**Ministry of Education and Science of Ukraine**
**Odessa National University of Technology**
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**P.N. Platonov Institute of Computer Engineering, Automation, Robotics and Programming**

# INFORMATION TECHNOLOGIES AND AUTOMATION– 2024

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# «ІНФОРМАЦІЙНІ ТЕХНОЛОГІЇ І АВТОМАТИЗАЦІЯ – 2024»

***МАТЕРІАЛИ***
***XVII МІЖНАРОДНОЇ НАУКОВО-ПРАКТИЧНОЇ КОНФЕРЕНЦІЇ***

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м.Одеса

блокчейн може бути життєздатним рішенням для конкретних сценаріїв та забезпечити спрощений процес, ефективність та прозорість.

### СПИСОК ВИКОРИСТАНИХ ДЖЕРЕЛ:

1. Використання технології «БЛОКЧЕЙН» у телекомунікаціях. URL:https://www.tech.vernadskyjournals.in.ua/journals/2021/3_2021/22.pdf
2. Можливість застосування технології блокчейн в телекомунікаційних системах. URL: http://surl.li/muqeev
3. Дослідження можливості використання технології blockchain в телекомунікаційних системах. URL: http://surl.li/ryrrkl

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## ANALYSIS OF MODERN TELECOMMUNICATIONS: DATA TRANSMISSION VIA GSM CHANNEL

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*The article discusses modern technologies of telecommunications with focus on data transmission through GSM channels. Key aspects such as advantages and disadvantages of this communication standard are studied. Particular attention is paid to processes of encoding and compression, which ensure efficiency and reliability of communication. Analysis of automation in data management shows how adapting technologies can improve quality of communication. The results of the study confirm the relevance of GSM in various fields, emphasizing its importance in face of rapidly changing requirements of our time. The identified advantages and disadvantages of technology make it possible to optimize data transmission processes, reducing costs and improving quality of communication. The results can also serve as basis for further research in field of transition to latest standards, which ensures competitiveness in modern telecommunications market.*

**Problem Statement.**

Modern telecommunication technologies have become integral part of everyday life, enabling fast and reliable exchange of information between users around world. One of key technologies supporting this process is GSM (Global System for Mobile Communications), standard used for mobile communications and data transmission in more than 200 countries. GSM networks provide not only voice calls, but also variety of data services, including SMS, MMS, Internet access, and other multimedia services.

The relevance of topic is due to fact that, despite the emergence of latest communication standards, such as 4G and 5G, GSM remains an important component of telecommunications infrastructure, especially in regions with underdeveloped network or limited access to latest technologies. One of key trends in development of telecommunications is automation of data processing and transmission processes, which can significantly increase efficiency of networks. Automated systems for monitoring, diagnostics and management of GSM channels ensure uninterrupted operation of network, minimizing impact of human factor, increasing reliability and speed of data transmission [1-3].

The analysis of principles of data transmission via GSM channel allows for deeper understanding of how these systems function, as well as to assess their effectiveness, reliability and prospects for further development in context of digital transformation of society.

With this in mind, study of data transmission mechanisms over GSM channel is important both for engineers and telecommunications specialists, as well as for enterprises seeking to optimize their communication infrastructure.

The purpose of study is to analyze modern telecommunications with emphasis on data transmission via e GSM channel.

Tasks that were solved: determination of the basic principle of GSM operation; analyze the structure of GSM; determination of the features of data encoding and compression in GSM; assessment of the advantages and disadvantages of data transmission via GSM channel.

**Essence of study.**

Systems using GSM technology, combined with big data and robotic systems, are able to provide efficient information transfer and real-time resource management, which contributes to automation of processes in various industries [4-6].

GSM technology was developed in late 1980s and was first global mobile communication system to standardize networks across countries. The basic principle of GSM operation is data transmission over network consisting of base stations (BTS) that provide communication between mobile phones and switching centers (MSC). Both voice and packet data are used to transmit information, which opens up possibility of implementing various services, such as SMS, GPRS and other multimedia services.

Data transmission via GSM channel is carried out through use of various modulation and coding methods, such as Gaussian Minimum Shift Keying (GMSK), which allows efficient data transmission even in poor signal conditions. Automation of transmission process consists in fact that system independently controls quality of communication, using adaptive coding and signal strength adjustment technologies to maintain stable signal strength between base station and mobile device. This not only reduces load on network, but also ensures uninterrupted data transmission.

Data encoding in GSM performs several important functions:

1. Providing error protection.
2. Optimization of data transmission for narrowband channels.
3. Providing reliable signal recognition on the receiving side.

The main types of encoding are shown in Fig. 1.

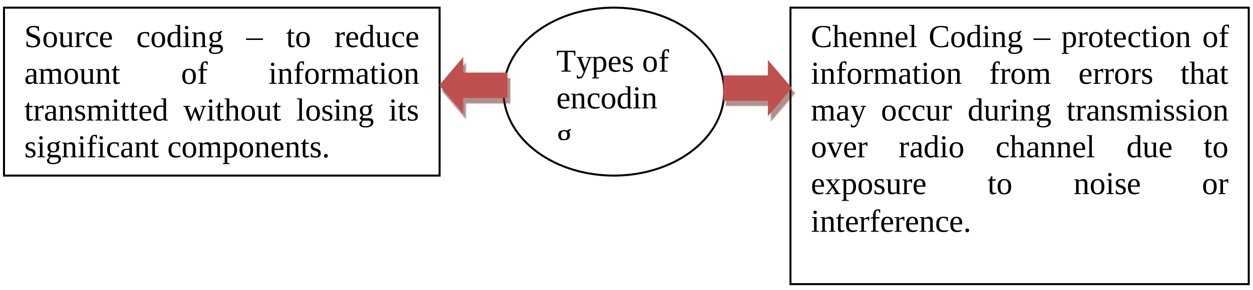


Figure 1. Types of encoding in GSM

We will analyze process of data transmission via GSM channel, as result of which we will highlight advantages and disadvantages. Therefore, it is determined that advantages of data transmission via GSM channel:

1. Wide Coverage – GSM provides global availability in many countries, making it one of most widely used mobile communication standards.
2. Reliability of communication – thanks to error correction systems and automatic adaptation of signal strength, stable data transmission is ensured even in difficult conditions.
3. Security – GSM uses multiple levels of data encryption to protect against unauthorized access.
4. Cross-device compatibility – A wide range of devices supports GSM standard, making it accessible to different users.
5. Support for voice and digital services – GSM allows not only to make voice calls, but also to transmit data via SMS, GPRS, MMS and Internet.
6. Automation of data transfer processes – automatic power adjustment and codec adaptation ensure efficiency

The disadvantages of data transmission via the GSM channel were also identified:

1. Low bandwidth – compared to latest technologies (4G, 5G), GSM provides limited data transfer speeds, especially for internet services.

2. Outdated technology – GSM was developed more than 30 years ago, and many aspects of this technology do not meet modern requirements of transmitting large amounts of data.

3. Limited scalability – performance and latency issues can occur when network is heavily loaded.

4. Vulnerability to interference – GSM networks may experience a deterioration in quality of communication due to physical interference, weather conditions, or network congestion.

5. Protection against the latest threats – although GSM has encryption, it is not always effective enough to protect against modern cyber threats.

6. Inability to transmit voice and data simultaneously – when transmitting data via GSM (without GPRS or other technologies), it is impossible to make voice calls.

7. Power consumption – older GSM standards can consume more power than newer technologies, which affects autonomy of devices.

**Conclusions**

In process of analyzing modern telecommunication technologies, attention is focused on data transmission via GSM channel, which is one of most common mobile communication standards in world. The key advantages of this technology have been identified, such as global coverage, reliability of signal transmission, high level of security, compatibility with wide range of devices, and cost-effectiveness in use of network resources.

However, despite these positive aspects, GSM has number of disadvantages, including low bandwidth compared to latest technologies, scalability issues under heavy loads, and vulnerability to modern cyber threats. It was also noted that GSM technology is outdated, which creates certain restrictions on transmission of large amounts of data.

The analysis emphasized importance of automating data encoding and compression processes, which allows you to optimize network and maintain quality of communication even under high load. This shows that, despite limitations, GSM continues to be relevant tool for data transmission in many countries around world, in particular for automation systems and industrial applications.

Therefore, it can be concluded that GSM channel remains important technology in telecommunications industry, however, in order to improve network efficiency and meet modern requirements, possibility of introducing newer communication standards, such as 4G and 5G, should be considered. The practical value lies in determining effectiveness of using this technology for automated systems, in particular in conditions of limited network resources and need for reliable data transmission. The results can help in making decisions about feasibility of using GSM or need to switch to newer communication standards.

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