

A BIDIRECTIONAL MODEL OF SMELL AS A MEDIA IN COMPUTER TECHNOLOGY AND IT'S APPLICATIONS

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Abstract: This electronic document gives the study of a bidirectional model, of smell as a media and it's applications in the real world. This paper presents a prototype system, which uses smell as a medium to communicate information bi-directionally in the computer environment. The paper also emphasizes the possibility that apart from video and audio, smell can also become a strong medium for exchanging information based on the proposed model.

Keywords: Smell, media, bidirectional model, sensor, emitter, binary code, Computer Technology.

INTRODUCTION

The Medias used frequently in recent times are audio, video, text, graphics, etc. However smell can also be used as a significant medium to exchange information in computer science field. Various researches have been performed to achieve this objective. Several types of smell generators and sensors are available such as electronic nose, etc. But due to the absence of proper standardization these are yet to be used and implemented in larger scale for the benefit of the mankind. It is worth of understanding, that the technology itself is not revolutionary. There are a number of patents implementing a variety of multimedia-linked scent systems, dating back over the last thirty years. [1][2] What has changed is the manner of interaction with computers, which is primarily a change in society. There is a small amount of prior work on using smells with computers.

Most notable is Morton Heilig's device, 'Sensorama', patented in 1962 [5] – and brought back to the attention of the public by Rheingold in 1991. [6] There also exists some work on the use of smell to induce alertness, such as in the case of drivers falling asleep at the wheel. [4] Computer controlled devices for producing scent have been announced and are starting production. This paper explores other uses of smell in the context of users and computing, leveraging in particular the attributes that make it ideal as an ambient media.

This paper proposes a bidirectional scheme for mutual exchange of information via electronic medium. A bidirectional model to sense and generate smell with proper standards can be very useful in this context. To understand the working principle of this bidirectional model, discussing the mechanism behind smell sensing is important.

Smell Sensing Mechanism:

The smell sensing mechanism in a human nose is a complex process. A human has approximately a thousand different

kinds of receptors in his nose, each of which reacts to a small group of odour. [3]. A given molecule will combine with some number of receptors to varying degrees and produce a characteristic response.

Basics of Smell :

It has been proposed that there are seven primary odours: They are listed below with examples [7][8]

- a. Musky- perfumes or aftershave
- b. Putrid- rotten eggs
- c. Pungent- vinegar
- d. Camphoraceous - mothballs
- e. Ethereal- dry cleaning fluid
- f. Floral- roses
- g. Pepperminty- mint gum

Different aspects of odor can be measured through a number of quantitative methods, such as assessing concentration or apparent intensity. Sensation of odor has 4 properties related to threshold and tolerance: Odor concentration, odor intensity, odor quality, and hedonic tone. Electronic sensors mimic the sensing activity of human nose.

Electronic Nose:

Electronic Nose is a device that detects odors or flavours. [12] The electronic nose was developed in order to mimic human olfaction that functions as a non-separative mechanism: i.e. an odor or flavor is perceived as a global fingerprint. Essentially the instrument consists of head space sampling, sensor array, and pattern recognition modules, to generate signal pattern that are used for characterizing odors. It includes three major parts: a sample delivery system, a detection system, a computing system. The sample delivery system enables the generation of the headspace (volatile compounds) of a sample, which is the fraction analyzed. The system then injects this headspace into the detection system of the electronic nose. The sample delivery system is essential to guarantee constant operating conditions.

The detection system, which consists of a sensor set, is the “reactive” part of the instrument. When in contact with volatile compounds, the sensors react, which means they experience a change of electrical properties. Each sensor is sensitive to all volatile molecules but each in their specific way. Most electronic noses use sensor arrays that react to volatile compounds on contact: the adsorption of volatile compounds on the sensor surface causes a physical change of the sensor. A specific response is recorded by the electronic interface transforming the signal into a digital value. Recorded data are then computed based on statistical models. [10][11]

A variety of attempts have been made over the past fifty years to develop an electronic nose capable of detecting and recognising smells [12][11]. The majority of these noses work in one way or another similarly to a human nose. They have a set of receptors which bond to varying degrees with different molecules with varying changes in electrical or chemical properties. A variety has been produced and is commercially available and used in research and manufacturing. Artificial noses have not come close to the accuracy and versatility demonstrated by our noses, let alone more those with more specialized olfactory apparatus, like such as bloodhounds. [13][11]

Problem of Smell as a Media :

There are several problems about smell as a media that need to be discussed.

- There are seven primary smells are defined but smells are not additive like colour. So say smell A + smell B=smell C We cannot say that smell C has the properties of smell A and smell B it may have the properties or may not. We can analyze a smell to detect the primary contents available in it.
- It is possible for the users to be temporarily or permanently unable to receive smell information – having a cold, or anosmia.
- The slow refresh rate of smell can be a problem, such as the smell of grass in the desert above. Furthermore, differentiating different smells can be hard: if three smells are already in a room, it’s hard to determine the presence of the four.
- The device that emits the smell as the output need to undergo certain standard so that the output has no harmful effect. If its standards are broken that it may have dangerous outcomes.
- Some people have allergy from the specific smell so that also need to be taken care while using smell as a media for exchanging information.

Proposed Model:

The proposed bidirectional model comprises of three main components which work in coordination .They are as follows:

- Receptor & Sensor unit
- Computing and controller unit
- Emitter unit

The Sensor unit consists of electronic receptor cells which encodes the smell received into smell code .Smell code is a binary code which can be understood by the computer counter parts attached to the sensor interface. For Example the seven primary odours can be encoded as 000,001,010,100,011,110,101 and so on. The code 111

stands for dummy odour which can be used to define malicious, unpleasant or unwanted odours. The sensor works continuously and generates smell code which is fed into the end computer.

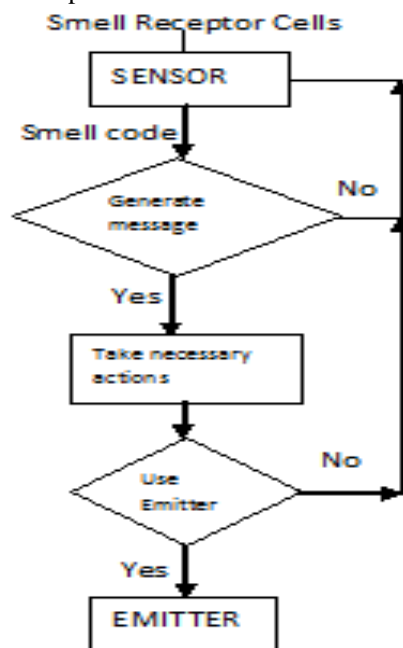


Figure1. Working Procedure of the Bidirectional model

The sensor after receiving a smell converts it into it’s binary format. For a primary smell Musky, the machine assigns it a binary code for example - ‘000’. The smell should be generated in the emitter section or not is decided by the standards and the guidelines. For a non primary smell the sensor finds it’s corresponding primary components and assigns it the generated code. For example for a smell X with primary odours 1, 2 and 3 with intensity coefficients 01 each, a code ‘000 01 001 01 010 01’ can be generated.

The computer then processes the code and analyzes the odour sensed by the sensor. It also generates alert messages and can also activate the emitter counter-part to emit certain odours. The alert messages are of highest priority and it is shown to the user. The computer can also take certain actions on behalf of the user. Now the computing unit can be distributed or centralised. In Centralised system only one computing unit is involved whereas in distributed system network is used to transfer the smell code between two or more systems. The Emitter senses its interface for incoming computer signal to emit a certain odour. These actions are periodical in nature. Figure 1 depicts the working procedure of the model.

Sensor Unit:

The sensor unit of the model consists of 3 parts: Sample delivery system, detection system, computing system. The sample delivery system enables the generation of the headspace (volatile compounds) of a sample, which is the fraction analyzed. The system then injects this headspace into the detection system of the electronic nose. The sample delivery system is essential to guarantee constant operating conditions. The detection system, which consists of a sensor set, is the “reactive” part of the instrument. When in contact with volatile compounds, the sensors react, which means

they experience a change of electrical properties. Figure 2 shows the sensor's working procedure as a whole.

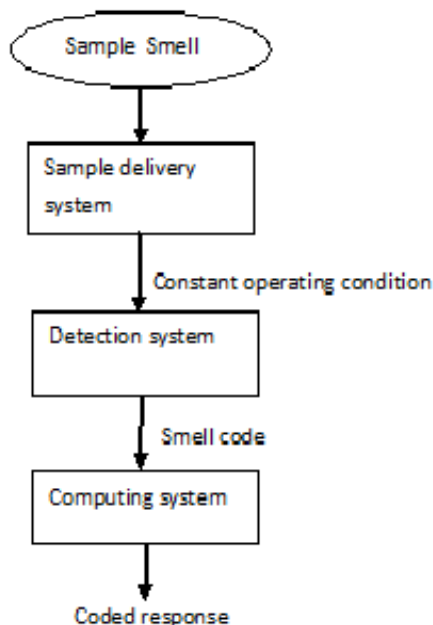


Figure2. Working procedure of Sensor

Each sensor is sensitive to all volatile molecules but each in their specific way. Most electronic noses use sensor arrays that react to volatile compounds on contact: the adsorption of volatile compounds on the sensor surface causes a physical change of the sensor. A specific response is recorded by the . electronic interface transforming the signal into a digital value. The digital value is then sent to the ng and computcontroller unit for further processig.

Computing and controller Unit:

The computing and controller unit monitors the total process as the brain and heart of the system. This system is basically a computer software that receives the digital data and transforms it to the emitter understandable data and feeds it to the emitter. The emitter processes accordingly governed by the standardized rules. Figure 3 depicts it.

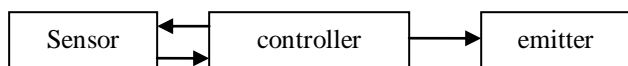


Figure3. The controller unit

Emitter Unit:

The emitter is kept on the receiver end incorporated with the Computer to emit the desired smell of a desired quantity. It is actually a device containing a vessel container, that contains the seven primary smells. The container is controlled by a manifold card. The card sprays odour taken from one or more vessels according to the binary code set by the computer.

The input to the card comes from the interface board. The digital to analog converter converts the computer produced digital code into analog signal and feeds it to the card. If the computer sends a command of emitting the odour O1 then it sends the code 000 to the interface. The digital to analog converter converts it to analog signal. The vessel number one is sprayed. Careful caution should be taken to stop the emission of unwanted, harmful or unpleasant odor.

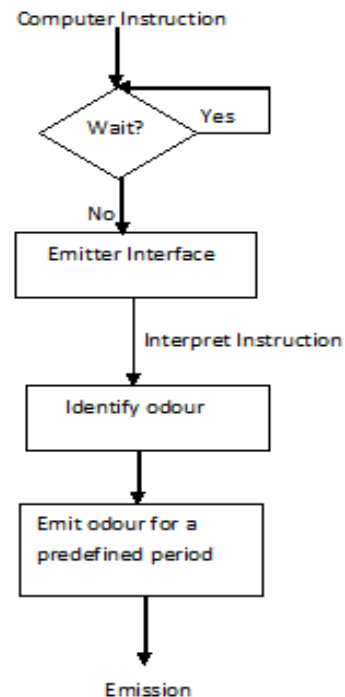


Figure 3. Working procedure of Emitter

The computer instructions are fed into the emitter interface which processes it to find whether it is a wait instruction or emit instruction. If it is a wait instruction it waits for a predefined period of time and then searches for the new instruction. The wait period may be interrupted by the on demand computer instruction. If the instruction is for emitting then it decodes the smell binary code to find out the odour and then emits the odor for a limited period and then stops.

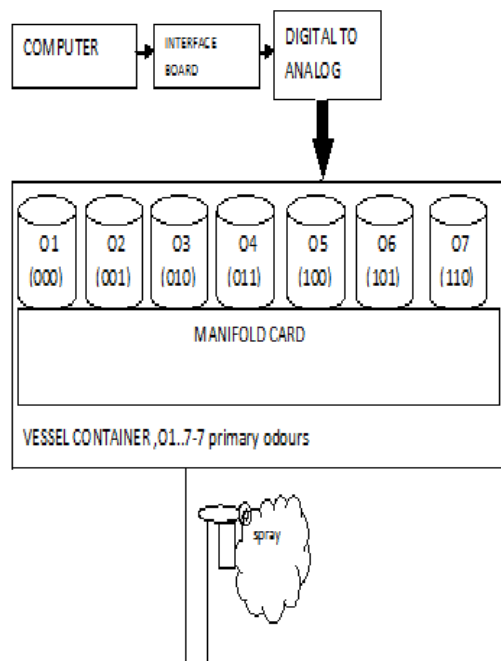


Figure 4: Receiver end emitter

APPLICATIONS AND FUTURE POSSIBILITIES

From the bidirectional model of smell media that the paper proposes here can be used in several practical scenarios and application made based on this model will be beneficial for

mankind. This will be the next big thing in the field of computer science. Here in this paper we discuss few of them

Application 1-This model may be used in vehicles to check the alcohol content drunk by the driver. If alcohol readings are inappropriate, our system may not allow the driver to drive the vehicle and it can generate warning message to concerned authorities. [4]

Application 2-Certain devices based on this paper can be useful in the cold stores. This can be used in the broader sense for example the cold store of fruit and vegetables will automatically generate an alert message in the computer that certain materials are need to be taken off from the storage to keep the stock fresh and good to use.

Application 3-The smell media can be used to store a password. As we know that there can be several smells and their respective smell codes can be there for password.

Application 4-The Model can be useful in household in a versatile manner. Example-Our device will immediately generate alerts when the cooking gas leaks and works as a safety device.

Application 5-This concept can be used by gaming industry, film industry to create a more interactive, real atmosphere to give a heightened sense of reality.

CONCLUSION

The application based on this model can be very useful in achieving certain goals. Further development of this model based devices will be next big thing in the field of computer science. The standardization of smell as an media to information exchange will enable a new domain in Information Technology .The application will be broadly used to enhance the quality of artificial Intelligence .This bidirectional model can be the basis of next dimensional era of computer science and their related fields. The broader picture of this model will certainly add values to digital world, but in the mean time, it is also required to ensure that smell media will only be used in ethical manner.

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