Summer Internship Project - I

Development of a smart cooking aid.
Godrej and Boyce Mfg. Co.

Introduction

cooking /ˈkʊkɪŋ/

noun [mass noun]

the practice or skill of preparing food by combining, mixing, and heating ingredients.

Anyone who has a fair amount of experience in cooking knows that it is certainly more than that. It is, in a way, science. It is how different ingredients react with each other over time and how the reactions can be altered with various factors such as time, type of heat source and also the type of vessel used. It a delicate balance of flavours and textures and the experience of eating that perfect meal is unparalleled to any other.

India, owing to its diversity has a wide variety of cooking habits and cultures. Each region has over the years developed their own staple food based on the produce and environment. Food habits vary not only among large distances but also among two different places in the same state. As a result, no other country in the world offers such complexity and diversity in their cooking habits like India does.

Indian cooking is one of the most complex among all cuisines. Developed by our ancestors, it usually involves quite a few ingredients and multiple steps. Even some thing as common as a dal has around three to four cooking processes. These steps are essential to not only obtain the best flavour but also to retain its nutritional properties. So, it is no secret that Indian cuisine is considered to be the most balanced and healthy among all. Recipes passed down from generations have ensured that rich and healthy food is still consumed by a considerable amount of people. Even though newer cooking appliances like microwaves and induction cook tops have made way into the market, we have still found a way to cook our Indian dishes on them.

Current Scenario :

The quantitative analysis done done by the team revealed that fewer people have been cooking a full traditional meal according to their roots. This trend is significantly higher in tier-I cities than compared to the rest.

We narrowed down on the predominant reasons for the rise of this trend and are listed as follows :

Nuclear Families:

More and more people today are migrating to the cities and a significant number of people are first generation city habitants. As a result they stay away from their parents and thus are in small families of three to four people. Since they are not familiar with the skills of Indian cooking, which were earlier imparted by the elders (parents and grandparents) , they have no choice but to make do with their limited cooking skills.

Working Partners:

With both partners contributing to the financial needs of the family it is cooking that seems to be taking the beating. With nuclear families this make the situation worse as the stress and exhaustion of professional lives has a direct impact on the amount of daily cooking.

Eating Out:

The number of people that have been eating out has increased significantly. The fact that both partners are working has contributed to the boom of eateries significantly. Food is easily available outside of offices, near railway stations and bus stops and everywhere in between. The eateries seem to offer a quick and easy alternative to home cooked food.

If they cook, it is very basic:

A long day at work drains you both physically and mentally. Hence a full traditional meal is replaced with something minimal. Usually working families have less than half of the number of dishes found in a traditional Indian meal. Furthermore, the availability of ready to eat food like two minute noodles, cereals and even pre cooked curries have ensured that less cooking ties place at home.

People are not really happy with this :

On questioning people from different backgrounds, regions and cultures we found out that they are not happy with their current eating habits and are also looking forward to a change.

People love to cook for family and friends:

On talking to people we found that people love to cook. There is a sense of happiness and satisfaction that one gets when cooking for people you love. Not only this, people realise that cooking at home is healthier. Moreover cooking at home is also lighter on the pockets as outside food which tends to be cheap often adds a significant amount to the monthly expense list.

Ready to try out new recipes:

Humans are creative and so it is no surprise that people love to try out new recipes. People look forward to cook something that their mothers or grand mothers cooked for them back at home. Limited by the pressure and stress of their professional lives, they find it difficult to find the energy and motivation to try something different and cook something new.

People unhappy with their domestic help:

Quite a few people are not happy with their cooks. While a vast majority in India cannot afford the luxury of hiring a cook, even those who can are not entirely satisfied with them. From the stress of covering up for the maids in her / his absence to the dissatisfaction about the taste of the food cooked, it is problems like these that are compelling people to look for an alternative.

The recipe:

Gone are the days where recipes were only available in print media. With the advent of the digital age more options like the television, laptops and even tablets have come up. Specific apps also try to serve as a good value addition in comparison to their traditional counterparts. We studied the recipes in all formats, from print to electronic and then asked specific questions to our user. We wanted to know as to was there, if any a problem that people encountered while trying to follow the recipes. It turned out that it was not only the novice users that faced these problems but sometimes even the experts were left confused. The following are the predominant set of problems that users face in the current situation:

Lack of accurate measurement:

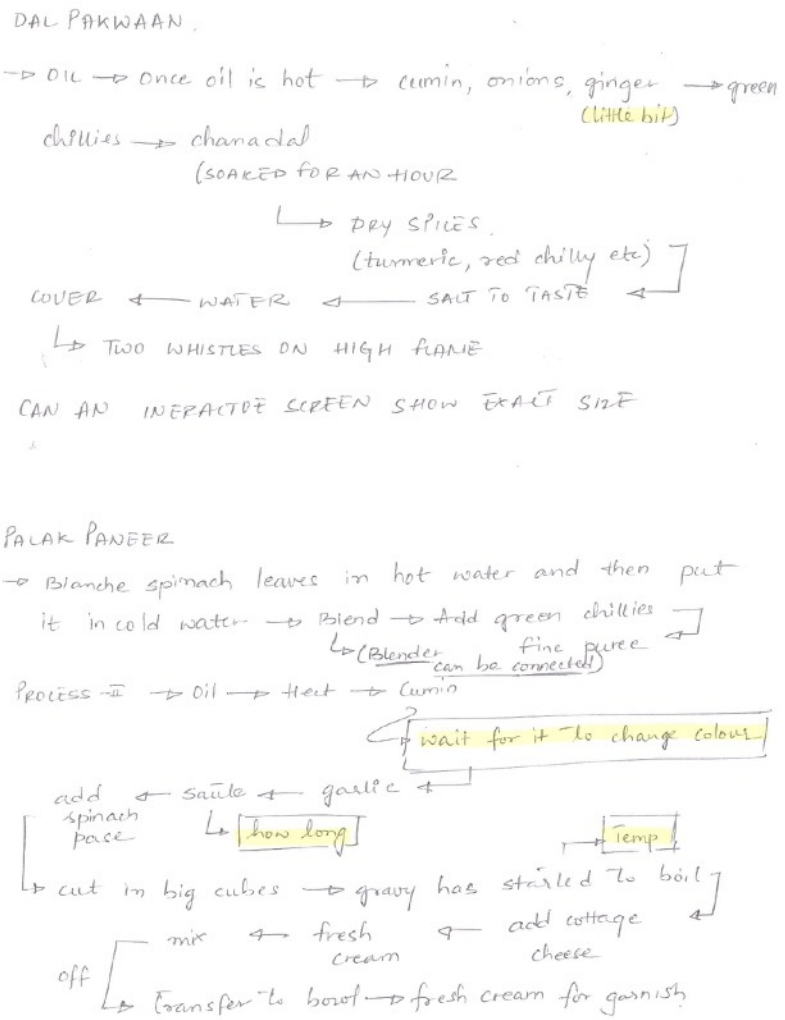
While most ingredients are measured relatively accurately in their convenient units, there are still some that lack accurate measurement. Most of them are the relatively small ingredients in the recipe. For example, while studying the recipe of Dal Pakwaan we noticed that the quantity of ginger was “little bit”. Also some spices that are used in fairly small quantities are also measured pretty vaguely. Moreover the size of the produce may vary depending on the region it is cultivated in. A lemon available in the south of India is considerably smaller than the ones available in the north. As a result, the taste may differ.

Confusing visual parameters:

Often we see recipes give instructions like, “sauté the onions till they are golden brown”. This, again adds to confusion as there is no clear definition as to what golden brown actually is. There are many similar visual parameters that need to be considered while cooking and most of these involve ambiguity and thus, they tend to be confusing.

Overwhelming guess work:

Most recipes involve some amount of guess work by the cook. Be it from determining the spiciness of the chillies or the temperature of the oil from frying, it is this guess work that adds the most amount of stress and is one of the major cause of the dish not tasting as per its intended taste.



The highlights how the problems with recipes.

VEG BIRYANI

→ INGREDIENTS SPECIFIED by Vol and Qty.

→ Size of vegetables,

→ Masala and spices in ~~tea~~ spoon sizes.

PROCESS

→ Heat a table spoon of btr. (temp + time) → Onions (Nice & Brown) (time/temp) → Cinnamon, Cloves, Bay leaves → Garlic Past → [COOK IT WELL] (Time/temp) → Capsicum, Tomatoes

[PROCESS - 2]

Curd + Biryani Masala + Red Chilly powder (SEPERATE WEIGHING SCALE)

Curd mix to the onions. → Add coriander leaves + sugar → Mix → SMART

PROCESS 1 and PROCESS 2 MIX

Mix the rice, veggies, onions well → Add salt + 2-3 tbl spoons of water → Coating the masala easily. → Cover and let it simmer (Temperature + time)

Garnish → Grated Cottage Cheese.

TAWA PULAV:

→ Heats the butter (gms) → Melts → ONIONS CUT LENTHWISE (gms.)

→ DON'T LET THE ONIONS GO TOO BROWN (let the temp be adjusted) (standard temp/time.) } COMPLEX

→ ADD THE GINGER Gahlic Paste (gms) → LET IT COOK NICELY

→ Small/Medium/Large

4 TOMATOES CHOPPED FINE → Gauge.

ADD ½ BELL PEPER (gms) → CHOPPED INTO SQUARES → Gauge?

→ Small/Medium/Large

→ LOTS of CORIANDER LEAVES — LOTS? (gms)

→ PAVBHAJI MASALA (gms) → 2 FINELY CHOPPED GREEN CHILLIS

→ TABLE SPOON of WATER

BOILED GREEN PEAS

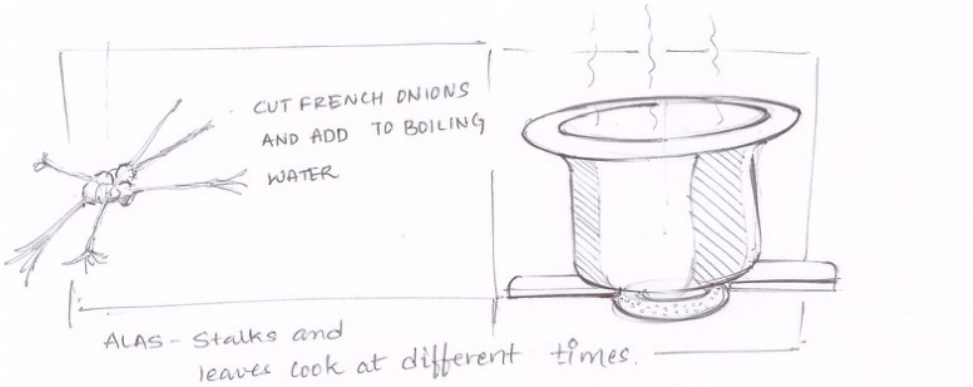
→ 2 DICED POTATOES (gms) → RICE → CORIANDER LEAVES

MIX → TOSS

The highlights show the problems with recipes.

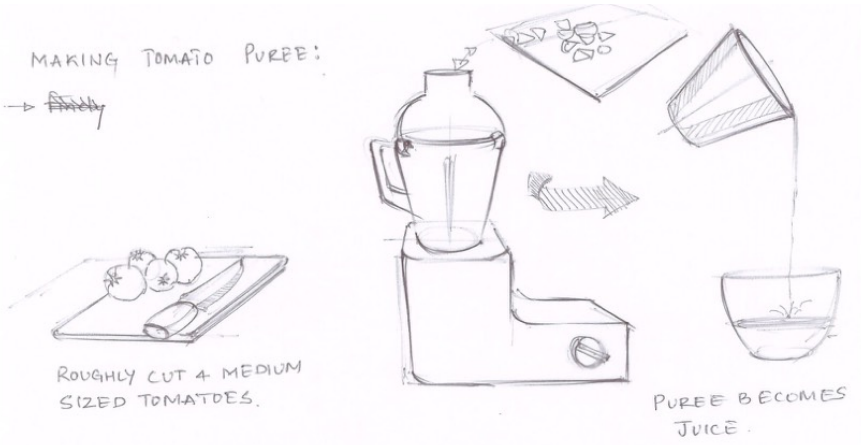
Storyboards based on interviews:

To better understand the cooking process and to further develop an insight into Indian cooking we decided to interview people who cooked on a regular basis. They included chefs, apprentices and home makers. We not only asked them questions but also watched as they didi their cooking. This gave us topics for making storyboards that could be related to Indian cooking The storyboards played the most crucial part in finally deciding as to what the cooking aid should do and how it will perform.

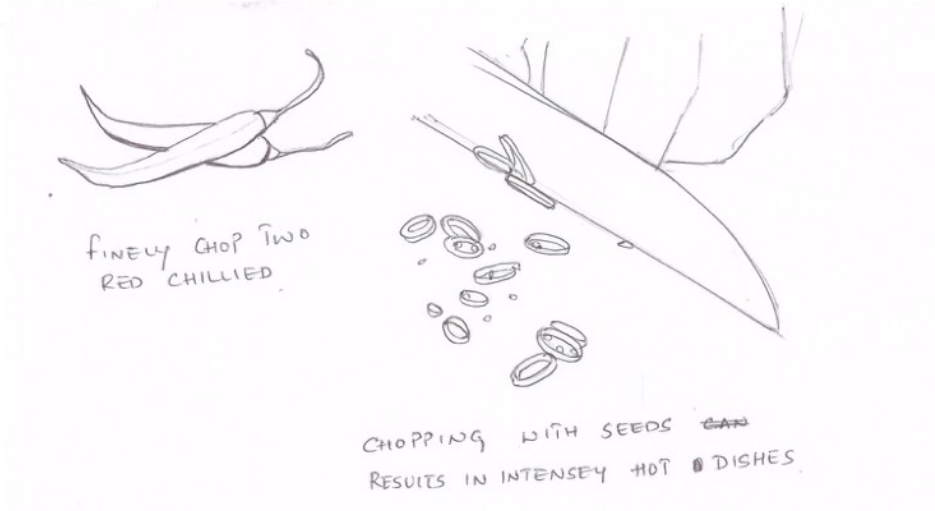


Fine details need to be known. Like cooking the stalks and leaves for different time.

There are times that when cooking something common, you fall short of ingredients.



Not having complete control over devices.



Chopping chillies with and without seeds alters the spiciness of the dish significantly.

Your mood plays tremendous impact on the taste of your food.

Delicate food like fish have very little room for error.

Lack of instructions on the product packaging also leads to confusion.

Things that people said..

"In our restaurant we need to make sure that food doesn't go waste"

"We both work and are tired at the end of the day"

"At home we focus on taste and less on presentation"

"When the milk is boiling, we have to always stay by the stove"

"I don't like home cooked food"

"I don't attend calls when I'm making sweets for Diwali"

"We don't get exotic ingredients in small amounts"

"My food tastes different every time"

"Its irritating that I am cooking while my friends are watching the match in the living room"

"Festivals are a nightmare for us"

"I don't know how to cook properly"

Developing of a cooking aid concept:

After a thorough identification of the problems in cooking faced by people we went ahead in determining the fundamentals of our cooking aid. We knew that cooking was a very personal and enjoyable process and so our main focus was to make cooking easy by assisting the user and trying our best to minimise the stress. The cooking aid should do the following effectively :

Help the user:

The cooking aid should help the user by covering up the mistakes done by the user. For example if the user is occupied in some other work like talking on the phone, the cooking aid should make sure that the dish on the stove doesn't burn. Even during the cooking process it should understand the recipe and make subtle suggestions and inform the user about the same.

Remove the ambiguity:

The cooking aid should thoroughly remove all ambiguity from the cooking process and thereby ensure that the process is stress free for the user. All ambiguous parameters like weights of ingredients in small quantities and temperature of oil prior to frying etc should be accurately and instantaneously measured. This would ensure that the recipe is followed as required and the food inevitably tastes as it should.

Keep the user in control of the process:

As mentioned before, cooking is a personal and enjoyable process. The cooking aid should not interfere in this. It is essential that ultimately, the control is with the user. The cooking aid should work around the user and adapt as per the users tastes and preferences. This would ensure that no matter what, the process of cooking is enjoyed as purely as possible. This is the most essential and complex function the cooking aid should be able to perform.

The parameters and senses involved in cooking:

While developing the cooking aid it was also important to determine and study the important parameters and senses that are involved in cooking. It is these parameters and senses that give the valuable indications of process and completion of all cooking processes. For example the crackling sound of cumin in hot oil indicates that the oil is at the right temperature. The separation of oil from the vegetables in a curry indicates that the it is thoroughly cooked. We needed to make the cooking aid smart enough to identify these parameters.

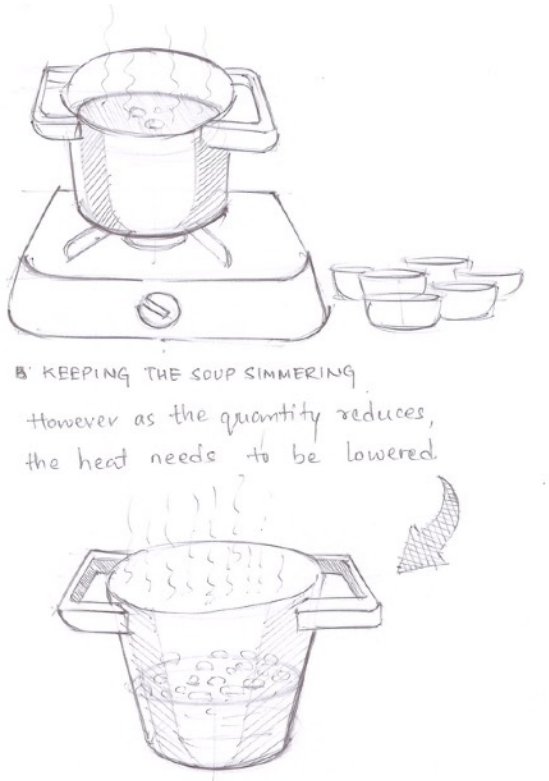
The following are the parameters and senses that are actively involved in cooking:

1. Time
2. Temperature
3. Weight
4. Sound
5. Visual references
6. Touch / feel

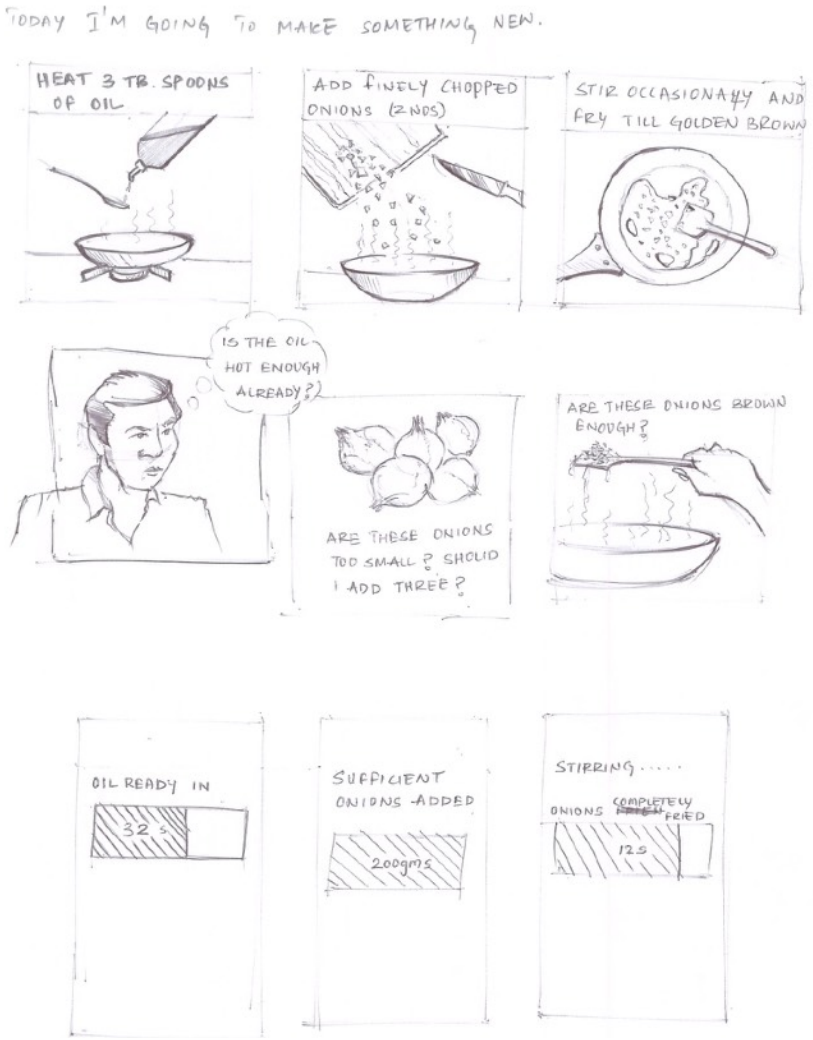
Of all these six, the first three can be accurately measured with current technologies. Measuring subtle parameters like sound, visual references and touch can become complex and increase costs. Furthermore, it is the first three parameters that result in the happening of parameters 4,5 and 6. For example, if the temperature of the oil and the weight of cumin seeds is accurately measured, then the crackling sound of fried cumin is bound to be heard.

Storyboards based on the concept of cooking aid:

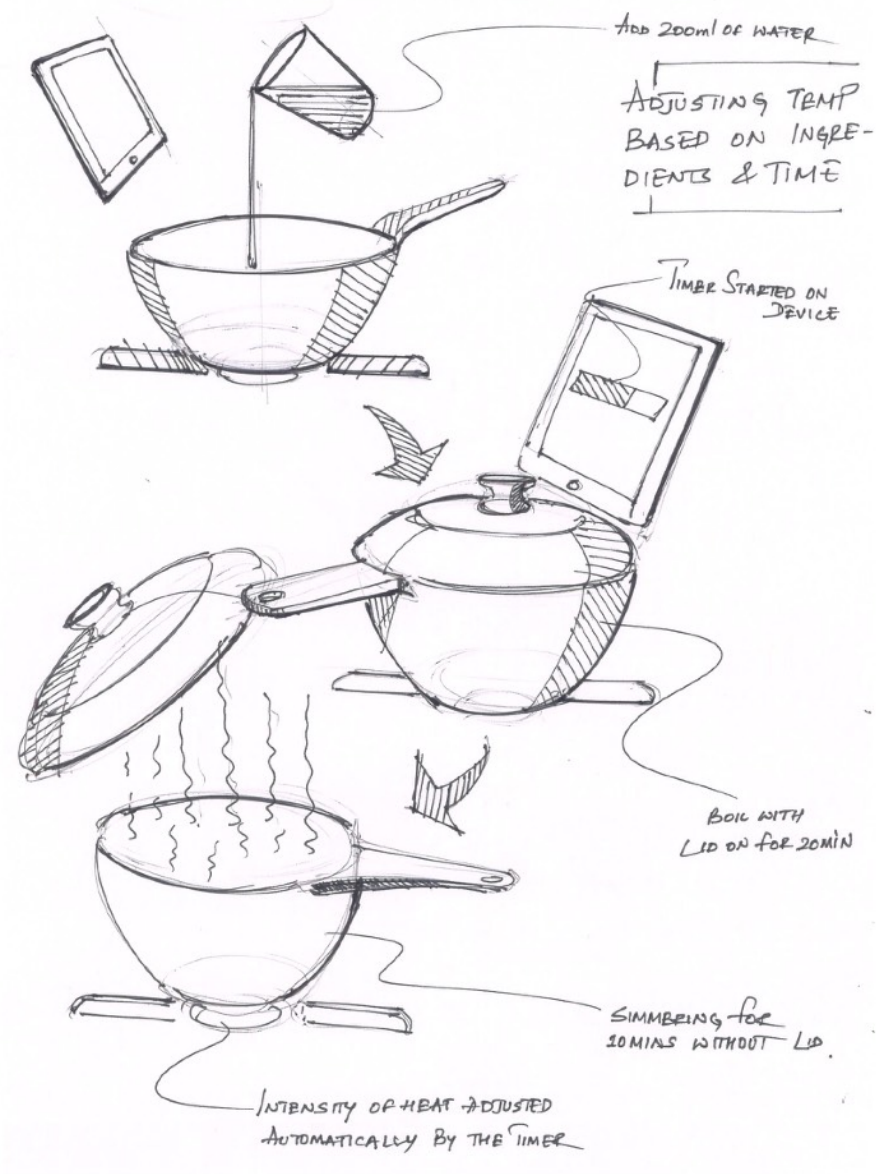
After figuring that the cooking aid concept would be able to accurately and instantaneously measure out time, temperature and weight we went ahead in making the use case scenarios. We tried to see as to how the cooking aid would be able to solve the problems we figured out in our earlier interviews.



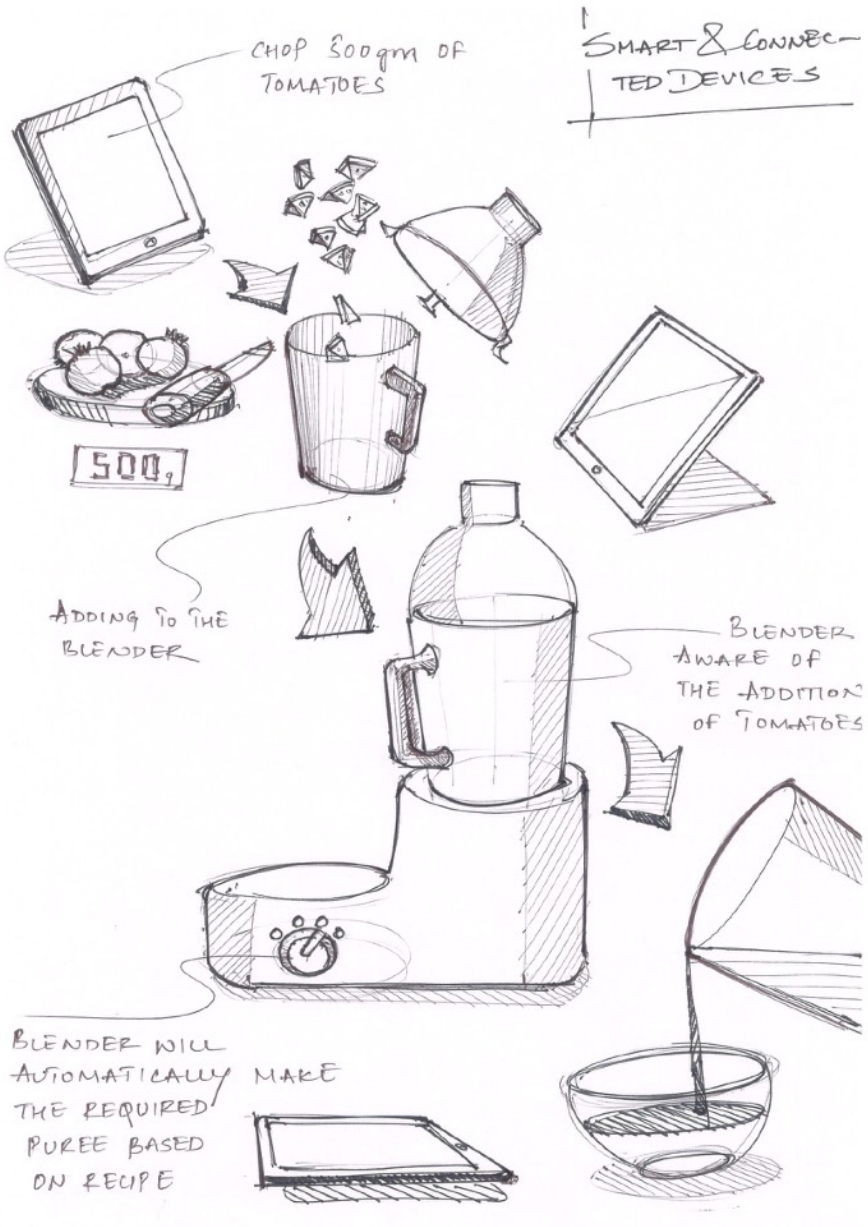
As the quantity of the soup reduces in the buffet, the heat will also reduce automatically so as to ensure that the soup doesn't burn.



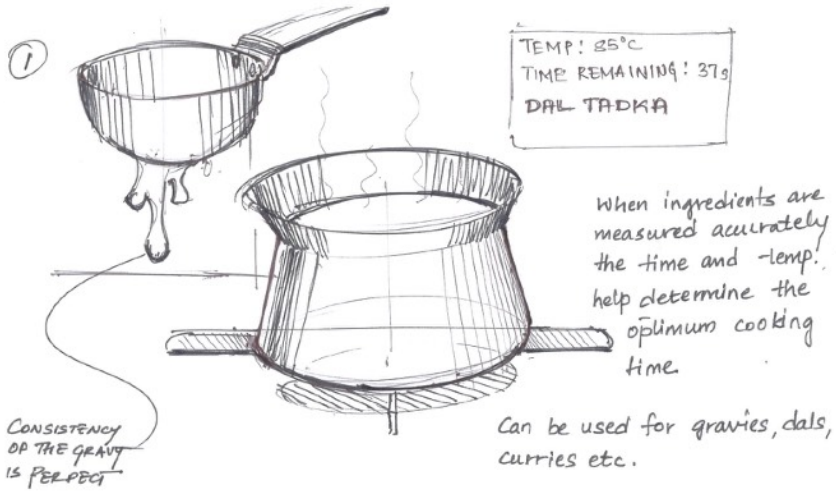
User will be told how much and when to add the ingredients.

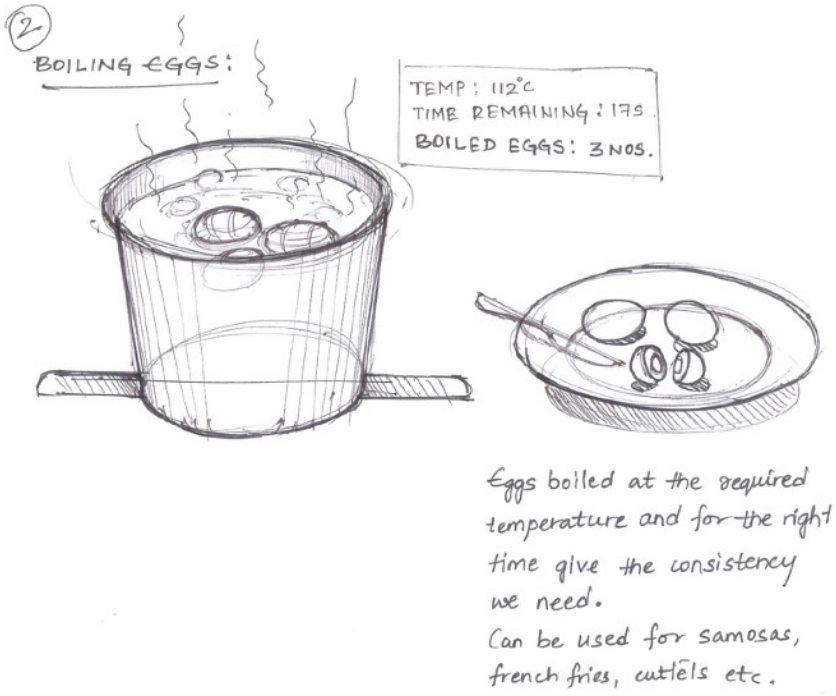


Automatically adjusting temperature as required by different processes. For example, dal is cooked on a much higher flame soften and break down the lentils and simmered on a low flame after the tadka.



Aware of the role of different appliances.
In this case since the weight of the tomatoes is accurately measured the blender will make the puree of the consistency required by the recipe.

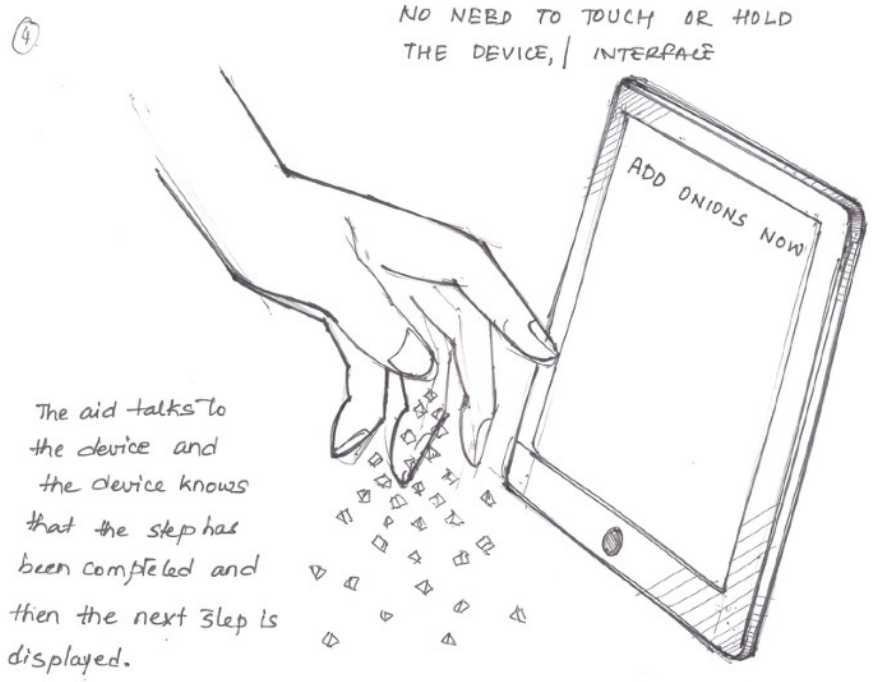




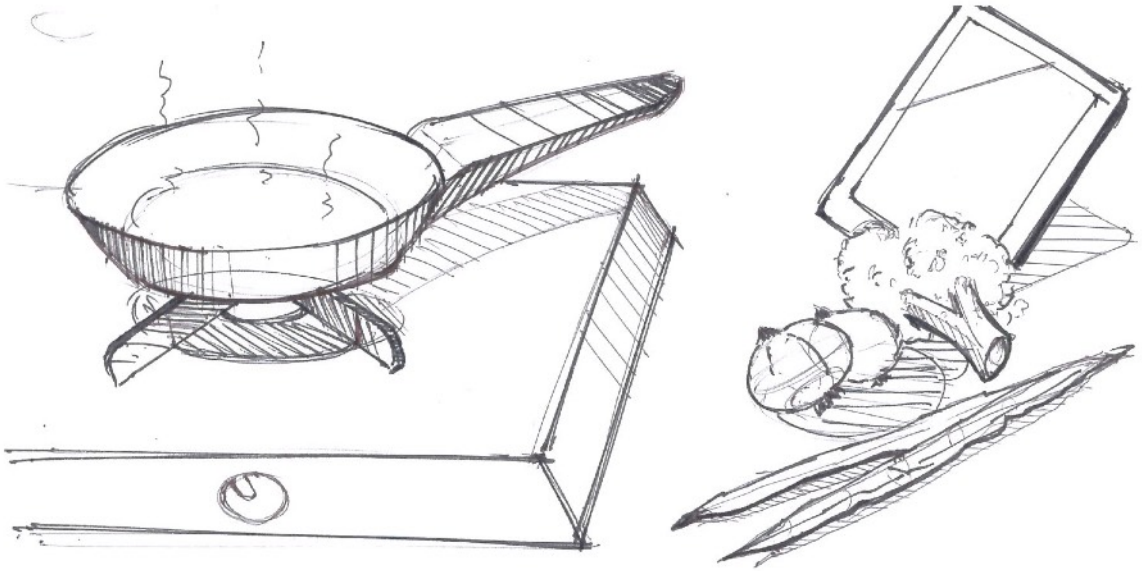
Accurate measurement of time, temperature and weight determine the optimum cooking time.
Can be used to make dals, curries etc.

Yolks of hard boiled eggs will have the perfect consistency every time. The device, being adaptive can also adjust recipes according to the users taste preferences.

The cooking aid will cover up for the users mistakes. In this case, the device will reduce heat accordingly so as to not burn the food.



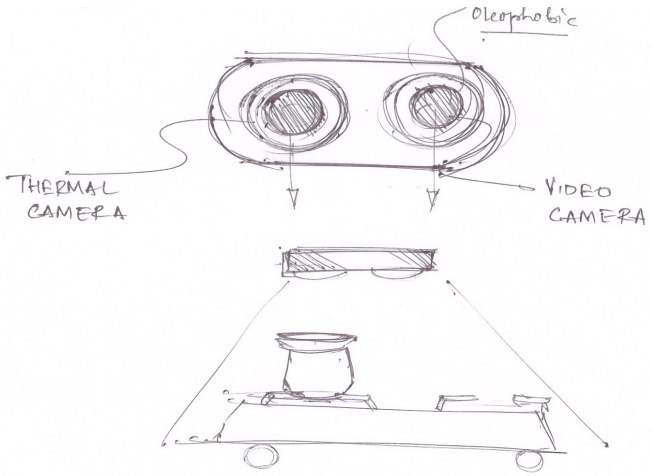
The device shall have minimum interaction. It will automatically know when a certain step in the recipe is completed.



Device lets you cook food in the healthiest way. Gives methods in retain nutrient content. Also gives tips like using a nonstick pan to reduce oil consumption.

Ideation:

After figuring out what the device will be able to do we went ahead to determine what the device should be. The idea was to make a product that could effectively measure time, temperature and weight quickly. Since the product had to be used everyday, it had to be familiar and long lasting.



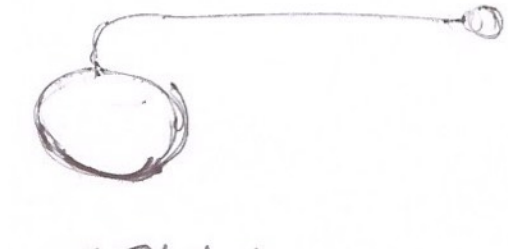
Camera mounted over the stove.

1. Camera mounted over the stove

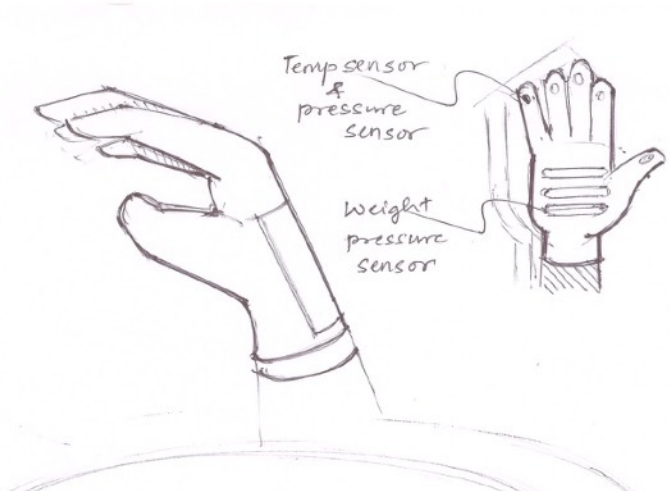
A set of two cameras will be mounted over the stove. One would be a thermal camera and the other would be a video camera. The thermal camera would help in determining the temperature of the preparation and the video camera would identify the ingredient.

2. Retractable probe

The device would have a retractable probe that could be extended and placed into the container. This would help in getting the accurate temperature of the contents inside the container.



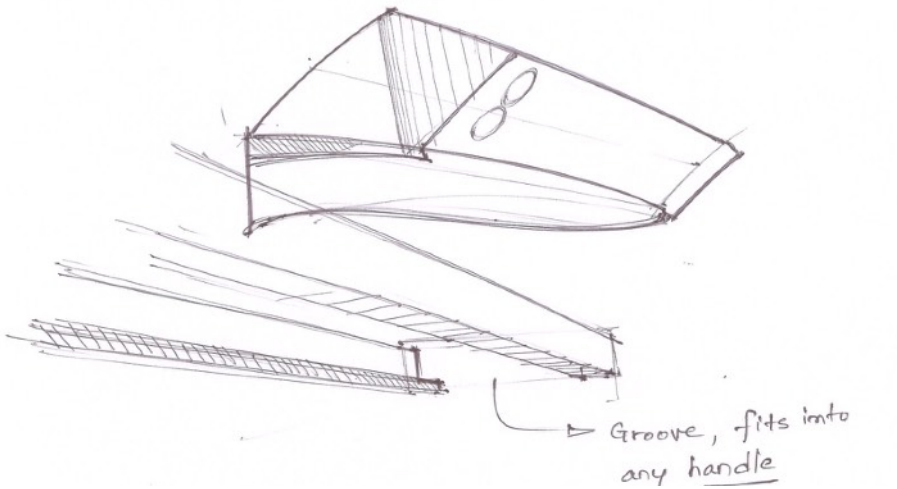
3. Glove



A glove with temperature and pressure sensors.

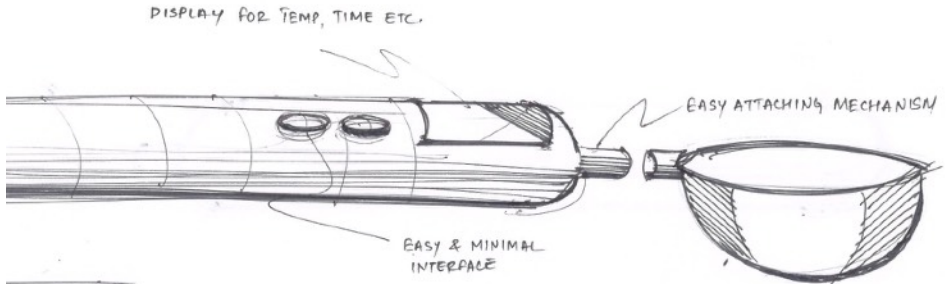
4. Modular handle

A handle that slides into existing handles of cooking pans, pressure cookers etc.

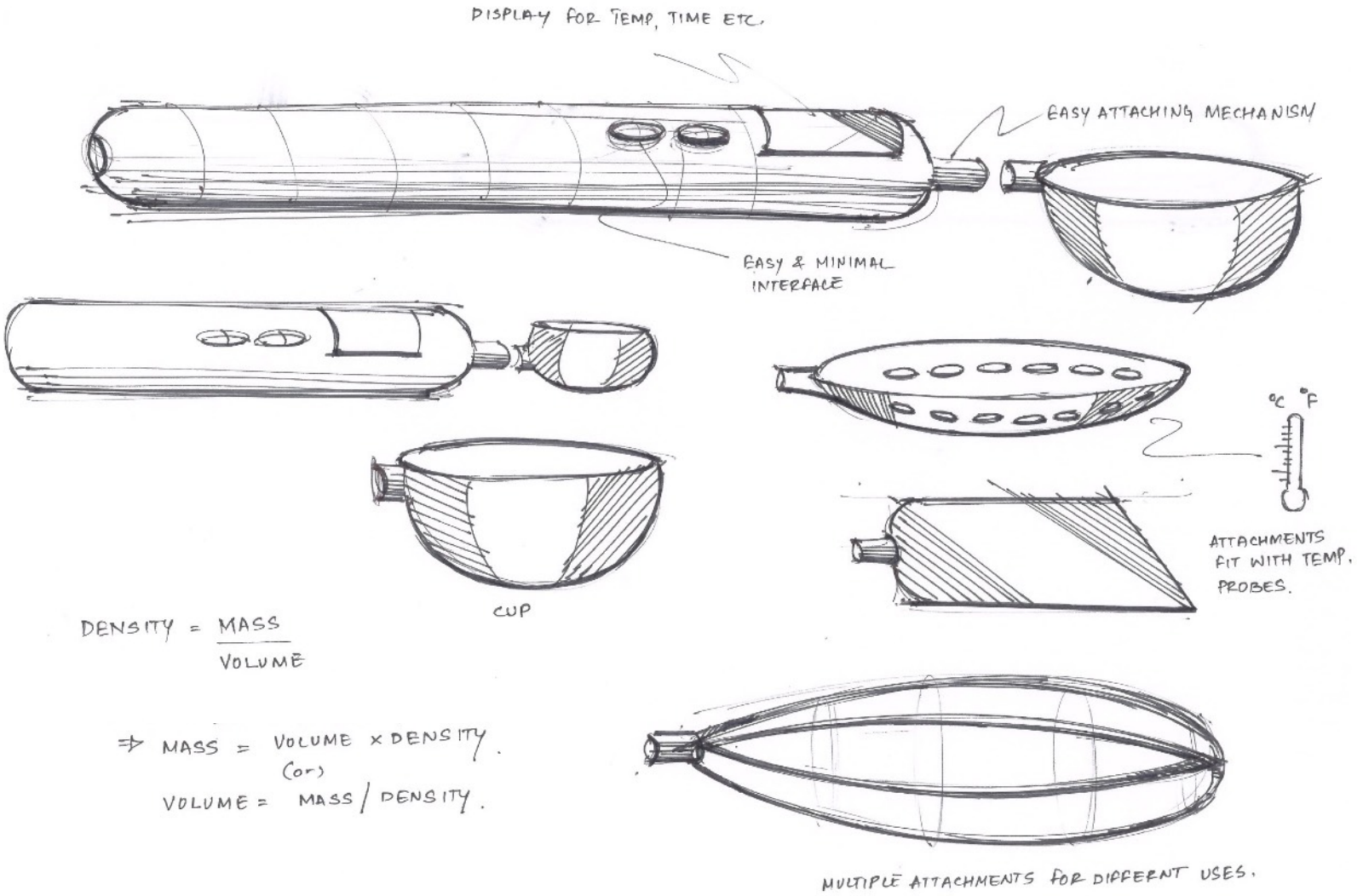


5. Modular ladle

The modular ladle will be an intuitive device that will measure all the designated parameters like time, temperature and weight. Also different attachments for different cooking processes can be attached.



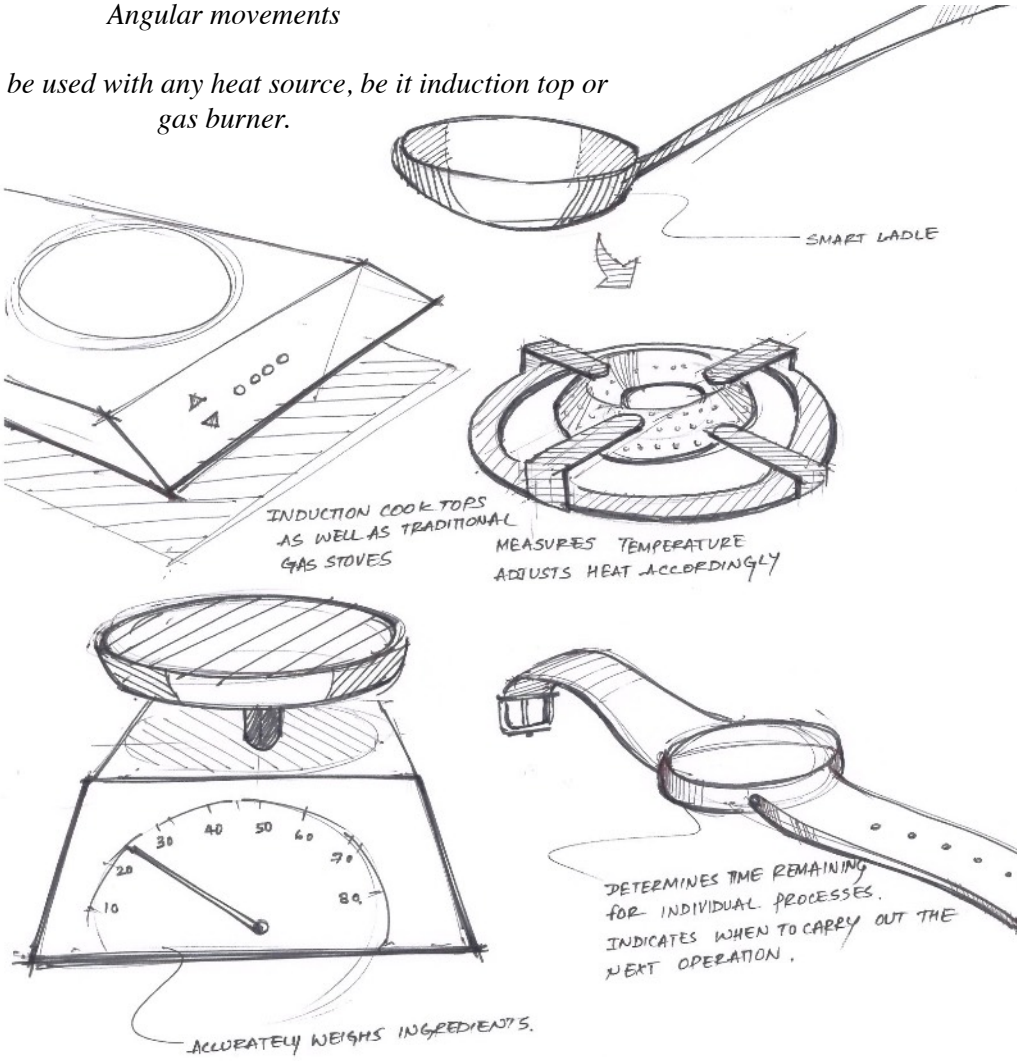
Final concept

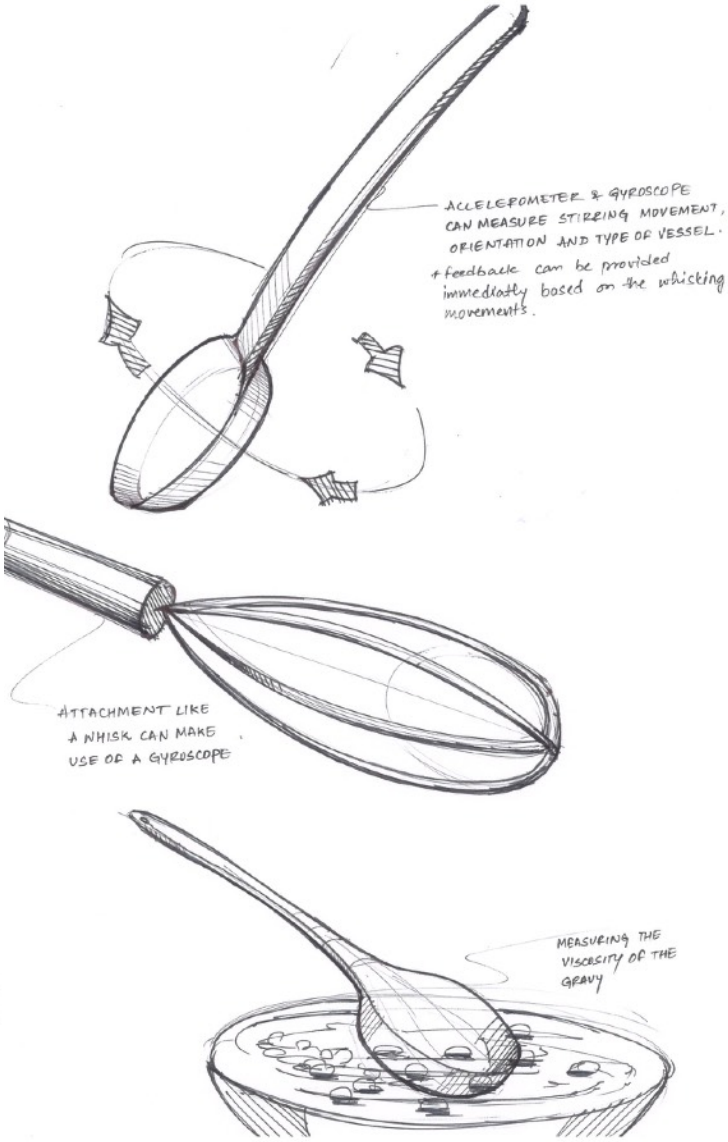


The smart ladle will accurately measure the following:

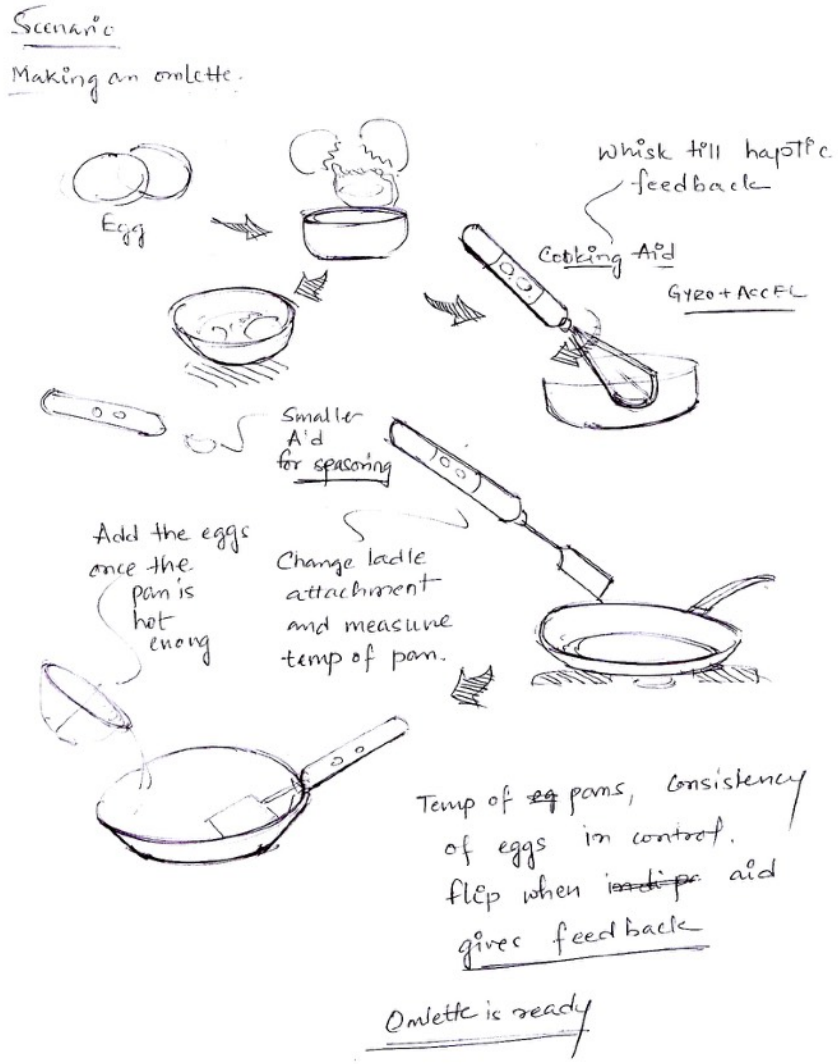
Temperature
Weight
Time
Orientation
Angular movements

The ladle can be used with any heat source, be it induction top or gas burner.





Use case scenarios for the smart ladle:



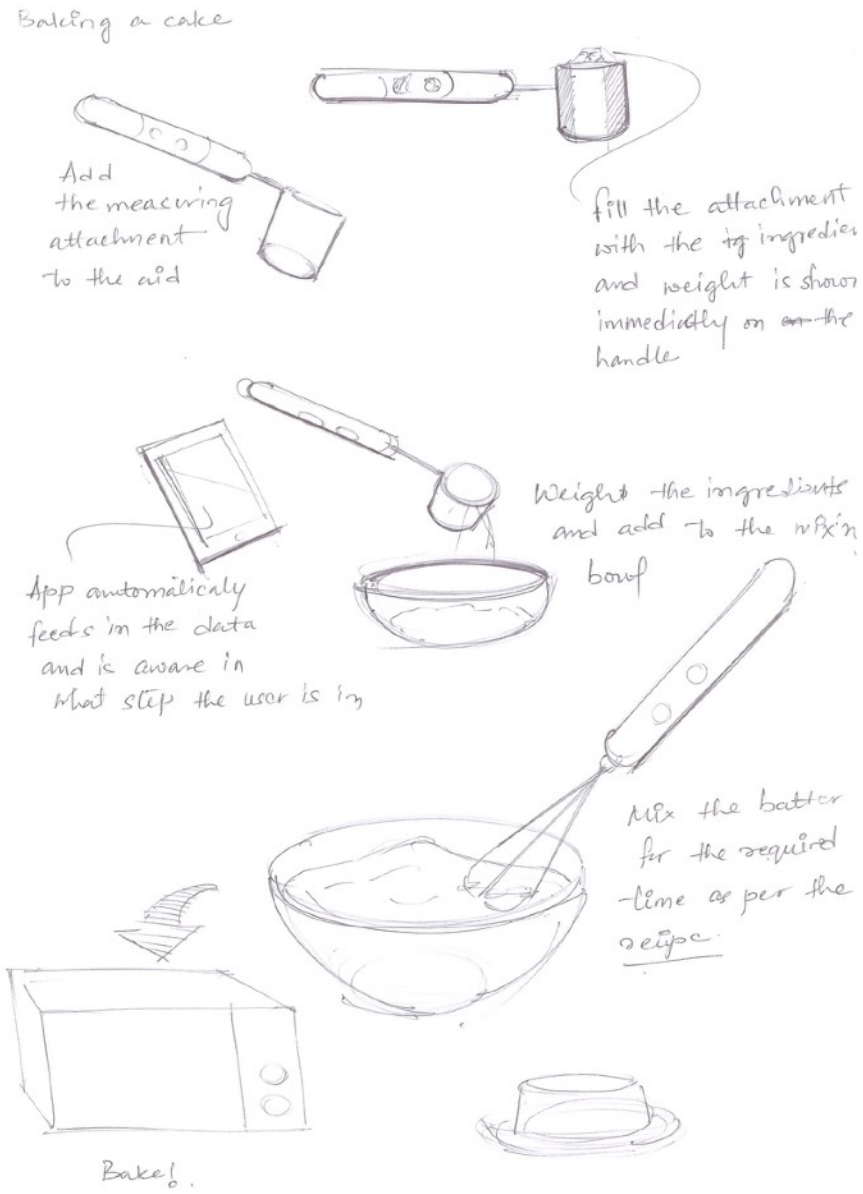
Making the omelette requires the steps as follows:

1. *Cracking the eggs*
2. *Whisking them*
3. *Heating a flat bottom pan*
4. *Adding the eggs*
5. *Serving*

The way one beats eggs for making an omelette is different than how one would for scrambled eggs. The gyroscope would assist the user to beat the eggs suitable for an omelette.

Once the eggs are beaten, the flat ladle attachment is used to add oil and measure the temperature of the pan. Embedded heat sensitive filament gives the instantaneous temperature of the pan and notifies the perfect time to add the eggs.

It is suggestions like these that manage to remove the ambiguity even in simple recipes like omelette and scrambled eggs.

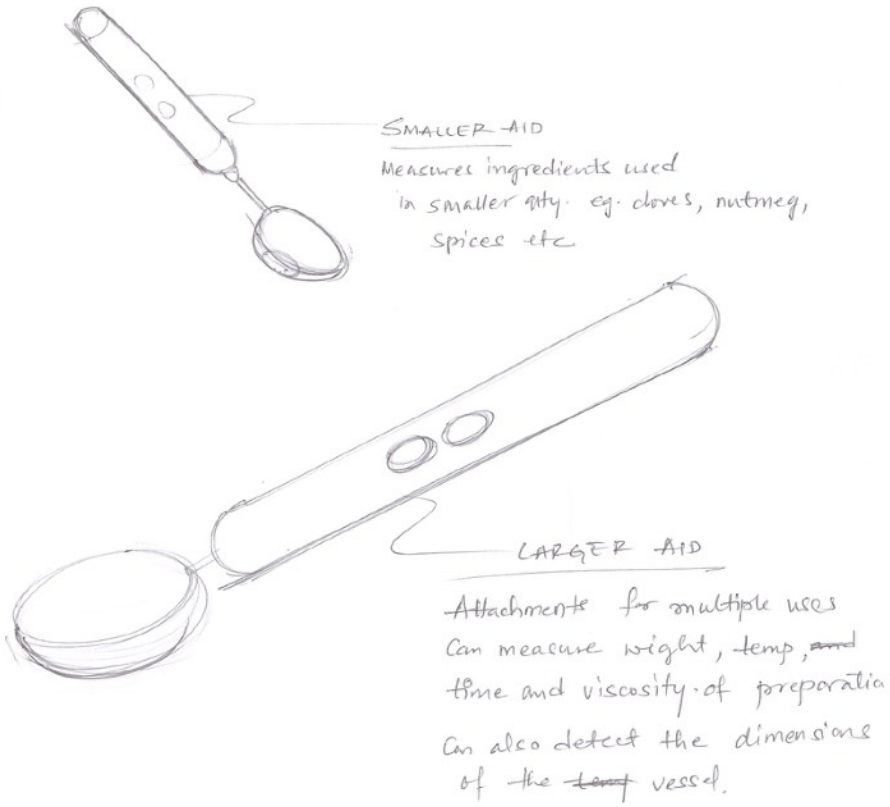


Baking a cake is considered to be one of the more complex tasks. It involves accurate mixing of wet and dry ingredients and then baking at a specify temperature for a stipulated time period.

With the smart ladle, the user can accurately weigh the ingredients. The individual weights of the ingredients are recorded into the device.

The ingredients need to be thoroughly mixed to achieve a homogenous texture. The whisking attachment can be effectively used to mix all the dry and wet ingredients. The homogenous cake mixture is then put onto a baking tray and into a preheated oven to bake.

Here again, it is observed that the smart ladle performs multiple roles and facilitates accurate measurement and thorough mixing of the cake batter. It keeps the user thoroughly involved as the physical effort of mixing and adding ingredients lie with the user.



A recipe has different ingredients in different quantities. While some primary ingredients are relatively large in quantity, there are also some ingredients that are relatively small in number. In a recipe though, irrespective of the quantity, each and every ingredient is of utmost importance.

Keeping this in mind, we proposed a second smaller attachment to measure small quantities. These can measure quantities of terms like "pinch", "few", "little", "few drops" etc.

Advantages of using a ladle as a smart cooking aid:

1. Most common tool:

Not only is it common but it is also one of the most essential. There are very few recipes that involve absolutely no use of the ladle. Ladles are used to effectively substitute human hands. They are used for all type of processes like stirring, adding ingredients, serving apart from cooking.

2. No learning curve:

Since the ladle is one of the most commonly used kitchen tools, there naturally is no learning curve. Irrespective of his or her background the ladle has absolutely no learning curve. The device feels very natural and intuitive to use for young and old, educated and illiterate. Even if the user does not want the ladle to aid cooking he or she can still use it as a normal ladle.

3. Independent of the type of heat source:

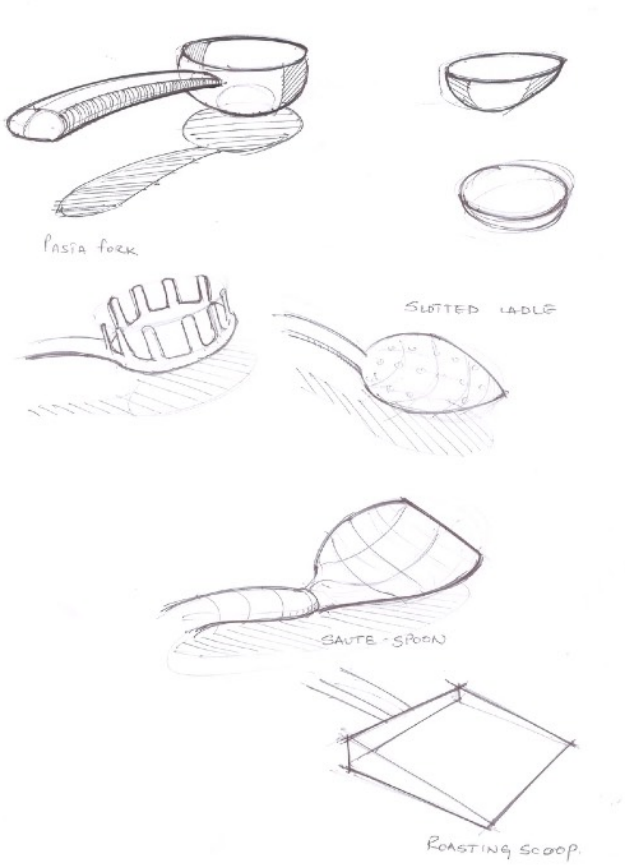
Today, the LPG stove is not the only used cooking medium. New induction cook tops have come up which makes use of electric inductive heating. However the vessels for induction cook tops and LPG stoves are different. The smart ladle is built for the future and can be used on both cooking media.

4. Modular:

The smart ladle is modular in sense that different attachments can be attached as the recipe demands. The user need not buy multiple ladles. One handle with different attachments is sufficient for most recipes. They can buy different attachments as per their cooking habits. All these attachments attach to the handle in the same way with a universal connector.

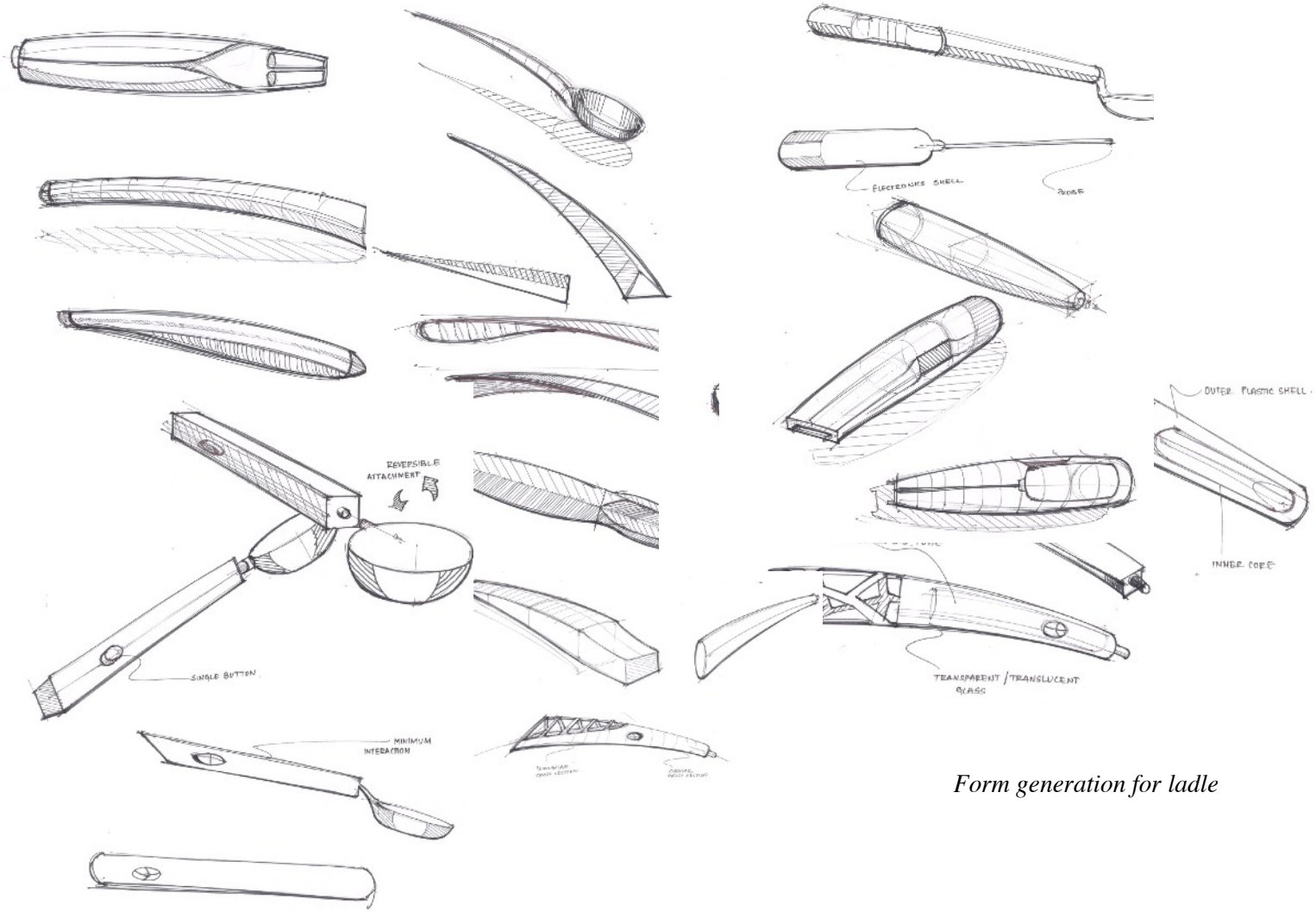
5. Does not require any other investments:

The smart ladle is all you need for your assisted cooking. It requires no additional investments of other cooking medium like inductive cook tops do. Moreover they can be used as a substitute for traditional ladles as well.

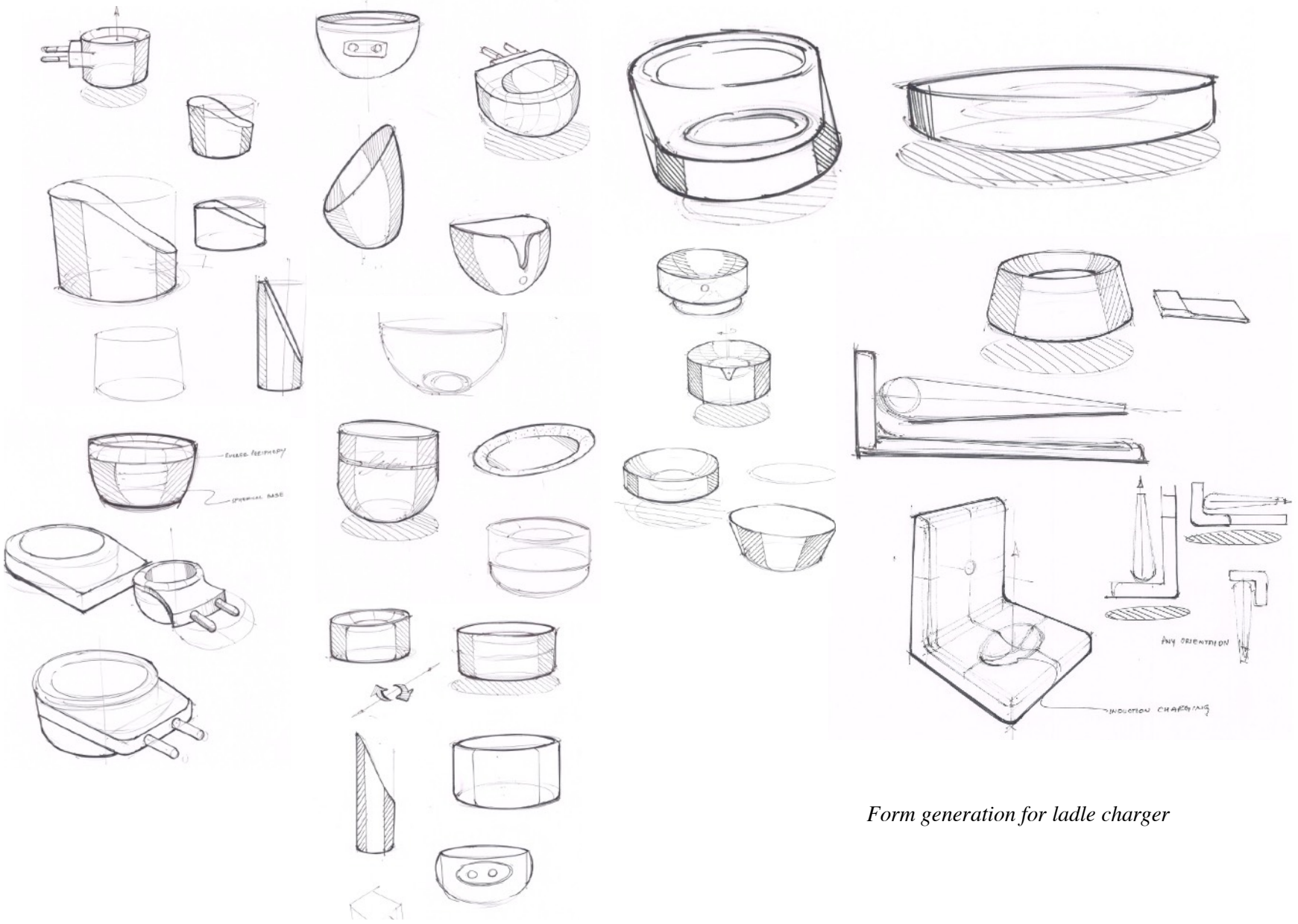


Form generation:

The ladle being one of most used kitchen equipment needed to be simple and sturdy. The form needed to not appear alien and look natural. Also it had to be easy to clean and store.

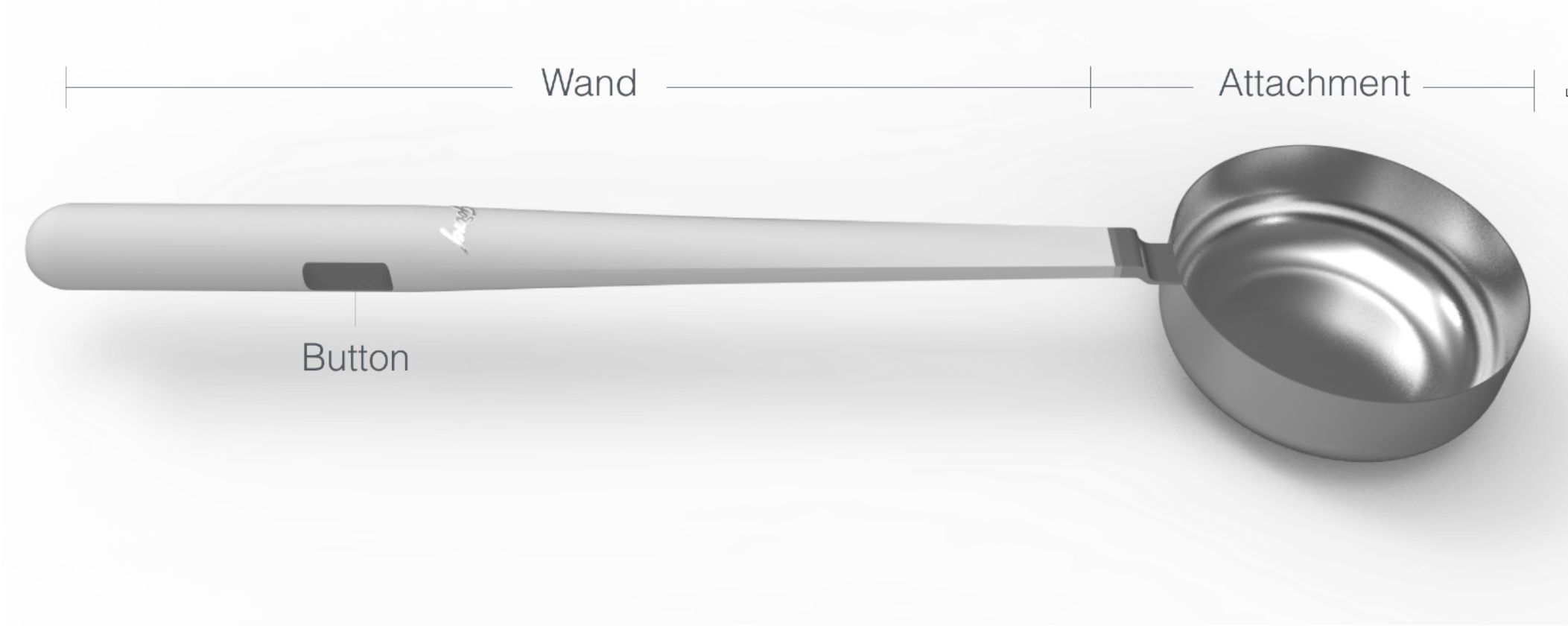


Form generation for ladle



Form generation for ladle charger

Final design:

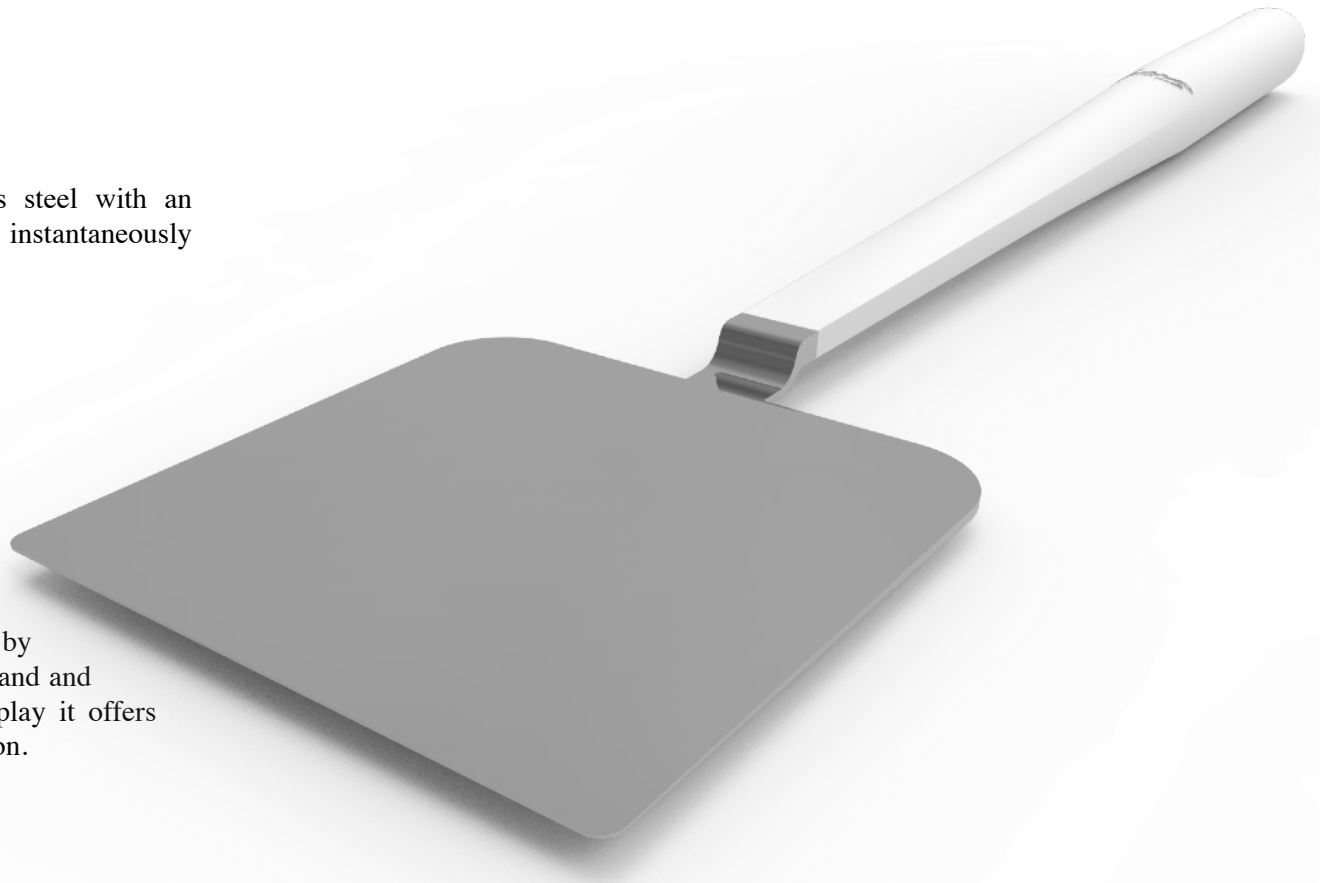


1. The wand:

The wand is the brain of the ladle. It houses all the electronics and battery of the smart ladle. The enclosure can endure high cooking temperatures and is also fully washable. The material (which has not been finalised yet) would be tough and resistant to nicks and scratches. The wand would securely attach to the attachment via a secure and reversible connection. This would make this device usable by both left and right handed people.

2. The attachment :

The attachment will be made up of food grade stainless steel with an embedded conductive film inside that would accurately and instantaneously measure temperature.



3. The button :

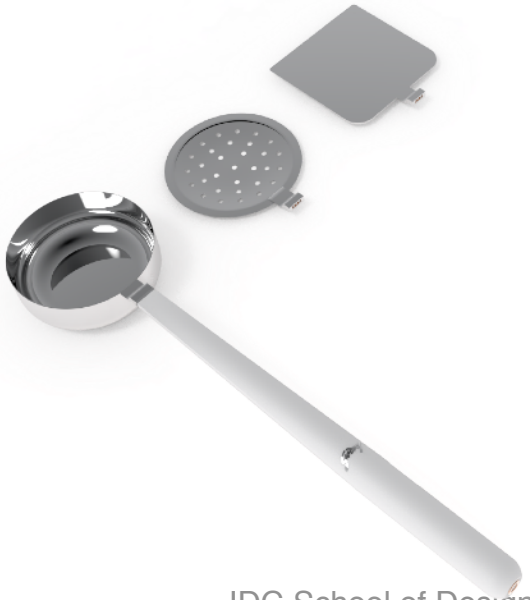
The button is specifically designed and positioned to be used by the thumb. It is differently textured from the texture of the wand and it hold the thumb comfortably. Since the wand has no display it offers haptic feed back by giving out a tiny but distinguished vibration.

4. The attaching mechanism:

The attaching mechanism will be a secure and reversible locking mechanism to firmly attach the modular attachment to the wand. Since the attachment is reversible, it will ensure that left handed people are able to use the device naturally. The mechanism not only attaches itself to the modular attachment, but also transmits temperature and weight data to the electronics built into the wand.

5. Unique signature of modules:

Each module, based on its type has its own signature. This means that the wand will automatically understand which module it is connected with, This is essential for the device to be smart enough to decipher the different stages in the recipe. Also different modules have different heat signatures and heat dissipation behaviour.



6. Induction charging:

At the back end of the wand is the induction charging ring which attaches itself to the charger. This ring ensures that there are no cables that get tangled and ports that get dirty. Moreover the wand can be just put into the charger without worrying about the orientation. The circular cross-section of the handle makes for hassle free charging.

7. The charger:

The charger is a simple device that houses the wand and charges it by induction charging. It fits into the standard domestic wall outlet and thus is a comprehensive cable free charging experience. The rim on the top is line with rubber so as to gently guide the wand into the charging cavity. It also provides any accidental nicks and scratches that may occur while putting the wand for charging. The cavity is deep enough to hold the wand securely in an upright position while charging.

Future scope:

1. “Tastes” the food:

With advances in technology it is highly possible that we may develop sensors that can determine the taste of a substance upon physical contact. This would open up a whole lot of possibilities. For example, the ladle would know what ingredient is being added and thereby would automatically suggest the quantity. The ladle would also be able to tell if the seasoning is according to the users taste. It may also determine the freshness quotient of food.

2. Your taste on the internet:

The ladle, along with the app is artificial intelligence that gets smarter as you use it. It will learn and understand your food habits and store them (with permission) on the cloud. In case the user orders food online, then the restaurant can use this data so as to prepare the food as per the choice of the user. More importantly, this feature can be used to eliminate allergic substances that the user may not be aware of. Being a system wide change, this would ensure that your taste preferences are accessible to the appropriate people for the users benefit.

3. The user health chart:

Monitoring of your daily nutrient intake will be really easy with the smart ladle. Since the ladle knows the quantity of ingredients added, it can give a pretty accurate chart of your calorie intake. What sets the ladle apart is that is also knows the size or quantity of your servings. As a result, it understands how much you have actually put on your plate.

4. Monitoring groceries:

The ladle, with the app will know the quantity of the groceries in your house. With this it will inform about missing ingredients in recipes before hand. It can also suggest what you can cook based on the quantity of the ingredients in your house. Furthermore it also warns about the depletion in nutritional value especially in fruits and vegetables if they are stored for long periods of time. In the future, the smart ladle will be connected to grocery suppliers and would be able to make automatic purchases of your groceries as per your requirement.

Conclusion:

The smart ladle is an innovative cooking assistant that manages to minimise the stress experienced in cooking. It makes use of existing technology to accurately and instantly measure parameters like time, temperature and weight. It does all this while ensuring that the user is always in control of the process and thus maintains the joy and satisfaction of cooking. Along with this, it also covers up for the users mistakes thereby not only minimising stress but also wastage of food. It is an attempt to make more people cook at home today and understand that home cooked food is cheap, healthy and finally tasty. With connection to the internet the smart ladle is now your nutritionist as well. It also warns the restaurant you are eating at about your allergies so that yo do not encounter any unpleasant experiences. With multiple modular attachments, the smart ladle has an active role to play in all your cooking activities.