HAZARDOUS MATERIALS DETECTION SYSTEMS

VIDEO SURVEILLANCE

Stereo Vision Camera

Vision Based Navigation System

Inertial Measurement Unit

Simultaneous Localization and Mapping [Slam]

- Autonomously follows the route in patrol mode
- Automatic obstacle avoidance
- Stops in position ideal for video surveillance
- Robots location and video from cameras transferred to command center and a guards tablet PC.
- Panoramic video surveillance and motion detection
- Automatic target acquisition and tracking with PTZ camera
- Remote video surveillance on a tablet computer, built-in DVR
- Change of surveillance positions without operator assistance
- Automatic battery charging
- Duration of autonomous patrolling - 20 hours
- Cruising range without recharging - 24 miles
- All weather, day-and-night operation
- Low-noise electric drive
- Autonomous nighttime operations
- Autonomously passing pedestrians, cars and other robots
- Elements of artificial intelligence
- Return to base when batteries discharged.

Unmanned UGV

Russian company develops and provides light unmanned ground vehicles (UGV) designed for all-season driving in des-ignated areas. Rover S5 performs mul-tiple trips over mapped routes, unat-tended. Its autonomous motion con-trol and navigation system is guided by machine vision, performing pin-point video data analysis, which allows the vehicle to select and navigate routes, avoid obstacles, stay on course and repeat the job cycle multiple times.

Technology

Company has developed a **UGV** guidance system for on-and off-road jobs. This autonomous navigation control system performs great even under conditions of interrupted satel-lite transmission, assuring the route integrity. Best suited to perform over a repeating route (closed-loop circuit), its accuracy increases with each trip. A particular advantage of this innovative UGV navigation control technology is consistent performance in all kinds of challenging conditions.

All our **UGV robots** are equipped with our proprietary navigation con-trol system, a computer vision network comprised of three video devices, each designed to perform a specific inte-grated function.

The first system includes Stereo Vision Camera that detects obstacles and allows the robot to correct the course. Stereo Vision Camera cre-ates real time 3D disparity map, which builds a dynamic 3D environment at a distance of a several meters ahead of the vehicle.

The second system consists of single road detection camera that provides the exact path image for the autopilot and keeps the robot on the route.

The third system provides autono-mous off-road navigation by using com-puter vision. It's based on the visual odom-eter system for Simultaneous Localization and Mapping – SLAM.

The system employs embedded Real-Time Image Processing to adjust (filter) incoming data, using data received from the Inertial Measurement Unit (IMU).

Autonomous navigation system enables the robot to determine its location on the map with an accuracy superior that of GPS, and remains fully operational under a roof or in a hangar.

Unlike the expensive **LIDARs** used by other manufacturers' models, our outdoor robotic navigation system is a low-cost, highly effective solution, ideally suited for mass production.

When operating at **UGV's** maximum speed, our navigation system relies pri-marily on the processing capacity of a built-in video data-analyzing computer. Such general-purpose microprocessors — available since 2013 — have enough capac-ity to guarantee safe UGV daylight travel at speeds as high as 20 kph (12.5 mph).

Regular status updates on the robot-ics systems are transmitted to the opera-tor's PC via Wi-Fi. Android user interface enables the operator to remotely monitor robot performance of its tasks and to view recordings from the robot's video cameras while checking the robot's position on a digital map.

The security robot Rover S5 is based on unmanned ground vehicle chassis and is approaching a large-scale production. The robot is designed for outdoor patrol-ling and equipped with intelligent video surveillance system which automatically scans the secured premises. The robot stops at preset positions for optimal sur-veillance and inspects the area within 50 meters (164 ft) range to detect any mov-ing objects.

When such objects are detected, the video surveillance system focuses its steerable PTZ camera on the object and transmits the video to the security post.

ROVER:S5

PERIMETER INTRUSION DETECTION SYSTEMS

Hazmat Robot

We proud to present our new modification of the security robot: Rover S5 Hazmat, designed to oper-ate in hazardous environments.

This autonomous robot is ideally suited for collection of information about air pollutants, temperature and radiation.

In addition to the standard set of cameras, Rover S5 Hazmat robots are equipped with special gas analyzers, temperature sensors and radiation detectors, and may be additionally equipped with other devices per customer´s request.

ROVER-S5 HAZMAT IS ABLE TO PERFORM REMOTE INSPECTION TASKS AT THE INDUSTRIAL FACILITIES WITHOUT HAVING DIRECT ACCESS THE HAZARDOUS AREAS. ITS OPERATION DOES NOT REQUIRE HUMAN PRESENCE.

Alarm systems are only triggered if some environmental parameters are outside of the normal range. The facility staff does not have to monitor the process all the time.

Our system provides not just the financial savings, but more importantly, relieves humans from repetitive routine tasks and improves execution of the wide range of inspection tasks.

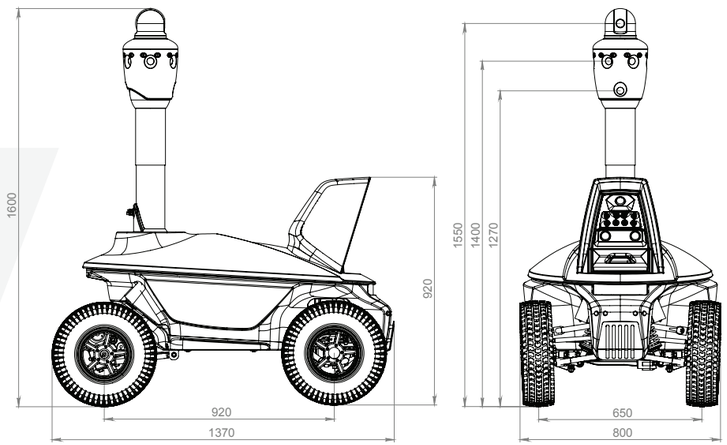
UNMANNED GROUND VEHICLE

ROVER S5

Range at +5°C (+41°F)	25 km (16 miles)
Speed (in autonomous mode in the daytime)	4-9 kph (2-6 mph)
Speed (in autonomous mode at night)	3-6 kph (2-4 mph)
Optimal width of a driving lane	1.2 m (4 ft)
Minimum curb-to-curb turning radius	3.4 m (11 ft)
Maximum degree of slope	18°
Maximum step height	14 cm (5.5 in)
Ford depth	up to 12 cm (5 in)
Dimensions, width×height×length	765×929×1369 mm
	(2.51×3.05×4.49 ft)
Gross vehicle weight	110 kg (242 lbs)
Nominal payload capacity	35 kg (77 lbs)
Nominal operating temperature range	-20°C...+45°C (-4°F...+113°F)

ROVER S5 Security Robot is a reliable solution for assuring security of personal and business property. Mobile video surveillance system continuously patrols the secured area, greatly enhancing the level of protection and dramatically reducing the dependence on human factor, especially when patrolling areas an expanded territory.

ROVER S5 Security Robot provides automatic round-the-clock patrol and surveillance of secured areas and specific objects. It serves as a reliable assistant to security services provider. As a mobile video surveillance system, it can continuously patrol the secured objects and perform video surveillance from various points.



Intruder Detection

The most exciting things happen when our robot detects an intruder. We call this behavior the Swarm Intelligence. Upon detection of an intruder the robot stops moving along its designated route and switches to the optimal path to the intruder

The chosen route is not simply the quickest route to the goal; its purpose is to find locations where visibility (video picture) is the best, with minimal disruption.

Target coordinates are transmitted and shared across the group of robots. The robots nearest to the intruder start looking for the intruder with their PTZ cameras. Other robots that are not involved in the response to intruder increase the interval between them and continue their regular path. The robots nearest to intruder activate the alarm, and begin transmitting video of intruders and their GPS coordinates to the central guard station and to the guards patrolling on-site. The human operators review the alarm and make decision to proceed to intercept, or to cancel the alarm. If the operator determines the target as the intruder, the robots will continue to follow the intruder until the arrival of human guards and cancellation of the alarm.

If the operator determines that the target is not a threat, picture and video data is added to special database of safe-pass objects. When these objects are detected by robots in the future, they will not trigger the alarm and the robots will stay on route. This experience is shared across the group of robots and is available to any robot within the group. Thus, all the robots are trained to determine their behavior in different situations and Artificial Intelligence of the swarm is growing.

Artificial Intelligence

The most important element of our system is its AI-enhanced software, at the heart of which is the Multi-Agent System (MAS). Each robot uses set of sensors to receive information about the environment. By processing the data coming from all these sensors, the traffic control system solves the problem of building a motion pathway. The primary source of data for successful motion pathway solution is a vision system capable of creating a map of alternative pathways. The vision system corrects and improves the map with every repeated passage. In the event of obstacles, the system detours and thus explores the surrounding area. Thus, the GPS navigation system becomes secondary in choosing a route.

(AI) Solutions

We developed the state of the art AI solutions for the robotic swarms. Unlike some other machines on the market today, our robots are not RC operated but truly autonomous, intelli-gent units. Our robots are capable not only of fulfilling the tasks specific to secu-rity; they also excel in other autonomous vehicle challenges such as location, motion control, travel path optimization, proactive mobile obstacle avoidance, etc. The robotic AI constantly works to achieve the optimum solutions.

The robot's primary autopilot is programmed for routine driving scenarios. Under favorable external conditions (e.g., when there is extra time available for finding the solution) the AI is capable of introducing an element of randomization, leading to the best available decision.

Under normal conditions, the robot moves along the route with minimum deviation from the path, keeping track on the energy consumption ratios to determine when the efficiency of the movement drops below optimal. When the battery charge allows it, the AI will instruct the robot to change the route in order to optimize the energy consumption. When this happens with one of the robots, it will share the optimized results with the rest of the swarm. This way the AI continuously improves its programming and adds optimized solutions to the preset programming of all robots working in that particular group.

algorithms and reinforcement learning, along with a predetermined program of the robot.

Truly Independent Robot

Our off-road unmanned ground vehicle (UGV) Rover S5 is fully autonomous robot with a payload capacity of 100 kg (220 lbs) capable of attaining speeds of over 20 kilometers per hour (12.5 mph) and traversing rugged terrain. In a security surveillance configuration, Rover-S5 chassis, outfitted with a high-power video surveillance system, will go places where humans cannot and monitor with accuracy and efficiency.

Multi-Agent System

Upon encountering obstacles along the way, the system automatically decides on the detour path selecting from a variety of possible ways. Naturally, every obstacle checked is this intruder or not. In the multi-agent system, all participating agents (robots and base servers) may access the information circulating in the system. Once one agent knows the information, it becomes available to every agent within the system. In fact, the ability of sharing information and executing group tasks is exactly what makes a group of our robots a Multi-Agent System.

MANUAL ROBOT CONTROL