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Taste Simulation using Electrical Impulse in AR

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Abstract:- In recent years, as the technologies are getting advanced it can be observed that most of the works done by human is becoming easier and less time consuming. There are various fields where technology has led to provide a lot of advancement in that particular field and has changed the way of living life that we used to in past years. As discussed about the fields in which advancement is made one of that field among those is food. Food industry has made a lot of advancement as compared to the way it was earlier. We can see there is various ways by which we can get our food whenever we are hungry just by a click of a button in our mobiles. Not only this but also we receive our order very fast which makes life easier. There are ways by which we can locate our food and also if there any kind of problem in food such as, we don't get food according to the order we can easily replace the food by just informing it about to the company. But there is a part which plays a very important role in food business needs to be explored a bit using machine and technology and that is taste. We all can order a food, and by eating the food we can tell whether the food is tasting good or bad, but it will become more easy for us, if without tasting the food we can check whether the food is too much salty or sour and also if the food is lacking taste due to less sourness or salt it can be easily changed. Although there has been many studies that have shown that the taste of any food can be produced by the simulation of electric impulse but still there are very little attempts that has shown an increase in the production of such devices that can result in such significant changes due to the simulation of artificial taste.

INTRODUCTION

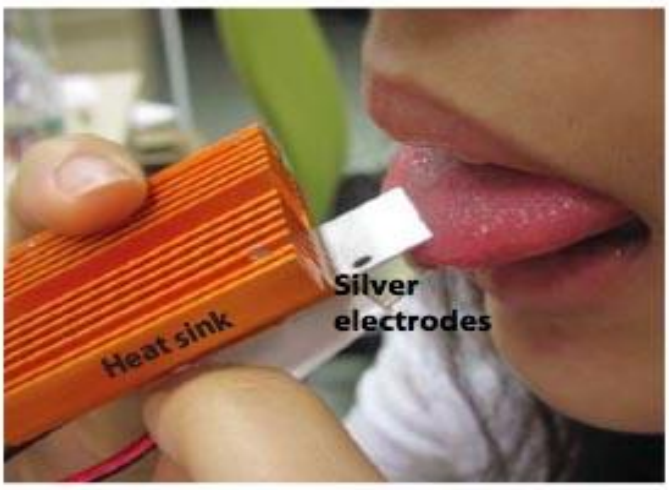

Figure 1 (Tongue interface)

Food plays a very important role in one's individual life. Eating food is one of the most important activity that we perform in our whole life span. Food provide us with all kinds of nutrients that we need to keep our body working in correct order and perform all our work without getting tired. Food is not only required to perform all our activities but it is also required in order to keep our body free from any kind of disease and to maintain the immunity to fight from any kind of harmful bacteria that can harm our body from Inside. One of the most important factors in the type of the food we consume is that how that food tastes and how good is the aroma of that particular food. Whatever may the age of an individual everyone is too picky about the food that they eat. However it does not depend on the food whether the food is heathy or junk if the food has good taste and aroma people will prefer to eat it. Taste of food plays a very important role as by tasting of food we get to know about different types of flavor present in the food and the combination different flavor in the food will lead to telling whether the food is good in taste or just ordinary. Aroma or smell of the food only can lead to deciding whether the food is smelling good or not and it's not always necessary that if the food does not smell good it is not good in taste although smell of the food plays some vital role in deciding whether the food is good to eat or not. We also know that between taste and smell a particular person will surely prefer the taste first and this preference of taste over smell may lead to development of various technologies which can be helpful for many of us. Taste can be considered to as key factor in simulation of taste using electrical impulse which can further lead to generation of some taste of food in human body without having food. Development of such technology will surely lead to a lot of advancement in field of food and will surely improve the food quality and will lead to better experience. In this paper we are basically we are going to present our idea of food tasting using electrical impulse. The basic concept of the project is to obtain the taste the food without tasting the food. In order to implement the idea, the basic principle used is the electrical signals which are used by our tongue in order to send the information to the brain and we get to know What kind of food we taste. In this project the basic equipment's involved are the electrodes which will help in producing of electrical impulse to the tip of the tongue and further help in generating of food flavors in the tongue only by doing certain adjustment in amount of current produced through electrodes.

As the food flavors are generated in the tongue it can be changed according to taste of an individual for suppose an individual person wants to taste food which is spicier can

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taste it within seconds by just changing the settings of the machine. The machine will be able to produce any type of food taste by mixing various flavors and replicating the taste of that food. This paper will consists of various parts which will further lead to understanding of this project in a more clear way, the sections involved are:

1. Making
2. Description of the taste simulator
3. Functioning
4. Conclusion
5. Advantages and Limitation

Section 1 will deal with construction of it.
Section 2 will help in describing of the project.
Section 3 and 4 will help in working or will help us to learn the functionalities of the project and tell us the result we obtain from the project respectively and
Section 5 will basically deal with the advantages and how its use can lead to advancement in that field and also the question which may arise in making of the project and finding the best way possible to develop the project.

Making:
Equipment's required: silver electrodes, wires, Arduino, potentiometer, heat sink, etc.

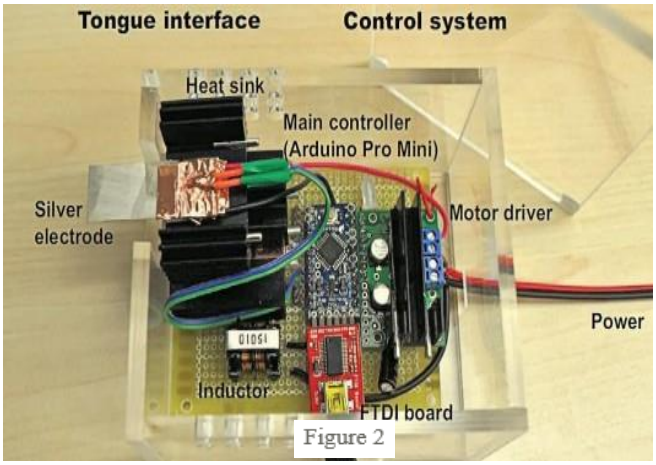

Figure 2

PROCEDURE

First of all a support in a form of box will be created in order to hold the project. We start the procedure by storing an Arduino in the box, so basically Arduino is a kind of electronic platform which help in receiving of input signals and producing some output and helps in connection of 2 different devices together. In this mechanism Arduino will be used to produce small amount or micro-ampere amount of current which will lead to producing of various different flavors. After Arduino is placed in the box wires will be connected through it which will help in connecting the Arduino with electrodes through the heat sink device. Now as we know by changing temperature by certain level along with the change in the electrical current will lead to the producing of different flavor, now here heat sink device will come into play and this will help us to change the temperature to such minute amounts so that we will get the taste of various different flavors. One of the most important equipment which will lead to the production of taste through our tongue is the silver electrode. The electrode will be made of silver and its work will be to produce the electrical impulse which will lead to the production of flavor. There will be 6-7 electrodes which will lead to produce different sorts of flavor according to the type of food an individual will like to have. Each electrode will have magnitude of a single taste, with the change in the current and temperature of each electrode the taste of the electrode will change, and the combined resultant of the combination of electrodes will result in the formation of new and different flavors. It will be clearly marked which electrode is specifically used for which kind of taste and hence by the combination of heat sink device and Arduino will lead to producing the flavor of the food as ordered.

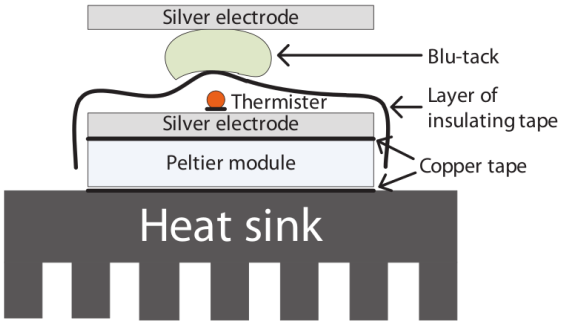

Figure 3 (Layers of tongue interface)

DESCRIPTION

Tasting of food without getting to have real food is a concept which will lead to a whole new development in field of food and the occupations related to it. As we all know food plays a very important role in our daily life and its very important for every human being to have food in order to remain healthy and to survive. As the world is developing, there are various advancement made in each and every field and various new technologies are invented in order to make life easier for human beings and from many of fields which are making development the fields involving eating items is also one of them. This project is also attempt to develop the area related to food items and provide a better experience to all the people using it. This project deals with producing taste of any and every kind of dish the user wants to taste, so this can help them in deciding to whether to try that food or not. The steps starts with producing of electrical impulse in the tip of the tongue through electrode which produces the taste of the food, as the food flavors are generated in the tongue it can be changed according to taste of an individual for suppose an individual person wants to taste food which is more spicy can taste it within seconds by just changing the settings of the machine. The machine will be able to produce any type of food taste by mixing various flavor and replicating the taste of that food. The mechanism will consist of switch which will lead to change in flavors according to there will for example if a particular individual want to taste some new variety of food and he is not sure about it so first using this particular machine he can get to have a flavor of that kind of food and then make up his mind whether to have it

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or not. The mechanism of this machine works such as the electrodes are brought in contact with the tip of the tongue the electrical impulse are sent to the tongue and as we know our tongue consists of various taste buds which are distributed all across the papillae of the tongue which are also responsible for receiving the electrical signal and directly sending it to the brain, the tongue also consists of palate epithelium. Its basic work is to understand the different flavor of the food, there are almost five flavors present in a particular food item they are categorized as follows : [1]

- SWEET (energy rich nutrients)
- UMAMI (amino acids)
- SALTY (dietary electrolyte balance)
- SOUR (sour taste)
- BITTER (noxious or poisonous food

Table 1 (Taste of common foods)

Taste	Taste substance	Common foods
Sweet	Sucrose Fructose Glucose	Sugar, Honey, Candy
Sour	Acetic acid Citric acid Lactic acid	Vinegar, Lemons, Limes, Yogurt
Salty	Sodium chloride	Salt
Bitter	Caffeine Alkaloids Momordicin	Coffee, Bitter melon, Chocolate (90% cacao mass)
Umami	Glutamate Inosinate Guanylate	Tomatoes, Cheese, Meat, Fish, Dried shiitake mushrooms

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FUNCTIONING

In this project we will produce flavor of lemonade. As lemonade consists of multiple taste, i.e. both sweet and sour which will make it easy for us to explain our project of producing taste of a food item using electrical impulse. As mentioned above the basic mechanism of this project, now we are going to understand about its working through a food item that we have taken as lemonade. So, first we must power on the Arduino and all the electrical components that are available. Now using a software air we will command the Arduino to change the the electric current and heat temperature of the electron with the help of the heat sink and the Arduino itself the software will now adjust the the temperature and current on the electrode according to the flavor entered this flavor will be e made by the combination of of different tastes that are provided by each electrode in the Simulator model the user have to to put the electrode on his tongue so that the electrode will pass the signal to the the tongue receptors true that taste papillae and hence the signal will be passed to the brain using the nerve cell. As we know the nerves transmit signal using electrical impulses which the the taste papilla will undergo during the the working of the simulation this will make the brain to believe that the actual taste of the food is coming from the Silver electrode and hence we get the flavor of the desired food that we require which in this case is a lemonade.

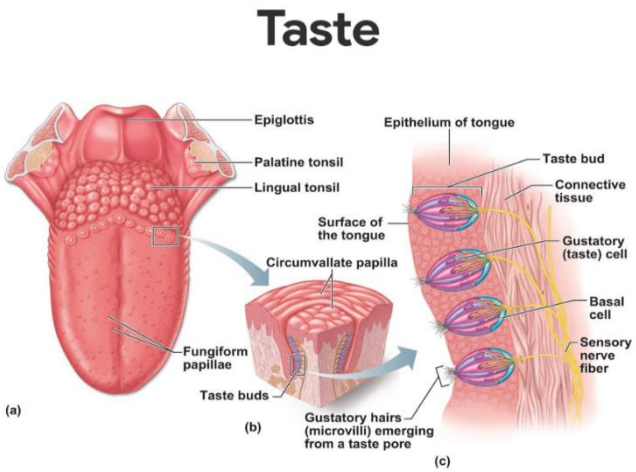

Figure 4 (Parts of tongue)

RESULT

In this section we will check the capacity of the model to really produce taste by studying the data that is obtained during the experiment. The data obtained is based on the research done by us with the reference to some sources that is available on the internet. The experiment done by us verified the results available online. We found out that the taste of the electrode varies on the basis of the current and temperature provided to it at an instance. Also the change in taste also needs the accurate rate of change in temperature and current as a result we must be very careful in performing the operations. The result obtained by us on the account of the change in temperature and current accounts for the fact that very minute changes in these can change the taste of an electrode

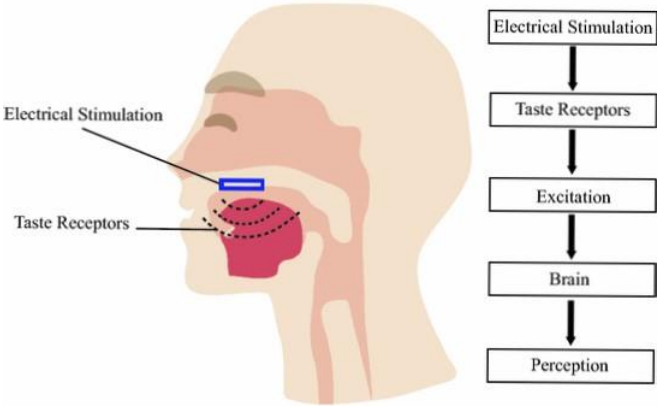

Figure 5 (Stimulation of taste)

and in our case the flavor of the food will drastically change. The results obtained for the production of a single taste with an electrode are: [10]

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- Sour: magnitude of current from 60uA to 180uA & increasing temperature from 20C to 30C
- Salty: Magnitude of current between 50uA (lower frequencies)
- Bitter: Magnitude of current between 60uA – 140uA (bottom surface of the tongue)
- Sweet: when the current is inverted and increase temperature up to 35 C and continuously decrease from 35 C to 25 C (during the transition - continuous exposure is required)
- Mint: Decrease temperature from 22 C to 19 C
- Spicy: Increase temperature from 33 C to 38 C

This was the result obtained by the experiment performed by us so that we know about the behaviour of the silver electrode when used to produce taste so we can produce the desired taste from it.

ADVANTAGES, LIMITATION & APPLICATION

Advantages

- Will help in making life simpler for sectors related to food.
- Will help people in having any kind of food according to their will.
- Health conscious people can get to have any kind of junk of food they wish to have
- Old people having difficulty to eat food also can get the experience of tasting food according to their wish using this machine.
- This machine will allow us to have any kind of taste without intake of any particular food item which can be harmful for some people
- This will surely help in reducing the food wastage, as compared to the modern world scenario where food is wasted in large amount.

Limitations

- People get worried to test such new technology.
- The electrical impulse produced artificially might lead to some damage to the taste buds.

Application

In today's world where all the things are done online from food delivery to house cleaning services. The chances of error for any online service have to be reduced. For that the service should be trial and tested. So that is the reason we have thought about the simulator model which will give the taste to the use without actually ordering a food item online, as in online model we can only see the food item visually but by the use of our model we can make the user to taste the food prior to ordering. This will also help the user to try other kind of food item which generally people are afraid to try especially while ordering food online. We hope that this model can be improved in future where we can add some texture to the food along with the flavour.

CONCLUSION

As per the modern world scenario is concerned various advancement are made or being made in order to make life simpler for us. According to us, successful functioning of this project will surely play an important role in advancement of food sectors and sectors related to it. This experiment conducted by us can be considered to be as first of its kind, there are various experiments which are related to, generating of taste using electrical impulse , but there were attempts made to produce only certain kind of tastes ,this project can be considered to be different because as mentioned above this is a basic mechanism built in order to produce not only certain taste but to produce entire flavour of any food provided. This project has been successfully implemented by producing taste of a lemonade using electrical impulse. We obtain various kind of theories and information while testing and implementation of this project.

Some theories can be termed as follows:

- By changing temperature, we can obtain various kinds of flavour, i.e. just by varying temperature by fraction of values we can obtain 2 basic taste and those are sourness and saltiness.
- Electrical impulse sent through electrodes are first accepted by papillae and further then it is passed on to the brain and then brain helps in deciding the various types of taste.

The study was conducted in simple two steps and those are mentioned as follows:

- First, we provide a freshly prepared lemonade to the subject and let him have a sip of that lemonade and tell him to remember the taste and various flavours present in it.
- After that we use our TSEIA (taste simulator using electrical impulse in AR) on the subject and try to replicate the same flavour and taste of that lemonade that he had earlier.

Based on our study we find following results:

- The subject agreed that the taste of original lemonade and taste produced by TSEIA is same.
- Also, the subject was easily able to add or remove the amount of sweetness or sourness according to the need of him.

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