Cookeezee: An interactive cooking experience

Abstract
This paper shows the current development of a work in progress called Cookeezee [Figure 1], which is the result of a school assignment based on a question by the Belgian company Novy. This is a concept showing the cooking experience of the near future. The aim of the concept is to make a modern and simplistic design that is intuitive and more autonomous in use. It implements an interactive display that guides the user through the cooking experience by showing no more of the display than needed and automating those handlings that the user is not interested in controlling like controlling fan speed. We describe the global concept, the user experience and the components used in the current prototype. Further on, we also discuss what steps are needed in the future to make a better prototype and to make this concept into an actual marketable product.

Author Keywords
Cooking experience, Pot detection, Induction cooking hob, User experience, Cooking hood

ACM Classification Keywords
H.5.2 User Interfaces: Input devices and strategies
Introduction
When looking at modern cooking hobs, we often see a simplistic and clean design. It should be well integrated in the kitchen and not dominate the overall look of it. Buttons and knobs are replaced by touch screens interfaces to create a flat surface. By eliminating as much buttons, icons and marks on the cooking hob, it is easy to forget the ease of use for the user.

As this is a case in demand of Novy, we tried to implement the design goals that the company values and stands for [1]. First off, design wise they make very clean and minimalistic products that are beautiful to look at as well as practical. There should be a triangular relationship between the cooking hood, the cooking hob and the user in which these three elements constantly interact with each other. There are not completely separate entities, but are seen as a whole in order to create a better cooking experience [Figure 2].

Cookeezee wants to use interaction to create a minimalistic design that is still very intuitive to use. Through the constant communication between the hood, hob and user, it is possible to automate some functions so the user only needs to focus on the necessary handlings.

Related Work
In recent years, a lot of progress is already made towards making more intelligent cooktops and hoods. Touch-panels are widely applied and induction hobs can detect when a pan is physically present on the cooktop. However, according to Ghelli et al [2] real steps have yet to be taken to make cooktops more autonomous and energy-efficient. Ghelli focuses more on the possible aspect of making the cooking hob more autonomous while our concept takes some steps towards a more autonomous and therefore more energy-friendly cooking hood.

Several induction hobs have little LED lights to indicate the place of the burners, but for several reasons, we want to have a full circle of LEDs around the burner. We didn't found papers researching the possibilities, but Samsung has an induction hob that does something similar [3] thus proving that it can be done.

System Description
General concept
The general idea of Cookeezee is guiding the user through the cooking experience by use of interaction between the cooker hood, induction hob and user [Figure 2]. When not used, the hob is a complete black glass plate, looking clean and stylish in every kitchen. By detecting a presence, the cooktop and hood come alive and an ambient lighting is created. By moving a
pot above the glass surface, the induction hob will show you where the burners are and which display to use. Meanwhile, the cooker hood works completely autonomous. The hob gives you extra visual feedback regarding the heat or when using a timer.

**User Experience**
The concept can be divided in different components (explained later) all working together to create a complete and easy experience starting with entering the room and ending when you finished cooking. From start to finish, the following steps show how the user experiences the complete cooking cycle.

Nearing the cooking space: When nearing the induction hob, ambient lighting is turned on in the cooking hood. The 'Novy' logo also lights up to indicate that the cooktop is ready to be used. When going away, the appliances will turn off again after a certain time.

Starting to cook: When you move a cooking pot or pan above the cooking surface, Led lighting will indicate the placing of the burners. When you put down the pot on a burner, the corresponding display will also light up. In the same time, the ambient lighting in the cooking hood will turn to a brighter, more functional light. The fans will also be set on stand-by, ready to start working.

While cooking: When you turn on the heat by using the touch displays, the LED strip around the burner will turn brighter or lighter to give visual feedback of the heat. Meanwhile, the cooking hood detects when steam is formed and suction is needed.

Using the timer: By using the intuitive touch displays, you can set a timer on all burners. When you start the timer, the LED strip around the burner will start to disappear so the circle has ticked away completely when the timer has finished.

Finish cooking: When you are done cooking and the pots are removed, the burners will first go back to level 0 and then turn off completely after a certain time. When the exhaust is no longer needed, the cooker hood will also turn off along with the lighting.

**Prototype Components**
The prototype we made solemnly shows the interaction with the user through use of LED lighting, simple touch displays and small fans. There are no real burners in the cooking top an there is no functional exhaust hood. The reason for this is that the existing hob and hood have difficult protocols that requires difficult reverse engineering, falling outside the scope of this project. Also, existing cooking tops are manufactured as compact as possible, leaving no room for all the sensors needed for this research.

The first part is the prototype of the induction hob [Figure 4]. Several IR range sensors are used to detect the pans. We used NeoPixel RGB LED strips for the circles around the burners. Further on we also used 7 segment serial displays and a capacitive touch sensor for the touch displays, although the one used in the real cooking top is considerably better and more advanced. An Arduino Mega is used for the processing power. Here we use a simple light sensor to detect when a pot is on the burner but when using a real induction hob, you can use the resulted induced currents to detect this.
Figure 4. Components induction hob

The second part is the cooker hood [Figure 5]. Again, we couldn’t use a real cooker hood so we used some PC fans to simulate the suction. Ideally, we want to use a humidity sensor (SHT11) to control the fan speed, but we experienced difficult to make this work properly and some fine-tuning is needed here. There is also a PIR Motion sensor that detects the proximity of a user and a wireless transceiver module (nrf24l01) for the communication between the induction hob and the cooker hood. This component makes that there is no cable needed between the induction hob and the cooker hood. An additional Arduino Uno is used as well. The cooker hood is a free hanging model. The technology is the same as the existing ‘Zen series’ by Novy.

Figure 5. Components cooker hood

Evaluation

Seen that this concept focusses greatly on user experience, evaluitive tests are certainly necessary to estimate the value of it. However, we did not yet do these tests for two reasons. First off, we worked with a limited time schedule and in the end the end we lacked the time to complete some tests with non-biased subjects. Second, this prototype lacks the vital functions and only shows the aspects of interaction. Therefore, testing would only give a partially correct view of the success.

We did test all the functions ourselves though, and although we see room for improvement, we did succeed in making a hob/hood combo that interacts with the user and is intuitive in use.
Future Work
The current prototype is still far from a working and marketable product. However, a lot of elements have already been researched or exist in some form. The combination of all these elements to create an interactive and more autonomous whole is what makes Cookeezee a new and innovative concept. The research described in this paper will be handed over to Novy. They can further experiment with the possibilities to implement it in a working model. There are several points that still need improvement.

User detection
The detection should be more advanced as to make a distinction between someone just passing by and someone wanting to cook. The ambient lighting could be handy when getting something to drink in the middle of the night but equally annoying when turning on when taking something from the fridge in broad daylight. Scenarios are probably needed for when lighting is needed as well as a more advanced sensor then the one used now.

Pot detection
The sensors used now are too big and will take up too much space in the real model. A smaller option will be needed. We also encountered problems with these sensors as they gave frequent errors and thus were not reliable enough. Better fine-tuning is needed to create a better range in which the sensors are active. This part is especially important as the working of the concept relies on the functioning of these sensors.

Fan speed
The humidity sensor now used is probably not enough to correctly decide the needed fan speed. Additional research will be needed to determine which values are needed to determine to most energy-efficient fan speed. There has been some research to other methods that is worth looking into.

Conclusion
This paper presented Cookeezee a future cooking experience concept that combines simplistic design with a better and more autonomous user interface. It tackles some of the problems in the development of smarter cooking hobs/hoods, which lack autonomous functions and we tried to make a more intuitive interface, which guides the user through the experience of cooking. First, the global idea and the flow of the user experience were presented. Then the current state of the prototype was discussed, which showed the interactive aspects of the concept. There is still room for improvement, especially concerning the user and pot detection and the efficiency of the autonomous cooker hood.

References