An Automatic Cooking Machine

Interaction and Society

Team 29

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1 Motivation

The modern world is filled with stress and time is scarce. Many workers need to be available at short notice, leaving many to neglect themselves. Many people can't find the time for meal planning and learning how to cook, with many others unable to find the time to cook for themselves, instead turning towards takeaways and instant foods[1]. This has resulted in a major degradation of people's mental and physical health, as they may be unable to eat a balanced diet. This is where our automated cooking machine fills in the gaps, allowing people to live healthier lives with less effort by planning out meals, ordering ingredients and cooking them. In this way our machine gives people free time to do other things instead, like working or relaxing.

A secondary motivation behind our automated cooking machine is that we believe it can help individuals to reduce their carbon emissions and effect on the environment. One study has found that emissions could be reduced up to 90%[2]. Going to the supermarket to buy groceries, or ordering food in, puts an extra vehicle on the road for each person or family that wants to do either of those things. In the vast majority of these cases, the vehicles will be powered directly by fossil fuels and will directly add carbon dioxide to the atmosphere, along with several other harmful pollutants, aggravating the already severe problem of air

pollution in crowded cities. On the other hand, one supermarket delivery truck can deliver to many different households in a single trip, reducing the total emissions while feeding the same number of people. This is made even better with recent initiatives to replace delivery trucks with electrically powered ones. By reducing the number of vehicles on the road, this automated cooking machine may help relieve the dire problem that is climate change.

2 Idea

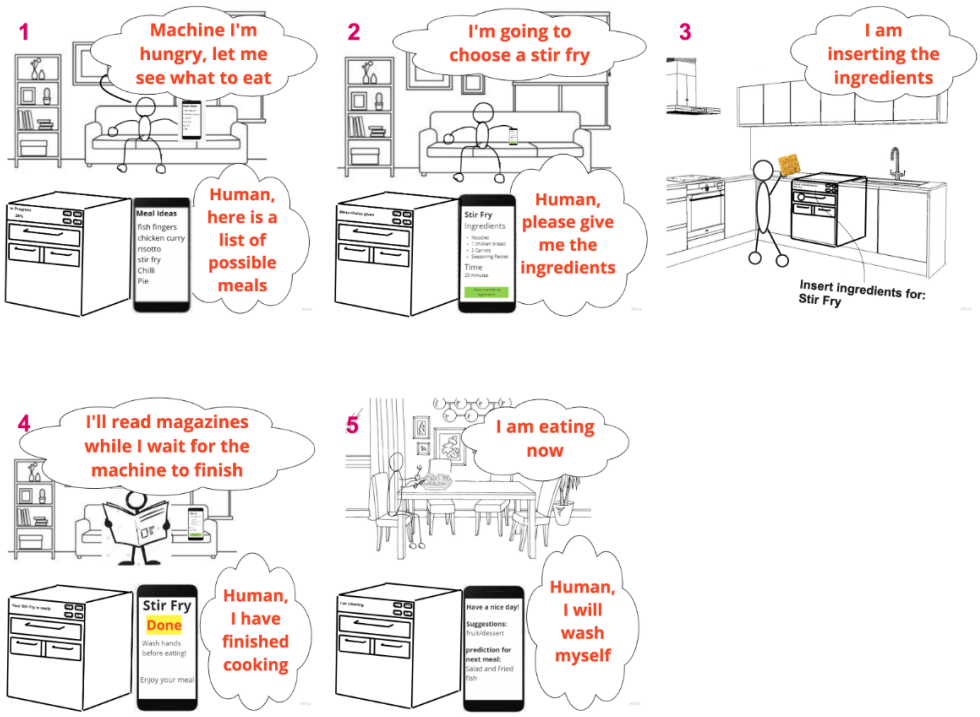
Our product is made up of an automatic cooking machine with a companion mobile application. The machine itself lives as a cabinet in the kitchen, with both a frontal door that opens out into the primary compartment and a touch screen interface, allowing for full interaction with the machine without a mobile application.

The machine has several compartments, one for loading clean dishes, one to take completed meals from, and one to insert ingredients. This section (the primary compartment) is compatible with a set of ingredient dividers, that can be interchanged depending on the meal being made.

From either the machine interface, or the application interface, users can search for the dishes they want to eat or be recommended dishes according to previous preferences, with the required ingredients and ingredient divider then being displayed. After that, all the user needs to do is gather the required ingredients, add them to the machine using the divider and press the start button. Users can also order the ingredients through our application if they are not immediately available, with the order fulfilled by local grocers and supermarkets. The time required for cooking will be displayed on the cooking machine and the application, with mobile notifications keeping the user up to date with the meal's progress.

Another option would be to choose a recipe and place ingredients in the machine before leaving for work, starting the cooker with the mobile application during their journey back, so that they can enjoy the food as soon as they get home. This would help the modern worker, as they would be less time-limited and have more freedom to relax as they wish outside of work, spending less time worrying about cooking or buying takeaways.

The machine can also recommend a healthy and sustainable menu according to the user's eating habits, seasonal trends and other factors. It provides dietary recommendations, such as cutting down on sugar or drinking more water, relieving the mental burden associated with healthy eating, cutting down on the time required to thoughtfully plan healthy meals. Our machine would also provide a much healthier alternative to ordering food in, as fast food has a reputation for being greasy, with elevated levels of saturated fats and sugar.



John felt hungry, so he browsed through the app to search for the dish he wanted to eat today. Stir-fry aroused his interest, he clicked in, and the app showed the required ingredients. John finds these ingredients in the kitchen and puts them in the cooking machine, then just presses the start button and it is done. In less than the time to read a newspaper, the app prompts that the dish is ready. While John was enjoying the meal, the machine began autonomously cleaning itself.

3 Related Work

With the 2022 Winter Olympics in Beijing, to cope with the huge workload, we see an example of a large-scale automated cooking machine in action [3]. The benefit of such a machine is that it has a large output with relatively little human input, but obviously would not be suitable for a home environment due to the impracticality of taking up a large amount of space. It is not designed to feed a single household, instead being designed to feed hundreds of athletes.

On the other hand, existing cooking machines for home use are relatively advanced, such as induction heating rice cookers based on electromagnetic technology or steaming machines based on new solar technology [4][5], often capable of preparing meals to a high quality without much effort needed from the user. Importantly, they are also capable of creating highly nutritious meals [6][7], with their capabilities only increasing with time. However, most cookers currently on the market only have a single function, such as stir frying or

steaming. They aren't flexible with what they can cook, and how they can cook.

Our system took these benefits while addressing the flaws of earlier works in two ways. Firstly, we have worked on miniaturizing the automated cooking system used in the Beijing Winter Olympics, as users would not want to give up an entire room for an automated cooker, and more importantly would not need to produce that much food. Our machine also combines the functions of several different cooking machines into one by using a modular design, allowing it to flexibly cook several distinct types of meals, while also aiding with miniaturization.

4 HCI Process

Once we had decided to solve the problem of manual cooking, we employed the user centre model, placing our users at the centre, in conjunction with the spiral model for rapid development of our product.

We first started by interviewing our target market, using a survey [8] with a combination of open and closed ended questions, to gather an understanding of the general attitude and perceived problems towards interacting with an automatic cooking machine. Our results brought to light potential ethical issues such as data protection, and the need to interact with the machine while away from it.

Our initial stage of development started by brainstorming and sketching a large variety of potential user interfaces, of which, we critiqued and further developed, while keeping in mind our survey findings. We applied the Neilson heuristics at this stage, to further refine our set of ideas into a key set of characteristics, one of which being the need for a progress indicator on both the machine itself and an app, to inform the user of the meal's progress. We used this evaluation to inform the design of our next iteration. We found that evaluation using the Neilson heuristics was a crucial and cheap process, and so we continued to apply them for future iterations.

Next, we merged our sketches and evaluation into a single storyboard, the purpose of this storyboard being to create a cheap guide for how one may interact with the machine. We gathered feedback from a sample of our target population. From this, a common complaint was that an app was required to interact with the machine; that as a user, they should be able to fully interact without one. Therefore, for future iterations, we ensured that a user could interact with the machine both through an app and, crucially, without any external devices.

At this stage, we created a paper prototype of both the machine and the app. We conducted a Wizard of Oz study with potential users using these prototypes; members of our team would provide the interactive parts of these interfaces for the users. We were primarily looking for opinions on the intuitiveness of the design, clarity of error messages, clarity of machine state, and efficiency of use. This study proved imperative to our continued development.

Overall, we found that users were comfortable with the design of the machine's interface itself except for clarity of where the ingredients should be inserted; to remedy this, we made the ingredients compartment the prominent part of the machine. We also found that our app, while intuitive, was severely lacking in efficiency of use; users did not flag this up in our storyboard feedback, due to them being told how it works in the storyboard rather than them exploring it for themselves.

We believe that users were happy with the machine's interface due to the prevalence of microwaves in UK households [9], and so they were used to interacting with a machine. However, interacting with an oven, microwave, fridge, etc., through an app is rare, and so users are less confident. This means that for future iterations, we will focus on the app's interface utilising high-fidelity wireframe prototypes, and rapid-development toolkits to quickly prototype a variety of interfaces, gather feedback and repeat. We expect to continue to develop and improve the interface for both the machine and the app, after it gets released, with a focus on identifying hot paths (key routes a user would take through the machine or app to accomplish a task) and improving these.

5 Ethics

With the arrival of our automatic cooking machine, people in the cooking industry may be afraid of losing their jobs. Our solution is to employ cooks to supply recipes, ensuring the machine can provide a diverse menu. Moreover, we believe our machine will not replace the role of restaurants. According to one survey [10], most people go to restaurants for socializing or for business appointments. Our machine cannot provide this, meaning the effect to the culinary industry should be limited. On this basis, we conclude that our product will not have a negative effect on the job market.

Another ethical consideration in a similar area is that people may become too reliant on the machine. To remedy this, we will encourage people to still make their own meals every so often, suggesting recipes which could be considered fun to make and walking them through the process. This could help motivate people to cook for themselves. However, it would need to do so only when the user has the time available for this. It could also reduce over-reliance by occasionally suggesting eating out or ordering food in, although this would need to be done in moderation to ensure a balanced diet. This would give work to traditional food production, further reducing the impact that our machine would have on the culinary industry.

Most people (up to 70% of those surveyed) fear their privacy being compromised when they use electrical products [11]. Therefore, we need to relieve people's concerns about using our products as the machine will naturally collect a lot of personal data. Firstly, the machine needs to track what the user is eating every day to suggest healthy future meals that the user would enjoy without leaving out any essential nutrients. We solved this problem by

only collecting a minimal amount of data with permission, which is all stored and processed locally on the machine, with a guarantee to customers that their data will not be sold or uploaded online. We also make sure to follow all data regulations currently in place and minimize the amount of data that is shared with third parties, only doing so with explicit consent.

One important problem that we would have to consider is the price of our product. As can be expected, a sophisticated cooking machine would have a high cost due to the complexities of production. This cost might be prohibitive for many people who might require a machine like this, so our aim is to help research ways to make the machine cheaper and more efficient to produce as time goes on.

In conclusion, our purpose is to produce a product which will improve people's quality of life. Therefore, we put user's values (what the customers need and want) in the center. This helps us design our product better. Offering people an automatic cooking machine will not only make people eat healthier but also ensure people enjoy their day-to-day life.

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