images-amazon.com/images/I/81l8wqysk2L.pdf

[5] *Ultrasonic Distance Sensor*, Parallax, Accessed on: Sept. 4, 2020. [online] Available:https://www.mouser.com/datasheet/2/321/28015-PING-Sensor-Product-Guide-v2.0-461050.pdf

[6] *Raspberry Pi 4 Computer Model*, Raspberry Pi Foundation, Cambridge, England, Accessed on: Sept. 4, 2020. [online] Available: https://static.raspberrypi.org/files/product-briefs/200521+Raspberry+Pi+4+Product+Brief.pdf

[7] “Turn Any Appliance into a Smart Device with an Arduino Controlled Power Outlet.” CircuitBasics.com, https://www.circuitbasics.com/build-an-arduino-controlled-power-outlet (accessed Sept 4, 2020).