**1. PROBLEM**

**1.1. Historical Introduction**

Coffee as a commodity arrived in the European markets in the early 1600s [1, pp.1], with home coffee roasting as the standard during this time. With the arrival of the first electric commercial coffee roasters in the early 1900s [1, pp.647], home roasting declined and pre-packaged coffee became the norm. Small-scale coffee roasting began to return with the rise of dedicated coffeehouses in the 1960s, which sought out speciality coffee from around the world.

In the 1970s, Siemens introduced the Siemens Sirocco: the first mass-marketed home fluid bed roaster for the consumer. The Sirocco featured an infrared temperature sensor, high aeration to agitate the beans during the roasting process, and a timer complete with a built-in cooling cycle [2]. This product is widely regarded as the beginning of the home roasting resurgence due to its advanced feature set and its affordable price of $139 (~$320 in 2018).

The 1980s and 90s continued the trend with numerous coffee roaster design patents and releases on the market. This coincided with a rise in coffee varieties and growing popularity for specialty coffee. The increasing number of patents and releases began to revolutionize the coffee roasting market to its current status in the 21st century with a desire for user control, effectiveness, and ease of cleanup. This desire has created a new market today with a variety of intelligent home-roasting options and room for new innovations.

**1.2. Market and Competitive Product Analysis**

The coffee roasting community judges the quality and appeal of roasting machines by the capacity of beans being roasted, amount of user-controlled variability, effectiveness in both its heating and cooling cycles, ability to reduce smoke during roasting, and ease of cleanup [3]. Bean capacity ranges from 100 grams in small machines to 450 grams for ultra-large capacity roasters within the consumer spectrum. Customizability of the roasting process varies from a simple power switch to a fully editable temperature control interface. Machines in the current coffee roasting market will usually excel in one technical area, such as high capacity or efficient smoke reduction, but lack in others, like user-controlled variability. A typical consumer coffee roasting machine costs anywhere between $150 and $1700 depending on the feature set [3].

The most direct competitor for IntelliRoast is the Ikawa Smart Home Coffee Roasting System. The Ikawa is constructed from ultra-premium materials such as an extruded aluminum case and cork insulating material. This particular roaster features app connectivity and Dyson vacuum technology for its convection-style roasting. These premium materials and technologies exceed $1600 [4] - a price only the top percentage of coffee enthusiasts would entertain.

By design, IntelliRoast brings a premium coffee roasting experience and quality without the premium cost. By utilizing the high cubic feet per minute (CFM) and high static pressure of a centrifugal style fan, IntelliRoast is able to push 54.7 CFM into the roasting chamber. This high flow solution is most effective for the rapid heating and cooling necessary to roast coffee beans, and provides enough static pressure to agitate the beans for even roasting. By using high quality yet inexpensive materials, IntelliRoast can keep costs down near an entry-level roasting machine and offer all the same features of a high-end roasting machine.

**1.3. Concise Problem Statement**

Coffee roasting is a complex and intricate process the average consumer cannot consistently perform alone. Most commercial coffee sellers have a lack of fresh roasted beans and general availability, necessitating home roasting techniques. A consumer could buy the green coffee beans online, but the tools required to consistently roast those coffee beans are expensive and typically only found at a coffee roasting company. Many people roast coffee at home using homemade tools, such as a repurposed popcorn popper or a cast iron skillet on the stovetop, but those tools require a certain amount of skill to use and are not always the safest [5]. Those who can afford to buy a coffee roasting machine enjoy a great roasting experience at home but at a very high price, upwards of $1600 [4].

IntelliRoast offers an in-home solution to average coffee roasting needs by providing a customizable roasting experience at an affordable price. Utilizing similar roasting technology as the homemade tools that hobbyist coffee roasters use today, IntelliRoast automatically roasts the coffee beans without manual intervention. Additionally, a smartphone app can be used to customize the roasting process to create and save user-defined roast profiles. Using this technology, the average user can easily perform the complex, intricate roasting process at a fraction of the cost of the current technology available on the market.

**1.4. Implications of Success**

The overall goals for IntelliRoast are to create a memorable user experience and roast coffee in such a way to extract the maximum flavor possible. If met, IntelliRoast will provide a consumer-friendly option for high-end coffee roasting. This product will offer a more efficient and automated method for a traditionally manual process. With its low cost and user-friendly interface, IntelliRoast could rise to a major market competitor based on current coffee roasting trends. Smaller coffee bars featuring locally roasted coffee could suffer the most due to the ease of roasting coffee at home. The possibility of wider commercial success could affect larger coffee companies as users start roasting their own coffee beans.

IntelliRoast’s marketability will lead to its success. The ease of use and automation will eliminate the time spent manually roasting coffee beans, providing a hands-off alternative to current imprecise methods and allowing the user to focus on other tasks. Additionally, IntelliRoast will create an easier entry point into high-end coffee by way of its lower price point. A budget-minded product will directly compete with products in the current coffee roasting market and sustain a viable business product. In the future, IntelliRoast will become a commonplace household appliance, providing an unforgettable coffee experience.

**References**

[1] W. Ukers, *All about Coffee*. New York City, NY: Tea and Coffee Trade Journal Company, 1922.

[2] S. Checchia, “Coffee Roaster Ensures Freshness From Very First Drop,” *Chicago Tribune*, 17-Apr-1986.

[3] “Best Home Coffee Roasters 2018.” *Home Grounds* [Online]. Available: https://www.homegrounds.co/best-home-coffee-roasters/

[4] “IKAWA AT HOME.” *IKAWA* [Online]. Available: <https://www.ikawacoffee.com/at-home/>

[5] K. Davids, *Home Coffee Roasting: Romance and Revival (revised ed.).* St. Martin's Griffin, 2003, pp. 109