



SMELL TELEPORTATION: A NEW ERA OF TOUCH-ENABLED MOBILE COMMUNICATION

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Abstract: The article discusses the current achievements and prospects of smell teleportation technologies in the context of the development of touch-based mobile communication. Special attention is paid to the physiological aspects of smell perception, technical solutions for digital fragrance transmission, and integration of these technologies with fifth- and sixth-generation mobile networks (5G/6G). The analysis of existing methods of synthesis and modulation of smell signals is carried out, as well as the challenges and prospects of introducing smell teleportation in everyday communication, education, medicine and entertainment industries are discussed.

Keywords: smell teleportation, sensory mobile communication, digital aroma, 5G, 6G, smell transmission, olfactory physiology.

Introduction Modern mobile communication is developing not only in the direction of increasing the speed of data transmission, but also in expanding the range of transmitted information, including sensory sensations. One of the most promising areas is smell teleportation — a digital transmission of aromatic signals that provides emotional and sensory enrichment of communication. Smell perception plays an important role in human cognitive and emotional processes, which makes this technology particularly relevant for various fields—from distance learning and medicine to entertainment and e-commerce.

Despite significant progress in the field of digital transmission of visual and tactile data, technologies for teleporting odors remain at the stage of active research. The main technical challenges are related to the precise emulation of chemical and physiological processes of smell, the development of miniaturized and energy-efficient devices for generating aromas, as well as the creation of efficient data transmission protocols with low latency in next-generation mobile networks.

The aim of this work is to systematically review modern technologies for teleporting odors, analyze existing methods for transmitting and reproducing odors, and evaluate the prospects for

their integration with 5G and 6G mobile networks to create new forms of touch-based mobile communication.

The human olfactory system is a highly specialized biological apparatus that provides perception and recognition of a wide range of aromatic molecules. The main organ of smell is the nasal cavity, where olfactory receptors are located-specialized neurons that can bind to volatile chemicals.

When odour molecules enter the nasal cavity, they interact with olfactory receptors, which initiates a cascade of biochemical reactions that convert a chemical signal into an electrical nerve impulse. These impulses are transmitted through the olfactory nerve to the olfactory bulb of the brain, where primary information processing takes place. Then the signals are sent to the higher parts of the central nervous system, which leads to awareness and recognition of the smell.

The uniqueness of the human sense of smell lies in its sensitivity and ability to distinguish more than 10,000 different odors. Olfactory receptors are selective for various molecules, which provides a complex perception of aromatic compositions and their emotional impact.



Figure.1. Integration of biological and digital components in smell teleportation technologies

The study of olfactory physiology is key to the development of effective technologies for digital transmission of odors, as it allows you to determine the signal parameters that need to be reproduced for reliable emulation of the smell experience.

Digital teleportation of odors requires accurate and controlled reproduction of aromatic substances. Modern devices for generating odors are based on the principles of microencapsulation of aromatic compounds, where activated chemical components are released as volatile molecules.

Another promising area is the use of microfluidics and chemical synthesis of aromas in real time. Such systems use specialized cartridges with basic aromatic substances, mixing them in the right proportions to form unique smell compositions. This allows you to provide a wide range of reproducible flavors with minimal resources.

In addition, technologies for non-contact exposure to olfactory receptors using electromagnetic waves, in particular in the terahertz range, which can stimulate nerve endings without releasing chemicals, are being investigated, which opens up prospects for creating compact and hygienic devices.

The transmission of odors in digital format requires efficient encoding of chemical information, taking into account the multidimensional nature and complexity of aromatic signatures. The main task is to reduce the unique properties of odors to a set of digital parameters, such as intensity, duration, combination of basic aromas and time characteristics.

Coding methods include spectral analysis of aromatic substances, digital modeling, and the use

of machine learning algorithms to recognize and recreate odor profiles. This allows you to compress the amount of data without losing the quality of perception.

The transmission of such data in mobile networks requires adaptation of protocols to take into account the characteristics of sensory information. An important aspect is minimizing latency and ensuring reliable transmission, which is achieved by using 5G and 6G capabilities, including URLLC (Ultra-Reliable Low Latency Communications) and Network Slicing.

Fifth (5G) and sixth (6G) generation networks provide the necessary infrastructure for implementing smell teleportation due to the following characteristics:

- High throughput required for transmitting large amounts of sensor data.
- Minimal delay that allows you to synchronize the transmission of odors with audio and video content.
- Reliable and secure transmission, ensuring stable and accurate reproduction of sensor signals.
- The ability to virtualize and dynamically allocate resources through Network Slicing technologies to prioritize touch data.

Sensor devices are integrated with mobile networks through specialized APIs and protocols that ensure compatibility and scalability of smell teleportation systems.

Smell teleportation can significantly expand the interactivity of educational platforms, especially in the fields of biology, chemistry, cooking, and medicine. The use of smell signals allows you to create deeper sensory impressions, improving the assimilation of material and student engagement.

In medical practice, digital smell transmission can be used for remote aromatherapy, psychological rehabilitation, and patient monitoring. The ability to elicit certain emotional and physiological responses through odors opens up new possibilities for therapy and diagnosis.

Integrating scents into multimedia content and virtual environments enhances the immersive experience, making the user experience more realistic and emotionally charged. This is relevant for the film industry, computer games, as well as theme parks and museums.

In e-commerce, digital smell teleportation allows consumers to "feel" the aroma of products (for example, perfumes, food) remotely, which helps to increase confidence and increase sales.

The technology of smell teleportation within the framework of sensor mobile communication is an advanced direction at the intersection of neurotechnology, telecommunications and materials science. Modern developments in the field of electronic noses (e-nose) and synthetic olfactory systems allow digitizing and transmitting odors, opening the way to the formation of a full-fledged multi-channel interaction between users.

Research conducted by institutions such as Keio University (Japan), MIT Media Lab (USA) and KAIST (South Korea) is already demonstrating prototypes of devices that can transmit odors at the command of software interfaces. For example, the startup Aromajoin develops dynamic aroma modules for the film industry and advertising, and the company FeelReal Inc. creates virtual reality headsets with the ability to transmit odors in games and movies.

It is scientifically proven that odors play a key role in the formation of emotional memory and cognitive perception (Herz, 2004), which means that their transmission enhances the effect of presence and can become the foundation of a new generation of mobile interfaces. The prospects for using these technologies cover not only entertainment, but also e-commerce, healthcare, education, and even neuropsychological rehabilitation.

However, the implementation of full-fledged smell teleportation requires solving a number of scientific problems: standardization of aromas in digital form (aroma coding), safe stimulation of olfactory receptors, reduction of energy costs of smell generators, and protection of users from

sensory overload.

Thus, smell teleportation as a component of sensory mobile communication can become part of the Sensory Internet of Things (SIoT) concept, expanding the boundaries of human perception in the digital world. This area deserves close attention of the scientific community and can transform both the technical and cultural paradigm of mobile communication in the XXI century.

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