A: Greetings, everybody. I am Alexander Gordeev and this is my team mate and friend Olga Gorshunova.

And today we present our project, Automated Tram System, to you.

B: Many major cities in Russia face the problem of transport exhausts, one source of which is public transport.

A: To combat this, the municipal governments are replacing diesel buses with gas buses, trolleybuses and electric buses. Still the most environmentally friendly transport for the city is the tram.

B: Moreover, the tram also solves the transport problem typical for minor towns without a metro, because the tram is a mainline and high-speed transport that can connect different parts of the city.

A: However, in cities with trams, they are often used inefficiently. It stays in traffic jams, has no traffic priority and has to slow down because of imperfect infrastructure. In terms of energy usage, the tram is also often used inefficiently.

B: That is why we have decided to project the prototype of Automated Tram System and to consider the issue of energy consumption optimization.

Our project also meets the four goals of sustainable development of the planet proposed by the UNO.

A: While designing the project we settled the following tasks:

Developing remote and automatic tram control and automating the tram infrastructure- namely: switches, traffic lights and stops;

Building the prototype of an automated tram system and planning its implementation in the city's transport system.

B: We have created the imitation model and we are going to demonstrate it to you right now.

B: Let`s consider separate details and mechanisms.

The tram body, rails, switches, intersections, elements of traffic lights were modeled and printed on a 3D printer by us.

A: The tram. Since a modern tram is a mainline and high-speed transport, it means that its capacity should be appropriate. This system is suitable for the operation of single or multiple unit trams.

B: Our prototype is equipped with two cabins, which gives it the opportunity to work on routes without turning rings.

A: Moreover, the prototype is equipped with a laser rangefinder located in the cabin, which allows the tram to stop before an obstacle on the rails. Cameras and LIDARs will be used on real trams.

B: Also, all trams will be equipped with door opening buttons and an anti-jam system.

All the control electronics are assembled on a PCB made by us.

A: Switches. When approaching the switch, the tram passes an RFID-reader and a computer follows the unique tag number and turns the switch for required route, using a servo.

A: Traffic lights. In normal mode, the traffic light is green for cars, and red for trams. But as soon as the tram passes the RFID-reader, it immediately turns green for trams, and red for cars. So, the tram does not stand at traffic lights and the traffic interval is reduced.

B: The tram control panel is used only in case of a failure in the automatic control system.

B: Stops. When the tram approaches the stop, it closes the reed switch and automatically stops, waiting for passengers to board. Though the real system will use NFC tags and readers.

B: Alternative energy sources such as solar panels and piezoelectric elements under the paving stones are used to illuminate the tram stop at night, to power the system elements and information boards.

A: In addition, regenerative braking of trams will be used to optimize energy consumption as long as the recovered braking energy is practically not used now.

B: However, with the use of such a system, it can be fully channeled to the acceleration of the tram, especially in cities with complicated terrains.

B: Nowadays in Europe, such systems are being actively tested and show impressive results, saving up to 30% of the annual energy consumption.

B: In the future, it is planned to provide complete automation, to continue working on safety improvement, on the legal framework for unmanned vehicles, and on developing of a tram-laboratory, and a rail grinder, also automated.

A: It is planned to develop a module for automatic tram systems testing each tram before entering the line and to create a unified urban transport management system. This would enable optimization passenger traffic and energy consumption by using regenerative braking and increasing the use of alternative energy sources in the system.

B: We hope that our system will be in high demand in many Russian cities. The Institute of Urban Environment Development of Nizhny Novgorod Region has already got interested in this project.

A: Due to creation and testing the prototype of Automated Tram System and a more detailed consideration of the issue, we have managed to develop the main prospect of our work and to identify some problematic points and further development directions.