# *Enhacing Internet : Transporting Smell over the Internet*

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***ABSTRACT***

Senses have been one of the most powerful gift to mankind by God. Till now Internet inarguably one of the strongest communication mediums at present, uses all senses Viz. Vision, Hearing and Touching but one is missing. It is the power of smell. And this paper deals with the issue of , as how to transport smell over the internet. Another humble try to "Enhance' the Internet.

## INTRODUCTION

"Survival of the fittest" – a famous quote by Charles Darwin in his famous book 'Origin of Species' [1] is still true in present times and is applicable to each and every field. It is applicable to our Computer field. For ex. we are using decades old Internet structure with a very few additions in the structure as a whole.

This paper is all about adding a small but surely a great enhancement to the internet which it lacks at present. What is this lacking stuff ? It is like that we are not able to use all our senses on the Internet. While working on Internet, we use a few of our senses viz. Sight, Touch and Hearing. We use Sight watching the monitors, Touch mouse or keyboard keys, Hearing songs in our favorite media player. But still we are not using two of our senses namely Taste and Smell. Right now idea is to transfer smell over Internet.

### *A Smelling System*

For letting computers interpret and produce a particular smell, we first need to understand what smell is composed of and how do we sense smell. Then on these bases lets study a proposed of computer smell model.

### *What is Smell*

**Smell** is another powerful sensing gift from God. Whether for finding food, choosing a mate or avoiding a predator, the sense of smell is essential for the existence of almost all creatures. We humans, able to distinguish over 10,000 different odor molecules, utilize our sense of smell for multiple activities from enjoying the aroma of freshly brewed coffee to deciding whom not to sit next to on the bus.

Smell basically is generated by vapors which themselves comprise of various chemicals, mostly carbon-based aromatic compounds. In the last 15 years scientists have made great advances to our understanding of how our nose detects odor molecules and our brain processes the resulting information that gives rise to the sensation of smell. This paper does not goes deep into biochemistry, but here is a small synopsis of the human nose smelling system. Smells are detected in the nose by the specialized receptor cells of the olfactory epithelium. These are called olfactory receptor neurons. These sense bipolar parts judge the vapors and send the signal to the brain. Now, there are various theories as how this process works i.e. how the nose recognizes various smells:

**1). Molecular shape**

One being the "lock and key" hypothesis (Moncrieff, *The Chemical Senses*, 2nd ed., 1951) ,which was borrowed from enzyme kinetics and applied to smell. He proposed that distinct primary odours had receptor sites. [2].

**2). Diffusion pore**

The theory of Davies and Taylor (1959) suggests that the olfactory molecule diffuses across the membrane of the receptor cell forming an ion pore in its wake. The diffusion time and affinity for the membrane receptor determine thresholds. But, it is difficult to explain the different

qualities of smell. The problem of frequency coding and stimulus intensity is difficult to resolve. The different odour would cause a different size pore and therefore a different receptor potential, giving rise to a particular firing rate - but in olfaction, stimulus intensity is frequency coded and not the different quality of the odour. However, many odorants are organic molecules that will dissolve in membranes and alter their properties. [3]

**3). Piezo effect**

This slightly "off the wall" theory was proposed by Rosenberg et al (1968). They believed that the carotenoids (vitamin A, in the pigment of the olfactory cells) combine with the odorous gases giving rise to a semiconductor current. They argued that this current could activate the olfactory neurons. [4]

**4). Molecular vibration**

The frequency of many odours is in the infrared (IR). Is this resonance associated with their smell? This idea was suggested by Dyson (1938). Male moths are drawn to candles because the flickery IR emission is identical to that of the female moth's pheromone. Different frequencies of IR could give rise to different smells. If the whole vibration range was used, up to 4000cm$^{-1}$, the detection of functional groups would be explained since many compounds with distinctive odours vibrate at around 1000cm$^{-1}$. There is an immediate problem - that of the body's natural IR heat. Perhaps the pigment acts to absorb this IR radiation. Another problem is that frequency coding is proportional to stimulus intensity in olfaction, so different frequencies of IR could not be converted into different nerve firing frequency. [5]

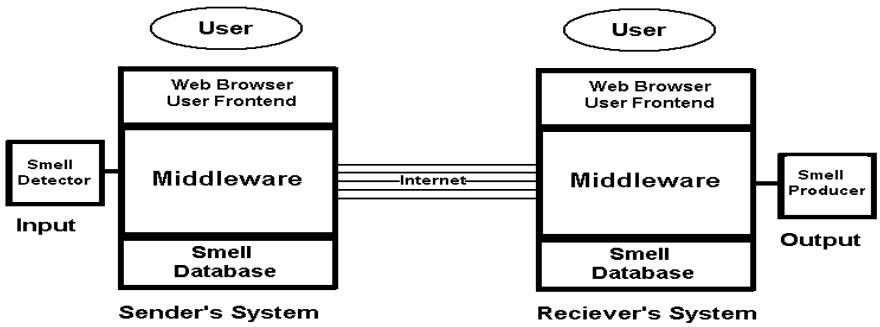
**5). the nose as a spectroscope**

This theory, proposed by Luca Turin (1996), originates from the work of Dyson (see above) who suggested that the olfactory organs might detect molecular vibrations.

Turin has proposed that when the olfactory receptor protein binds an odorant, electron tunneling can occur across the binding site if the vibrational mode equals the energy gap between filled and empty electron levels. The electron tunnelling then activates a G-protein cascade. Receptors are therefore "tuned" to the vibrational frequency of particular odorants, rather like cones are "tuned" to particular wavelengths of light. [6]

***Smell System***

Making computers understand smell is just like making them understand a pattern. Various techniques can be employed to make a system understand smell. But for this we need to attach a something called the ‘smelling’ device to the computer. The complete smelling system (including the hardware and the software) proposed here is depicted by the following figure .




**A Smelling System**

The various parts of the system are as follows:

1) *Smell Producer.*
2) *Smell Receptor.*
3) *Smell Database.*
4) *User Front end*

*All most all parts are present on both the receiver and sender's systems. Both of them may be located miles apart.*

**1) Smell Producer**: On the receiver's end, the system will be attached to a device which is just like an "atomizer" which using a few set of chemicals will be able to produce vapors. Now the smell which as discussed earlier is the composition of chemicals can be produced by a few reactions. Another, solution for the systems which intend to generate only a few types of smell, is to store the smells using particular chemicals. For example, a company having some ten types of perfume can always put very small samples in a machine at its store.

**2) Smell Receptor :** On the sender's end a sensing system is required, which just like any other chemical composition detector, which will try to judge the chemical combination of the vapors. Though developing such a system can be very complicate, but there are no barriers in the world of science. And if we go by the Molecular Receptor theory as discussed earlier, a frequency detector, different frequencies of IR could give rise to different smells. This thing can be very similar to a smoke detector.

A very major success has been achieved by the scientist at NASA. They are developing what they call an "Electronic Nose" or the "Enose" [8]. It's a device that can learn to recognize almost any compound or combination of compounds. It can even be trained to distinguish between Pepsi and Coke. Like a human nose, the ENose is amazingly versatile, yet it's much more sensitive.

"ENose can detect an electronic change of 1 part per million," says Dr. Amy Ryan who heads the project at JPL. She and her colleagues are teaching the ENose to recognize those compounds -- like ammonia -- that cannot be allowed to accumulate in a space habitat.

So with NASA going the Enose way our Smell receptor already seems to be on the line of production soon.

Dr. Mrinal Mandal, a professor in the university's Department of Electrical and Computer Engineering, along with Rafael Castro, have developed an apparatus that will recognize the odors of ten different smell groupings--from fruits, to coffees, to gases, to spices and to just about everything in between.

The device connects to a PC, which then determines what smell the electronic nose has captured.[12]

**2) Smell Database** : Now, the computer system in the model contains a database as backend. This smell database will store various chemicals of particular combinations which can be used to compose different type of smell. Even the database can hold record containing data regarding chemicals that can be used as whole or as substitute constituents to produce a required type of smell (if only the particular chemical are unavailable at the Smell Producer).

**3) User Front end:** The user front end in the model is the interface to the user. This can be like any other GUI interface. A web browser or any other similar interface.

**4) Middleware**: It is responsible for the processing of input from the Smell Receptor. It will look in to the database to find suitable chemicals constituting a particular smell. And on the client side it will recommend the Smell Producer as which chemical combination to be used so as to produce the desired smell.

***Working***

Now as illustrated by the model, the user makes the request for scanning a smell. The required *smell is sensed by the Smell Receptor* and then the *sensed signal is sent to the Middleware*. The middleware will search for the exact smell first, if found then the chemical composition is extracted. If the exact smell chemicals are not found then it can suggests some options to the user. Now this part is pure A.I. and will require the learning capability in the system. Once the smell is recognized and the chemicals components have been sorted out, data will be sent to the client side. Once again here the middleware will look in it's database as how can the required smell can be produced. If an exact match is found then the data is sent to the Smell Producer. If an exact match is not found, then based on intelligence the system will try to guess

alternative chemical compositions. The middleware on the both ends will be responsible for letting the editing process in the database. The model here leaves all the calculation part on the middleware so as to make it work with a wide variety of interfaces. So as to reduce the complexity at the front end.

***Example Systems***:

Now here we will discuss some day to day systems that can be benefited by this technology.

1) Consider the case of a perfume company, now all it needs is to set an intelligent outlet, which will require only the above discussed ***Smell Model***. The customer will ask for the smell of a particular perfume from the system by accessing the front end. And the system will produce the smell on the spot. Then depending upon the decision of the customer the product can be ordered at the online store.

2) This technology can be used in mission critical sensitive areas such as sophisticated research facilities. For examples, if the amount of ammonia grows in the air, the system will automatically activate an alarm. This is idea is similar to the detection of amount of ammonia in space crafts, the main aim behind Enose by NASA.

3) Consider an online food order system. Now with the same technique as in example one smell technology can be implemented here. Now this means great saving to the company as a few staff is required to maintain such a system and even the system will not very expensive.

4) Similarly as till now feelings have been transferred over the internet in the form of text, sounds and pictures, smell can also some into picture. Imagine a greeting card which not only has pleasing audio-visuals but also produces a soothing sweet smell. Even user defined smells can be transported.

5) This system can bring new realism to games, imagine smelling blood or the smell of leaves when you pass through a forest.

6) Even for many other areas can benefit from smell over internet. Invent a new smell and then transporting it through the internet.

***Future and conclusion***

Think of surfing Mc Donalds website and clicking on your favorite pizza for order. With a single click, one can smell a very pleasant smell of the pizza in the room and can change his order or finalizes his order. Integrating smell with computers is not a far fetched impossible concept. Smell promises to add a new dimension to the internet. And in a matter of few years this technology will find place in normal Personal Computers similar to audio-video systems. The power of smell really rocks. And from now multi-media will contain one more media, the media of smell !!.

**Bibliography**


1. The Origin of Species by Charles Darwin.
2. Moncrieff, *The Chemical Senses*, 2nd ed., 1951. Moncrieff, J.W. (1967) The Chemical Senses, pp 381-2.
3. Davies, J.T. and Taylor, F.H. (1959) The role of adsorption and molecular morphology in olfaction: the calculation of olfactory thresholds. *Biol. Bull. Marine Lab, Woods Hole*, 117, 222-238.
4. Briggs, M.H. and Duncan, R.B. (1961). Odour receptors *Nature* **191**, 1310-1
5. Rosenberg, B., Misra, T.N. and Switzer R. (1968) Mechanisms of olfactory transduction. *Nature* **217**, 423-427.
6. Dyson, G.M. (1938) The scientific basis of odour. *Chem. Ind*., 57, 647-651.
7. Turin, L. (1996) A spectroscopic mechanism for primary olfactory reception. *Chem. Senses* 21, 773-791.
8. Electronic Nose Story : http://science.nasa.gov/headlines/y2004/06oct_enose.htm
9. Some Information about smelling system in our nose : http://www.senseofsmell.org/feature/smell101/lesson1/01.php

10. Some knowledge about the smell : http://www.cf.ac.uk/biosi/staff/jacob/teaching/sensory/olfact1.html
11. http://www.hhmi.org/senses/d110.html
12. **“Now, smell mum's home cooked meals on your mail!”**
    Publish Date : 4/1/2004 10:17:00 AM
    Source : Tech Bytes
13. http://www.answers.google.com/answers/main?cmd=threadview&id=196891