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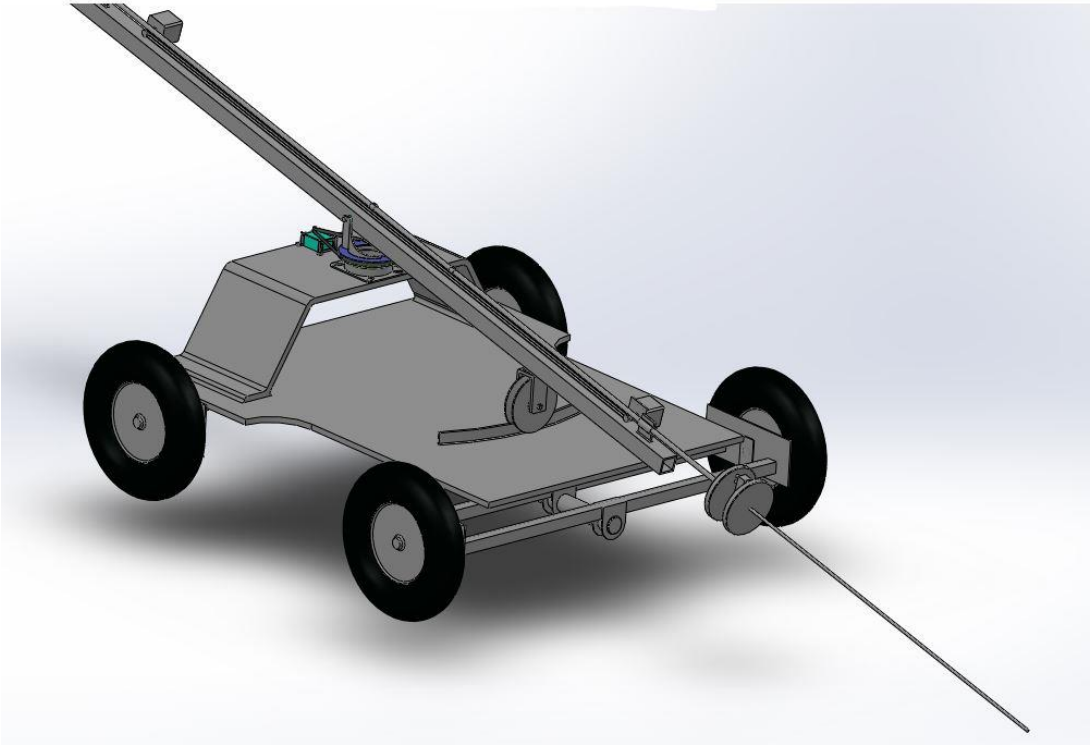
Modular Remotely Operated Mine Detection System "GEOTRON»

Technical capabilities of Modular Remotely Operated Mine Detection System

- low cost;
- guaranteed security for operators;
- Simplicity structures;
- absence serious damage influence dangerous factors;
- easy management;
- mobility;
- transportability.

Uniqueness of the modular remote mine detection system lies in the analysis of geo-anomalies through a mechanical method with minimal impact on the hazardous object



The proposed penetrometer, designed as an autonomous and self-propelled device, represents an innovative solution for the effective and safe detection of mines. Key features of this device include an earth probe, controlled by a microcontroller, which is capable of detecting mines through changes in resistance. The device marks the detected areas, reducing the need for direct human intervention in potential minefields, thereby enhancing overall safety.

Key Components and Features:

Autonomy and Self-Propulsion:

The device is capable of autonomous movement, reducing the reliance on human operators and enhancing efficiency.

Self-propulsion allows the device to traverse diverse terrains with ease, reaching areas that may be challenging for traditional detection methods.

Earth Probe Technology:

The earth probe is equipped with sensors to detect changes in resistance, a common indicator of buried mines.

Advanced sensing technologies provide accurate and reliable mine detection capabilities.

Microcontroller-Based Control System:

The microcontroller acts as the brain of the device, processing data from the earth probe sensors and making real-time decisions.

Programmable logic enables customization of detection algorithms for different types of mines.

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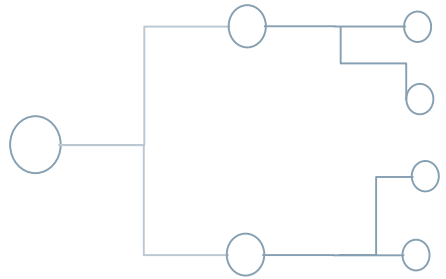
Marking Mechanism:
Detected areas are marked using a visible or GPS-based marking system, providing a clear indication for further action.
Marking enhances the efficiency of subsequent demining operations, ensuring no area is overlooked.
Safety Enhancement:
Minimizes direct human intervention in potential minefields, reducing the risk to demining personnel.
Real-time data processing and decision-making contribute to a safer and more efficient demining process.
Operational Workflow:
Deployment:
The autonomous device is deployed in areas suspected of containing mines.
Autonomous Detection:
The device moves autonomously, using the earth probe to detect changes in resistance indicative of buried mines.



Real-time Data Processing:
The microcontroller processes data in real-time, making instantaneous decisions based on the detected signals.
Marking of Detected Areas:
The device marks detected areas, either physically or digitally, for subsequent demining efforts.
Communication:
Incorporates communication capabilities to relay information about detected mines and marked areas to a central control unit or other demining teams.
Safe Retrieval:
Once the operation is complete, the device can be safely retrieved, and the marked areas are handed over to demining teams for further action.

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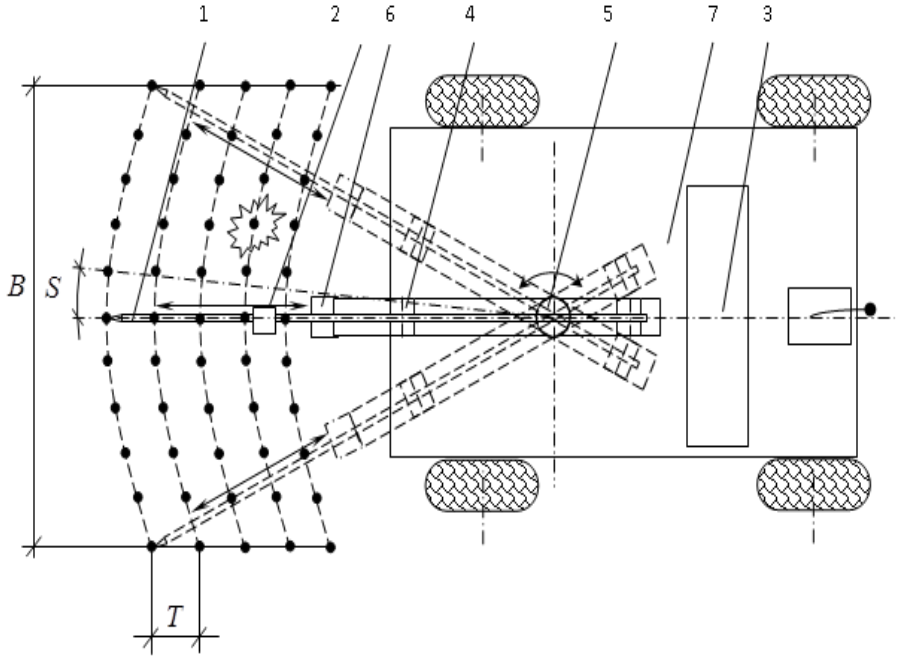
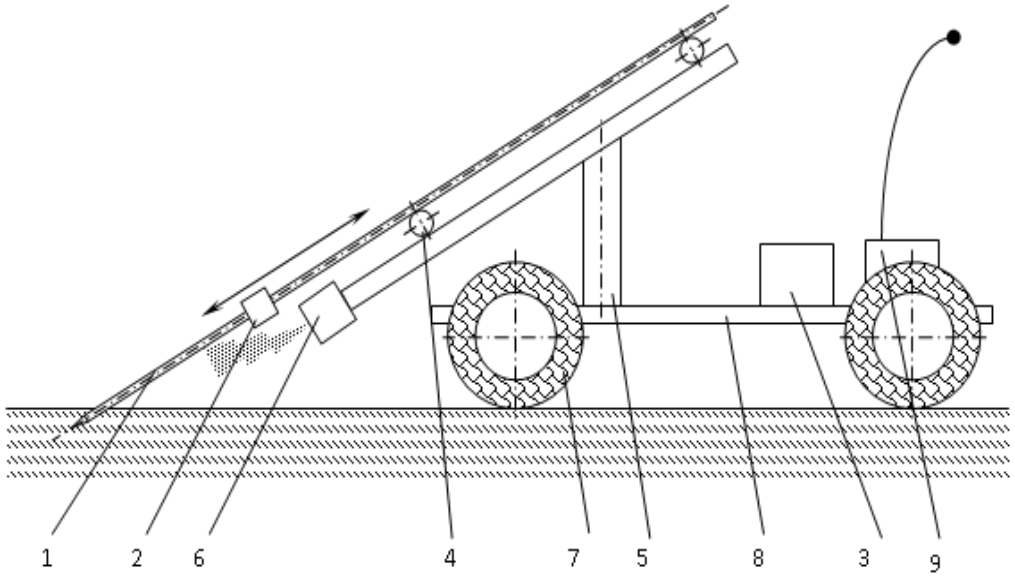
Advantages:
Increased Safety:
Minimizes the risk to human operators by reducing the need for direct intervention in potentially hazardous areas.
Efficiency and Precision:
Autonomous movement and real-time processing enhance the efficiency and precision of mine detection.
Adaptability:
The microcontroller allows for the adaptation of detection algorithms, making the device suitable for various types of mines.
Versatility:
Capable of operating in diverse terrains and environments.
Scalability:
The design can be scaled up for larger demining operations.
The proposed penetrometer represents a significant advancement in mine detection technology, offering a safer and more efficient alternative to traditional demining methods.

Modular Remotely Operated Mine Detection System "GEOTRON»

This project aims to develop a geotechnical system for the detection of unexploded mines and ordnance based on the analysis of soil geoanomalies. Such systems analyze the geotechnical parameters of the ground surface through contact and non-contact methods, allowing for the detection of mines and unexploded ordnance with maximum precision. Additionally, the geotechnical system for mine and ordnance detection can be used to create obstacle-engineering maps. The primary goal of the project is to design an affordable geotechnical system for the detection of mines and ordnance, ensuring reliable, safe, and highly productive demining of areas contaminated with mines during military operations.



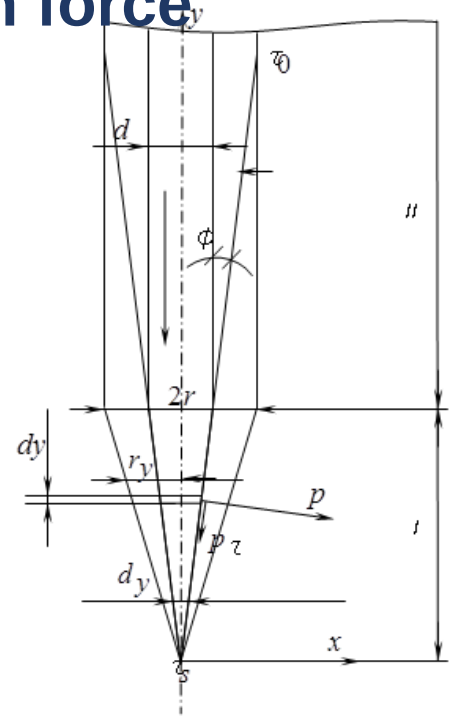


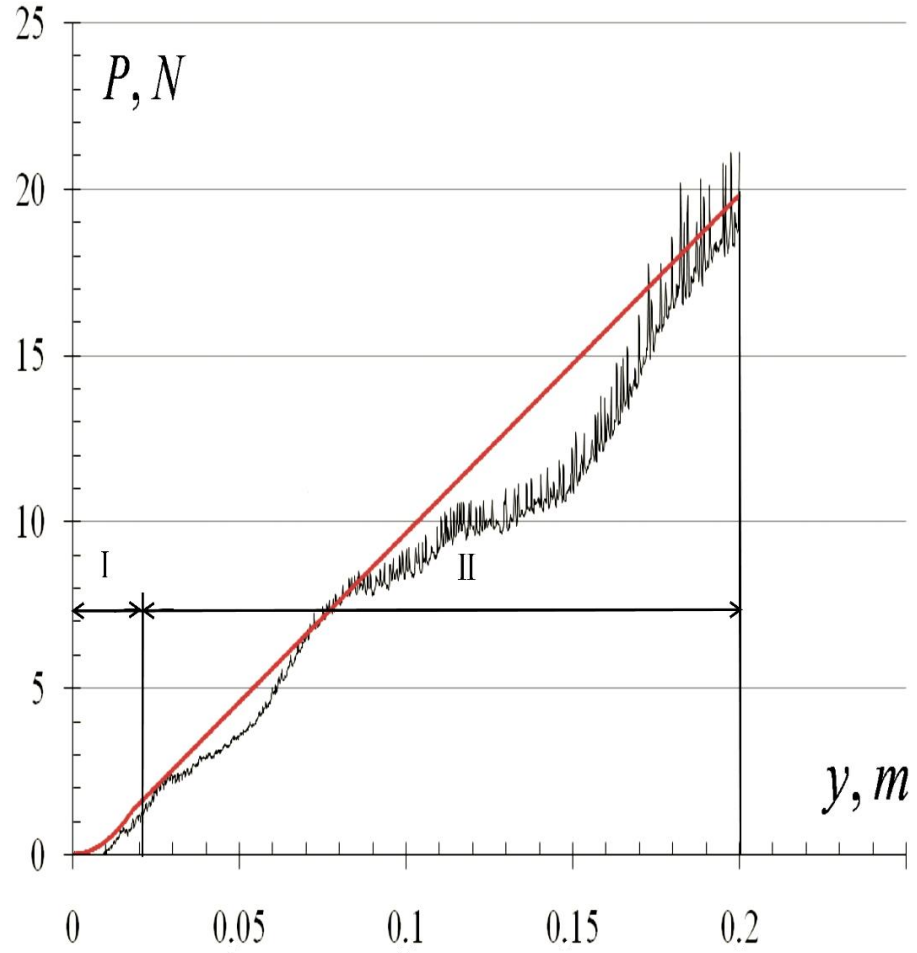
It consists of a probe 1, a force sensor 2, a microcontroller with a power supply system 3, a drive 4 immersion rob 4, a drive 5 of the rob 5, a marker device 6, a self-propelled chassis 7, a frame 8 and a navigation system 9.

Method of determination

Changes in the soil penetration force

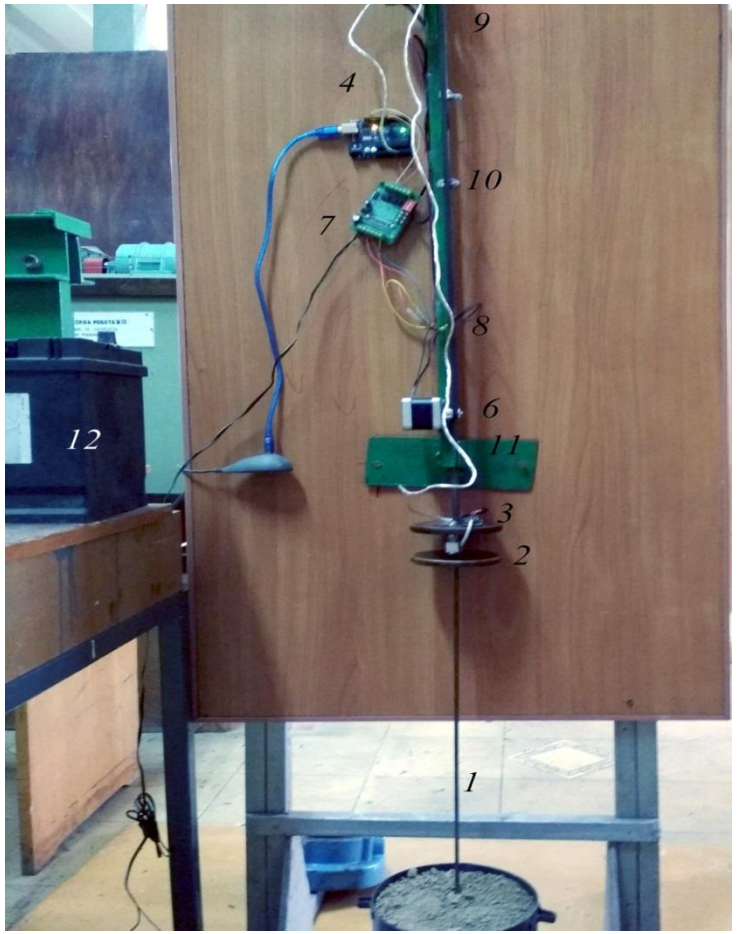
The probe performs reciprocating movements to penetrate the soil with a certain frequency. After each penetration, the robbery rotates to cover a given width. The force of penetration gradually increases if there is no mine, which will lead to a sharp fall (through the cavity or loose soil above the mine) or a sharp increase (due to contact with the surface of the mine). The microcontroller then retracts the probe to prevent mine activation and signals the marking of the device.





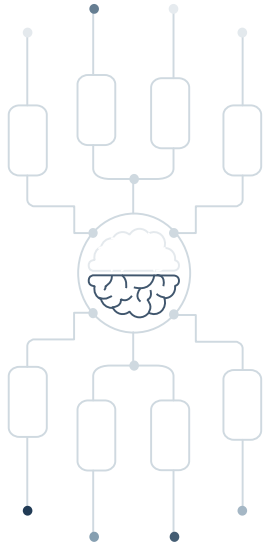
Experience of ES IEE specialists in modeling the analysis of geoanomalies using a mechanical method

Specialists from ES IEE have been awarded a NATO SPS grant for the development of a modular remote mine detection system.
The results of physical and analytical modeling of the process of searching for geoanomalies, which are caused by the presence of dangerous objects in the soil, are presented.
Mathematical modeling was conducted using the Mathcad 15 software package to predict potential efforts during the mine detection process.
The computer modeling technique developed by the department enables the assessment of potential power and energy parameters of the modular remote mine detection system.



Stages of work

WP		WP Name
WP1		Management and Coordination
WP2		Mine Detection System(MDS)
	WP2.1	MDS Prodding Mechanism - Invasive method
	WP2.2	MDS Complementary Mechanism - Non-invasive method
WP3		Remotely Controlled Modular Mobile Platform (MMP)
	WP3.1	MMP Conceptualization and Hardware
	WP3.2	MMP Remote Control and Data Transmission
WP4		Mine marking mechanism
WP5		Integration, Testing and Enhancement



Costs of materials

Major equipment

Industrial components for electrical drives 12000€

Equipment includes power converters, electric motors, sensors, actuators, power sources, controllers, software for programming and other. This equipment is intended to provide activity number three in WP2.1 (creation of laboratory set-up for primary investigations of critical points). Some components also can be used in a final version of mine detection system.

Altium Designer (schematic and PCB development) 11000€

Altium Designer is a CAD software for schematic and printed circuit board development. Using this software activity number six in MP2.1 (hardware development of combined electrical drive and control system) will provided.

Matlab, Simulink, Toolboxes (Control algorithm simulation and testing) 5500€

Matlab and Matlab Simulink is world-wide standard software for simulation. Simulations provide performance investigation and possible problem detection on system design stage. As far as mine detection unit is a complex dynamic system with several drives - simulations are mandatory tool. Design procedure of control system for electrical drives also require intensive simulation. Signal processing and curve fitting toolboxes of Matlab are necessary in this project for poking processes analysis.