

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
National University Zaporizhzhia Polytechnic

PRACTICAL GUIDELINES

in the discipline

"Smart Systems"

for students of specialty 123 Computer Engineering
according to the educational program "Specialized Computer Systems"

for all forms of education

Practical guidelines in the discipline "Smart Systems" for students of specialty 123 Computer Engineering according to the educational program "Specialized Computer Systems" for all forms of education/ Compl.: R. Kudermetov, M. Tiahunova – Zaporizhzhia: National University Zaporizhzhia Polytechnic, 2023. – 11 p.

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CONTENT

1 LABORATORY WORK № 1 DESIGN SMART SYSTEMS.....	4
1.1 Theoretical information	4
1.2 Tasks to complete	7
1.3 Contents	10
LITERATURE.....	11

1 LABORATORY WORK № 1

DESIGN SMART SYSTEMS

The purpose of the work: is to learn how to research existing Smart systems and identify their key components.

1.1 Theoretical information

Smart systems, also known as intelligent systems or smart technology, refer to interconnected devices and platforms that utilize artificial intelligence (AI), machine learning (ML), and Internet of Things (IoT) technologies to automate and optimize various processes, improve efficiency, and enhance user experience. These systems typically consist of sensors, actuators, data analytics algorithms, and communication networks to collect, analyze, and act upon data in real-time.

Here are some examples of smart systems across different domains:

1. **Smart Homes:** These systems integrate various devices, such as thermostats, lighting, security cameras, and appliances, to provide automated control and monitoring. Users can manage and customize their home environment through voice commands or mobile applications.

2. **Smart Grids:** These systems modernize traditional power grids by incorporating advanced sensors, meters, and control systems. They enable real-time monitoring, energy optimization, and efficient distribution of electricity, promoting sustainability and reducing costs.

3. **Smart Cities:** These systems leverage interconnected technologies to enhance urban infrastructure and services. They include intelligent transportation systems, smart parking, waste management, public safety, and environmental monitoring to improve the quality of life for residents.

4. **Industrial Automation:** Smart systems are extensively used in industrial settings to optimize manufacturing processes, monitor equipment health, and enhance productivity. This includes robotic automation, predictive maintenance, and real-time data analytics to improve efficiency and reduce downtime.

5. **Healthcare Systems:** Smart healthcare systems employ AI and IoT technologies to enable remote patient monitoring, personalized medicine, and efficient healthcare delivery. They can help doctors with

diagnosis, provide patients with real-time health information, and streamline medical operations.

6. Agriculture: Smart agricultural systems use sensors and data analytics to monitor soil conditions, weather patterns, and crop health. This data-driven approach enables optimized irrigation, pest control, and crop management, leading to increased yields and reduced resource consumption.

7. Autonomous Vehicles: Self-driving cars and other autonomous vehicles are prime examples of smart systems. They use AI, sensors, and advanced algorithms to navigate and make decisions without human intervention, improving road safety and transportation efficiency.

These examples demonstrate how smart systems are revolutionizing various sectors by harnessing the power of AI, ML, and IoT. They have the potential to make our lives more convenient, sustainable, and connected.

Here are some specific examples of smart systems in different domains:

1. Amazon Echo: The Amazon Echo, powered by the virtual assistant Alexa, is a smart speaker that responds to voice commands and performs various tasks, such as playing music, providing weather updates, controlling smart home devices, and answering questions.

2. Nest Thermostat: The Nest Thermostat is a smart home device that learns and adjusts temperature settings based on user preferences and daily routines. It can be controlled remotely through a smartphone app and helps optimize energy consumption.

3. Tesla Autopilot: Tesla's Autopilot is an advanced driver-assistance system that utilizes cameras, sensors, and AI algorithms to enable semi-autonomous driving capabilities. It can steer, accelerate, and brake the vehicle under certain conditions.

4. Philips Hue Lighting: Philips Hue is a smart lighting system that allows users to control and customize their lighting environment through a smartphone app. It offers features like remote access, scheduling, and color adjustments.

5. IBM Watson: IBM Watson is an AI-powered platform that provides cognitive computing capabilities to businesses. It can analyze large amounts of data, understand natural language, and assist in decision-making processes across various industries, including healthcare and finance.

6. Smart Traffic Management: Some cities employ smart traffic management systems that use sensors, cameras, and data analytics to optimize traffic flow, detect congestion, and adjust signal timings in real-time, reducing traffic congestion and improving transportation efficiency.

7. Fitbit Fitness Trackers: Fitbit offers smart wearable devices that track various health metrics like heart rate, steps taken, and sleep patterns. The devices sync with smartphones and provide insights into personal health and fitness goals.

8. Smart Waste Management: Smart waste management systems use sensors and data analytics to monitor fill levels of waste bins, optimize waste collection routes, and reduce operational costs. This helps in efficient waste management and improves cleanliness in cities.

9. Google Nest Protect: Google Nest Protect is a smart smoke and carbon monoxide detector. It can send alerts to smartphones, detect different types of threats, and even turn off other connected devices in case of an emergency.

10. Smart irrigation systems: These systems monitor weather conditions, soil moisture levels, and plant needs to optimize irrigation. They can adjust watering schedules and volume, conserving water resources and promoting healthier plant growth.

These examples illustrate the diverse range of smart systems available today, showcasing how technology is transforming our daily lives and various industries.

China has made significant advancements in the development and deployment of smart systems across various domains. Here are some examples of existing smart systems in China:

1. Smart Cities: China has been at the forefront of building smart cities that incorporate advanced technologies for urban management. For example, the city of Hangzhou has implemented a comprehensive smart city system, including intelligent transportation systems, smart energy management, and public services.

2. Facial Recognition Systems: China has extensively adopted facial recognition technology for various applications. It is used for security and surveillance purposes, access control in public places, payment systems, and even to monitor student attendance in schools.

3. Alibaba's City Brain: Alibaba's City Brain platform is an AI-powered system that uses big data analytics and machine learning algorithms to optimize urban traffic flow and management. It has been

implemented in cities like Hangzhou and Kuala Lumpur to reduce congestion and improve transportation efficiency.

4. Didi Chuxing: Didi Chuxing is a ride-hailing platform in China that utilizes smart systems for real-time matching of drivers and passengers, route optimization, and dynamic pricing. It has a large user base and has transformed the transportation landscape in China.

5. Tencent's WeChat: WeChat is a multi-purpose mobile app in China that integrates messaging, social media, mobile payments, and various other services. It has evolved into a comprehensive smart platform, allowing users to access a wide range of functions within a single app.

6. Smart Grids and Energy Management: China has been investing in smart grid technologies to enhance energy efficiency and reliability. It incorporates advanced monitoring, control, and communication systems to optimize energy generation, distribution, and consumption.

7. Smart Agriculture: China is utilizing smart systems in agriculture to improve productivity and sustainability. This includes the use of IoT sensors for soil monitoring, smart irrigation systems, and AI-powered crop disease detection to optimize farming practices.

8. E-commerce and Logistics: China's e-commerce giants, such as Alibaba and JD.com, have implemented advanced smart systems for logistics and delivery management. They employ AI algorithms, robotics, and automation to optimize order processing, warehousing, and last-mile delivery.

9. Smart Healthcare: China has been exploring the use of smart healthcare systems to improve medical services and patient care. This includes AI-based medical imaging, telemedicine platforms, and health monitoring devices to enable remote patient care and enhance efficiency in healthcare delivery.

10. Smart Manufacturing: China's manufacturing industry is adopting smart systems to improve production efficiency and quality. This includes the implementation of intelligent manufacturing systems, robotics, and automation technologies to optimize factory operations.

1.2 Tasks to complete

During the 4 classes, you need to complete 4 tasks.

Task 1. Analyze existing Smart systems. To do this, you need to use the search function of any search engine on the Internet or search through

patent databases. Choose two of these systems (of your own choice) for in-depth research.

Task 2. Determine the main objects of the selected system. Create a structural diagram. The main objects of the system can be everyday objects depending on the chosen smart system. For example, in a smart parking system, the objects can include a barrier gate, parking space, vehicle, etc. These are the objects that will be directly involved in the operation of the smart system. The structural diagram may have a format similar to the one shown in the fig.1.1.

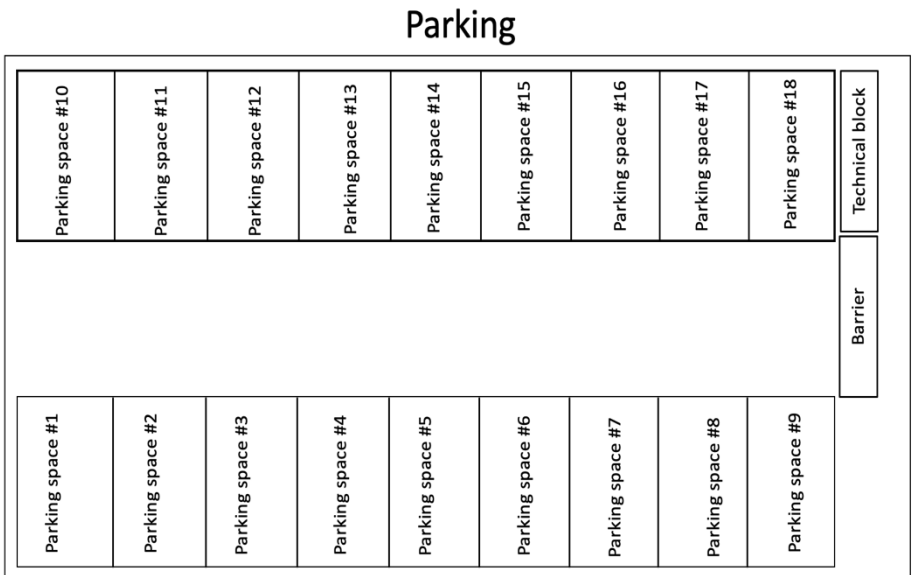


Figure 1.1 - Structural diagram

Task 3. Identify the main technical components of the system (sensors, actuators, etc.). Create a structural diagram of smart systems technical components (fig.1.2). Add them to the main structural diagram (fig.1.3).

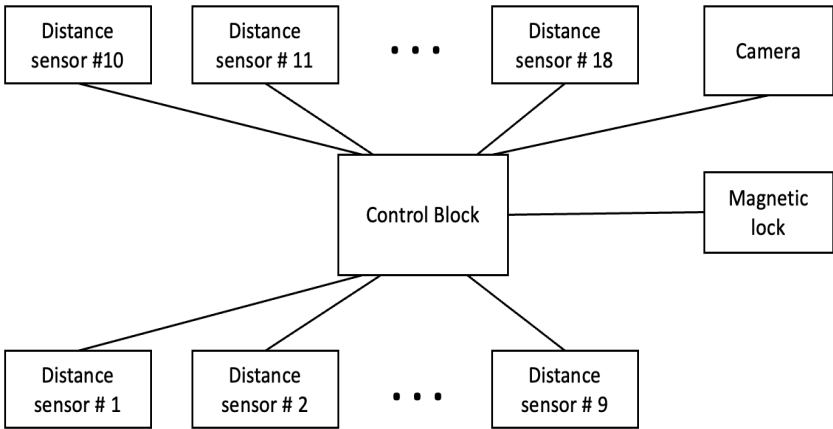


Figure 1.2 - Smart systems structural diagram

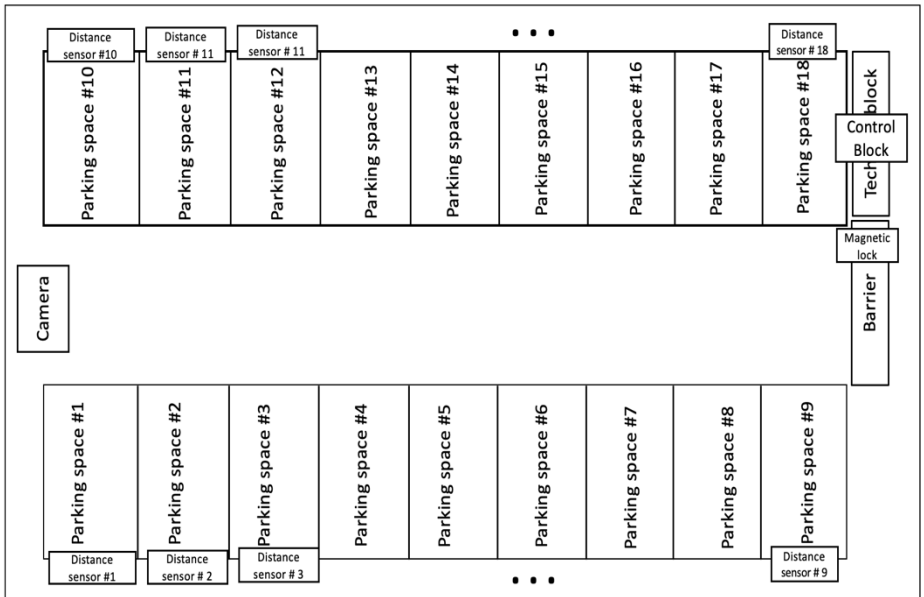


Figure 1.3 - Total diagram

Task 4. Fill in the resulting table.

Table 1.1 – Research results

System Name	Main Objects of the System	Main Technical Components of the System	Used Protocols

1.3 Contents

The report should have the following components:

- title page;
- the purpose of the work;
- the result of the tasks.

LITERATURE

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