SMP Security Robot

S5.2

www.smprobotics.com
www.smpsecurityrobot.com

SMP Robotics Systems Corp.

The Revolution in Security Business Begins Here!

Outdoor Security Robot
SMP S5.2 series

Outdoor Security Robot SMP S5.2 series

SMP Robotics Outdoor Security Robot is a fully autonomous, self driving security surveillance system.

Key features

- Intelligent Surveillance System with Threat Recognition
- Fully autonomous patrolling day and night 24/7
- Artificial Intelligence in a Multi-Robot Security System.
- Fully autonomous patrolling
- Robots working in a group as a team. Communicating to each other while exchanging data and intruder information.
- Swarm intelligence for reliable group patrolling of large areas
- Panoramic video surveillance system with PTZ camera
- Robots support the Wi-Fi MESH network
- Artificial intelligence for human face and behavior recognition within the cameras' observation range
- Intelligent security: Recognition of staff members by uniforms
- Obstacle avoidance and anti-collision system
- Overcome obstacles up to 7 inches high
- Cloud data integration capabilities
- Easy integration with VMS central monitor systems (such as Milestone, etc.)
- 100% support (compliant) of ONVIF standards
- High cross-application capability
- High Ingress Protection rating for outdoor applications
- Self-diagnostic system
- Panic button and two-way audio intercom
- Operates 24/7 in a wide variety of terrains and under any weather conditions (rain, snow, fog, gusty wind or hail)
- Operating temperature ranges from -25° C (-12° F) to 45° C (+118° F) (High Temperature version up to 62° C (144° F) will be available later this year)
- Up to 18 hours of autonomous patrolling
- Schedulers
- Automatic recharging system
- IP65 rating for waterproof and dust resistance
- Easy on-site deployment and installation
- 24/7 virtual monitoring of robots by the manufacturer
- Support, maintenance staff consultation and training
- Quick payback of your investment, easily within 6 - 9 months of operating time

WARNING
THIS IS NOT A SAMPLE, DEMO OR PROTOTYPE
THIS IS A REGULAR MANUFACTURING MODEL

Airports (Security + birds control)

Sea Ports (perimeter protections)

Military bases (perimeter protections)

Power stations

Solar farms

Electrical Substations

Refineries

Private facilities

Underground gas storage facilities

Chemical Plants
(Security + Hazmat Control + Fire control)

Oil & Gas Facilities
(Security + Hazmat Control + Fire control)

Resorts (Security + Mosquito control)

Correctional Facilities

Large manufacturing facilities

Shipyards (perimeter protection)

Warehouses (outside perimeter)

Vineyards (Security + birds control)

Gardens (Security + birds control)

Water supply areas
stations and reservoirs

Telecommunication
companies' installations

Hazardous facilities: (perimeter
protection)

Government facilities

Border patrol

Cemeteries

Golf clubs

Stadiums and sport facilities

Corporate campuses

University Campuses

Pipelines (oil and gas)

Gated Communities

Parking lots, dealership, cars lots

Parks

Schools

Solar Farms, Power Plants

Beach patrol

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Areas of application

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System for robotized patrolling

• Autonomously moving over a defined route • Avoiding obstacles and returning to the defined route • Patrolling in low-light conditions • Sparse illumination of the patrol route • Shutting down when forced to deviate from the route • Recalling from the route in case of emergency using manual remote control mode

Intelligent video surveillance and two way sound notification

• 360-degree video surveillance • PTZ camera for two models • Human detection • H.265 compression • ONVIF Profile S • Audible warnings for robot's immediate environment • Communication intercom between the operator and people around the robot • Multi-color beacon

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System with multiple robots

• Uniform distribution along the patrol route • Complementary surveillance of the common areas on premises that precludes the possibility of duplication • Optimizing the positions for the repeaters to support the Wi-Fi MESH network • Sharing experience such as new obstacles avoidance route, new type of intruders (like animals) etc. • Sharing potential intruder position between robots. • Ability to call drones.

Communications

• Instant notification about events through the Security Robot Messenger • Mobile Patrol Viewer for a laptop (tablet) •Transmitting "ONVIF video" via Wi-Fi or 4G* • 4G exchange of service data and remote monitoring** • Saving routes in the cloud**

Robotic Security Team for Intelligent Surveillance and Patrolling

Saves more than 3 times

Spend over three times less on security patrolling with a robotic security team. The robots can fully replace your security guards and provide truly uninterrupted patrolling.

Integration into Video Monitoring

A robotic security team can either be fully autonomous, or work alongside your security offices, integrating easily into existing Video Monitoring Systems.

Artificial intelligence system

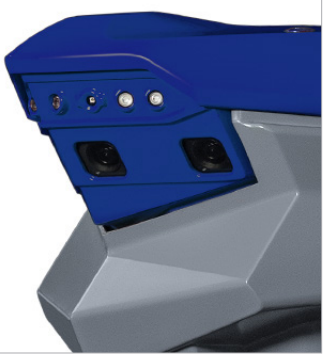
With on-board supercomputers providing video surveillance analytics and employing artificial intelligence algorithms, the security robots offer highly efficient threat discovery and intrusion prevention.

The security robots of the S5.2 series

Intelligent Surveillance with Face Recognition and Human Tracking

Fully autonomous patrolling day and night 24/7

Artificial Intelligence in a Multi-Robot Security System

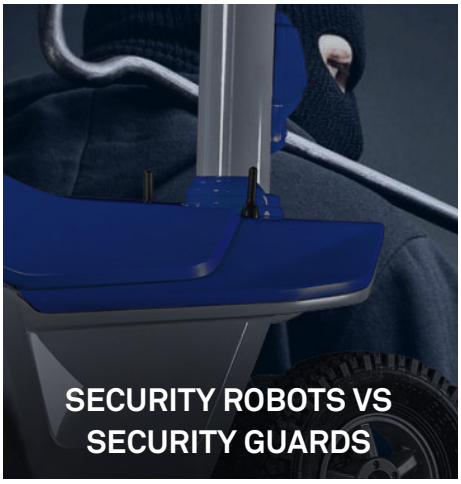


SMP Robotics Outdoor Security Robot is a fully autonomous, self driving security surveillance system.

Robot 2

SMP Security Robot

S5.2



SECURITY ROBOTS VS SECURITY GUARDS

A security robot automatically patrols the area along a programmed route and transmits video image via 4G or Wi-Fi. The robot is equipped with a 360-degree intelligent video surveillance system. The intelligent surveillance system of a security robot detects people and their faces. When a person or a vehicle appears in its field of view, the system detects them and sends an instant message via Telegram. The robot can issue an audio warning to inform the intruder about entering a restricted (prohibited) area. The operator can communicate with the person in proximity of the robot through a built-in intercom device.

NIGHT SECURITY PATROL

A robotic security team works day and night, providing security 24/7. In a night mode, the robots use infrared illumination of the pathway, making them barely noticeable to people. In case of alarm, a warning beacon (beam) is activated.

MULTI-ROBOTS SYSTEMS COORDINATION AND COOPERATION

The security robots are capable of working as a single team. When one robot leaves to be recharged, the rest redistribute the routes so that no area remains uncovered. If one of the robots travels into a remote patrolling area where wireless communication is restricted, the rest relocate themselves to transmit its data in MESH mode.

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Smart video analytics in a second evolution of the Security Robots

SMP Security Robot
S5.1
2017

SMP Security Robot
S5.2
2019

Our offering includes new second generation robots. These robots incorporate all of our experience working with first generation models. They feature a top-notch visual navigation system, high maneuverability, invisible infrared illumination, an audio alarm, and an intercom device for communicating with the operator.

Surveillance cameras
Visual navigation provides work without a GPS

Tall mast
The height of the cameras as the patrolling man

Remote control
To call the operator and intercom to talk

Large wheels
Excellent permeability

PTZ camera
Automatically detects people's faces

LEDs in the head
Indicating the operating modes

Stereo cameras
On the console to avoid obstacles

The LEDs above the cameras
Invisible IR lights for operating in the dark

The most cutting-edge feature, however, is an intelligent video analytics security system. The smart surveillance system can reliably detect humans even in the most challenging conditions, using deep learning neural networks to analyze images from built-in cameras. With exceptional computing capabilities of the embedded computer the analysis can be performed on-board the robot, and the resulting image with the human highlighted is then transmitted to the control center.

The security robots offered by SMP Robotics are capable of unmanned, automated-mode patrolling. The security robot's guidance system allows for highly-precise movement along a route set during the learning process.

The robot uses visual and satellite navigation, and that is why the best precision for it to follow its route is achieved while making adjustments by using both means. For the visual navigation system to work at its full capacity, sufficient illumination is necessary. In case there is insufficient illumination, patrolling routes out in the open are to be used, in order to ensure stable operation of the GPS system. With its highly efficient long-stroke wheel suspension, the robot can reliably traverse rough pathways, such as gravel tracks.

An emergency shutdown system

In case the robot significantly deviates from its route - for example, when taking a long detour around an obstacle - the robot is equipped with an emergency shutdown system that is triggered when the robot deviates from its route by more than 5 meters. For such situations, to return the robot to its route, there is a manual remote control mode.

Getting back on its route

While patrolling, the security robot is capable of taking detours around obstacles and then getting back on its route. To move around during the night in conditions of inadequate lighting, the robot turns on infrared illumination that is invisible to the naked human eye.

The robots' group mode of operation supports the ability to control how robots are distributed along the patrol routes to perform video surveillance on common areas of the premises are consecutively surveyed from different observation positions. It provides for uniform patrolling around the premises while minimizing the number of operating robots. It also controls the selection of the position by the repeater-robot to support the MESH network operation.

Data can be exchanged through Wi-Fi or 4G

All robots are equipped with warning lights and sound notification. The voice alert is capable of repeating set phrases multiple times. There is a mode for voice communication over a built-in IP intercom between the operator and a person located near the robot. Data can be exchanged between robots, the base station, and the operator through Wi-Fi or 4G.

The Security Robot Messenger mobile messaging service

The operation of robots while they are on their surveillance patrol routes is supported by notifications through the Security Robot Messenger mobile messaging service. This service informs on the robots' condition, and transmits images of alarm events detected by the video analytics system to the supervisor's and security guards' telephones. To watch the video stream and see the robot's current position on the facility map, there is a specially designed software application, the Mobile Patrol Viewer. It was developed for use on an Android-powered laptop (tablet).

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4 Models of Security Patrol Robots

All security robot models offer the same autonomous patrolling capabilities.

The difference between them is the video surveillance system installed.

2 types of video surveillance systems

There are two types of video surveillance systems available for the security robots. One video surveillance system is using on-board video analysis capability based on the built-in supercomputer. This type of security robot is able to automatically detect people that fall into the video surveillance cameras' field of view. This function is essential for patrolling when there are no people around, and when the appearance of a person on the guarded premises represents an alarm situation. In addition, these robot models have a buffer video recording mode that guarantees reliable transmission of the alarm event video regardless of the quality of the wireless connection. The second type allows for transmitting compressed video streams from the video surveillance cameras without analyzing them, and storing them aboard the robot.

2 types: with and without a PTZ camera

There are two kinds of design possible for both types of security robots: with a PTZ camera and without one. All robots have 6 cameras that permit 360-degree video surveillance over medium distances. To perform surveillance over long distances (more than 50 meters), the robots come equipped with a PTZ camera. During the daytime, the PTZ camera allows to observe the space around the robot over distances up to 200 meters. At night, the observation distance strongly depends on how well-lit the premises under observation are.

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Security Surveillance Robots

SMART SECURITY ROBOT

PROMT S5.2 IS

Intelligent 360-degree video surveillance and a Wi-Fi MESH repeater

A continuous 360-degree surveillance, and human detection over medium distances using an on-board intelligent video analysis system. It is ideal for patrolling along winding routes in confined spaces of medium-sized premises. Equipped with a highly-efficient Wi-Fi MESH antenna. Promt is able to perform intelligent video surveillance tasks, and operate as a repeater to transmit data from other robots that are located outside the coverage area for the base station. Supports edge recording when working with the ONVIF VMS.

SMART SECURITY ROBOT

PICARD S5.2 PTZ IS

Intelligent PTZ video surveillance and continuous panoramic video analysis

Detecting and recognizing objects at great distances using an automatically controlled PTZ camera. Continuous 360-degree panoramic image analysis, intelligent video analysis using two built-in T9 supercomputers. Perfect for robotized surveillance patrolling and video surveillance on large-sized premises that are out in the open. Provides for a high level of reliability for detecting people through a detection system that functions autonomously at different distances. Supports edge recording when working with the ONVIF VMS.

Security Surveillance Robots

SECURITY SURVEILLANCE ROBOT

DJET S5.2 IP

360-degree video surveillance upon request and aWi-Fi MESH repeater.

Attractive price Provides 360-degree online video surveillance. Designed to set up mobile video surveillance with ONVIF VMS in conditions where there is stable wireless communication. Does not have built-in video analytics or buffer recording capability. Equipped with a highly-efficient Wi-Fi MESH antenna. It is the most cost-effective solution that allows retransmissions through a Wi-Fi MESH network where there is no direct visibility between robots and the base station. Among all the robot models, this one provides the longest period of autonomous operation without recharging.

SECURITY SURVEILLANCE ROBOT

KEPLER S5.2 PTZ IP

Remote control for the PTZ camera and 360-degree video surveillance upon request

Equipped with an HD PTZ camera that can be manually operated and functions by using VMS commands. Designed for mobile video surveillance of large-scale premises out in the open. Allows for uninterrupted 360-degree online surveillance over medium distances. Ideally suited for work as a mobile camera as part of ONVIF VMS in conditions where there is reliable wi-fi coverage. Allows the use of VMS server video analytics capability and works in systems that can recognize faces and people. Does not have a built-in video analytics or buffer recording capability.

Picard | Kepler

Promt | Djet

Four models of security robots

All security robot models include identical autonomous navigation systems used for surveillance patrol. Please note that there are two types of video surveillance systems offered for the security robots. One video surveillance system is using an on-board video analysis capability ported to a built-in super computer. This type of security robot automatically detects people entering into the video surveillance cameras' field of view. This would be essential for patrolling when no people are supposed to be around, and therefore the appearance of a person on the guarded premises represents an alarming situation. These robot models also have a buffer video recording mode that guarantees reliable video transmission of the alarming event video regardless of the quality of the wireless connection.

The second type allows for transmitting compressed video streams from the video surveillance cameras without analyzing them, and storing them aboard the robot.
There are two design options for both types of security robots: with a PTZ camera and without one. All robots have 6 cameras that permit 360-degree video surveillance over medium distances. To perform surveillance over long distances (more than 50 meters), the robots need to be equipped with a PTZ camera.

During the daytime, the PTZ camera allows to observe the space around the robot over distances up to 200 meters. At night, the observation distance strongly depends on how well-lit the premises under observation are.

Intelligent surveillance and face recognition

The intelligent surveillance system of a security robot detects people and their faces.

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These functions enable to implement:

- human recognition by cloud-based face recognition;
- alarms in case of human intrusion into a restricted unmanned area;
- PTZ camera tracking the moving people;
- saving face photos and recording video footages of the moving people.

To ensure total human recognition, each security robot must be connected to a face recognition provider's server.

Artificial Intelligence and Big Data in Security System 5.2 +

As robots patrol the guarded premises, they accumulate data about places where they most frequently encounter potential threats. This data is processed and analyzed over large periods of time.

As a result, a threat intensity map is composed based on external factors, time of day, weather, and various other information that provides us with Big Data. Processing this data can help predicting threats and enhance robotic patrolling at potentially dangerous times. It is also possible to use AI features at the data processing stage to automatically focus the patrolling robots on potentially dangerous directions. Furthermore, by analyzing Big Data accumulated during the robots' use, we can reassign the patrolling routes and change the robots' schedule.

Face Recognition on the street

Security robot for face recognition on the street
The first type of robots detects people at short distances, i.e. in the streets and in parks. The onboard supercomputer enables simultaneous human recognition in images from the robot's six cameras. The cameras are positioned to form a full circle and can recognize human faces in all directions, no matter where the main flow of people moves.

The robot is as tall as a person of average height. Its video cameras match the face level of walking people. Such positioning of cameras enables to get human images that are optimal for recognition. The onboard supercomputer takes front face photos. By transferring solely front face photos, a security robot minimizes traffic in wireless communication channels and lessens load on the cloud-based face recognition servers.

SMP Robotics is open to integration with the total human recognition systems.

Human Tracking and Face Detection

Along with six cameras of the 360-degree panoramic CCTV system, the second robot type is fitted with a PTZ camera. Under control of a separate onboard supercomputer, the PTZ camera enables all-round scanning of the territory next to the robot. If a human is detected, the camera tracks the human being for a preset time or until a front face photo can be taken.

A separate onboard supercomputer ensures human / human face recognition, tracking with the PTZ camera on each frame in the video stream. The camera's high frame processing speed enables a full turn of the PTZ camera in less than two minutes. Running in this mode, the robot can recognize people in the range of up to 100 meters.

Both robot types perform human search in a cloud-based database. Such solution enables to use one server for a group of robots. Moreover, each robot is an active query initiator and makes an independent decision whether to give the alarm once it gets the response.

Neural Networks on Embedded Computers

The robot's video surveillance system includes a dedicated T9 supercomputer based on a Jetson TX2 processor module. NVIDIA's Jetson TX2 offers high performance sufficient for simultaneous processing of 6 high-definition video streams with fairly low power consumption. Power consumption is a critical feature for an autonomous mobile robot that has to rely on built-in rechargeable batteries.
The less power the video surveillance system needs, the longer the robot can work without recharging. The power consumption of a supercomputer based on Jetson TX2 is only 15W, so it can be used for long-term autonomous surveillance on a mobile robot. The processor's architecture is designed for working with deep learning neural networks.

This provides high performance necessary for human detection in a video stream.
The embedded supercomputer is a perfect solution for detecting not only humans, but also other objects of interest for security purposes. For example, construction supplies are often stolen using pickup trucks. A neural network capable of recognizing a car in threatening proximity to a guarded facility will be able to give an alert of a potentially dangerous situation. For this feature to work, it is enough to train a neural network to recognize a particular vehicle type, and then add this neural network to the software running on the robot's smart video surveillance system's on-board computer. This approach does not require a hardware upgrade, and with the development of new infrastructural software it allows to quickly expand the security robots' available functions.

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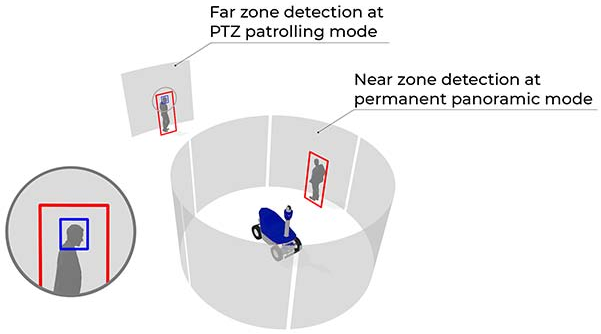
NVIDIA JETSON INSIDE

Human Detection in Video Surveillance System

The detection of humans on the images obtained from six 360-degree cameras is performed by a single embedded computer. The detection range depends on numerous factors: the size of a person in the frame, whether the person's full height is viewable, the lightning, the background, or whether there are other objects partially covering the person. Nevertheless, in the most general case, the detection range on the robots' current models is around 40-50 meters. The image from each camera is analyzed with the frequency of several frames per second, which is sufficient for robust operation of the system. In order to increase the human detection distance, for example when patrolling along chain-link fences, a potential threat can be localized at farther distances using a PTZ camera. This camera can detect a human at the distance of about 200 m. The camera works in scanning mode. It performs a 360-degree surveillance, rotating smoothly around its vertical axis. The PTZ camera image is processed by an additional dedicated Jetson TX2 supercomputer, that analyzes the high-definition video stream at 25 frames per second. The scanning detection mode can be suspended, allowing the PTZ camera to follow a specific object.



Processor module	NVIDIA Jetson TX2
Memory	8GB LPDDR4
Storage	2.5" SSD
Compression	H.265/H.264
Video	8 AHD channels, 720p; SMA
Audio	2 channels; Hirose HR10
Interfaces	RS232, CAN; Hirose HR10 USB 3.0, USB 2.0, HDMI 2.0 Ethernet 10/100/1000 Mbps
Power input voltage	2 VDC (10 ... 16 VDC)
Power consumption	7 W max
Dimensions	185×110×55

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Multi-robots systems coordination

To create a reliable patrolling system, groups of robots are used; to organize their interaction with each other, multi-agent solutions are used. It's recommended to estimate the number of patrolling robots with redundancy in mind.

System from a group of security robots

Security robots used to ensure safety for facilities and their premises need to perform this job continuously. Along with that, robots need to be charged, repaired, and serviced; conflicts are also possible if robots are unable to travel along their patrol routes. To create a reliable patrolling system, groups of robots are used; to organize their interaction with each other, multi-agent solutions are used. In a system consisting of a group of security robots, each robot acts as an intelligent agent that has its own purpose and objectives. All of them have wireless communication equipment to share information with other robots, and can inform each other about their current condition and intentions.

How many robots it is necessary?

It's recommended to estimate the number of patrolling robots with redundancy in mind. This will release resources such as endurance distance and off-duty time, free of patrol in the assigned area. The automatic redistribution of free resources among robots ensures the reliability and continuity of the patrolling process. For example, one of the robots can take place of its neighbor if the latter one needs recharging and has to leave its route. This interaction creates a self-organizing system that is capable of reacting to external circumstances without the need for programming every response.

Swarm Technology
for Adaptive Security Systems

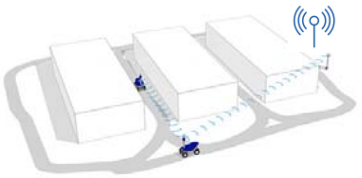
One of the main objectives for a group of robots patrolling the premises is to make sure that the area is evenly covered by surveillance, and to preclude situations where part of it is not surveyed. However, if a robot does not move over a long period of time, this reveals its position, and makes it easier for an intruder to covertly infiltrate the premises. That is why it is advisable to survey the same area from different observation points. This objective can be achieved by having the robots move in an interdependent fashion. Two robots located next to each other provide surveillance for one area of the premises, and take turns examining it from different perspectives.

Continuity for patrolling might be disrupted as the result of one, or several, robots getting excluded from the patrolling process. There are some predictable reasons for this, like the need of recharging, or unpredictable ones, like an insurmountable obstacle appearing in a robot's path of movement. In this case, the task of the robots that are still functioning is reassigned to ensure safety for the area of the premises that was patrolled by the inoperative robot.

This objective is achieved through multi-agent interaction between the robots where each of them can independently adjust its current task to resolve the larger, overriding one. It must be noted that solving such issues requires a certain resource redundancy in the mobile robot system. If the number of robots or amount of resources for the patrolling routes supports only the local task of the robot (that is, patrolling a certain area), then priorities must be set for the areas being patrolled in conditions when the resources for the security robot multi-agent system are limited.

At this stage, a feature that will allow setting the priorities for the patrolling areas is under development. The main goal for this work is getting the opportunity to set the priority for an area of the premises through analyzing the big data received as the result of robot operation.

Smart Mesh Networking for Mobile Robots



One of the conditions for the successful functioning of the security robot multi-agent system is the existence of wireless communication channels between them. Moreover, for the video surveillance system to work efficiently, video streams and warning messages with photo or video fragments must be sent to the company's security dispatch office. Deploying MESH networks between the robots help accomplish these tasks.

Using Mobile Robots to Establish Mobile Wireless Mesh Networks

All the robots can exchange data via 4G and Wi-Fi. To reduce the amount of 4G traffic, Wi-Fi routers can work in MESH and Ad-Hoc modes. These modes support relaying data from one robot through other robots to a base station. In case of a high-density development or a large amount of vegetation, it is advisable to use additional separate robots that serve as radio signal repeaters. In case it is preferable to use 4G only, there is a place inside the robot to install an additional router provided by the local cellular operator.

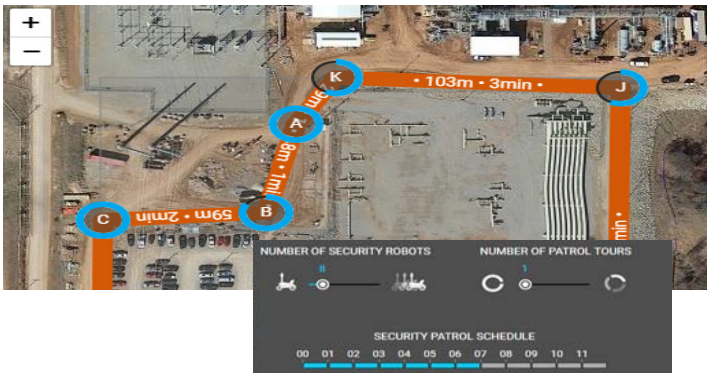
The Number of Robots Needed for Swarm Intelligence Patrolling

The number of robots necessary and sufficient to ensure reliable security is determined by the characteristics of the facility being guarded. An online calculator for patrolling and surveillance time will help you evaluate the number of security robots needed. This simple service is based on Google Maps and permits drawing out the patrolling routes and surveillance positions for the security robots at the facility. The program calculates how much time is needed for the robots to move, and how many of them are left for surveillance in stationary positions. Depending on the result, you can increase or decrease the number of virtually deployed robots.

Self-organizing security robot system for large facilities

Swarm intelligence, an intrinsic part of the robotics security team, allows large-scale facilities with complicated topography or high-density development to be guarded reliably. Swarm behavior supports the work of up to 100 robots at the same time. This number provides for reliable security of very large facilities.

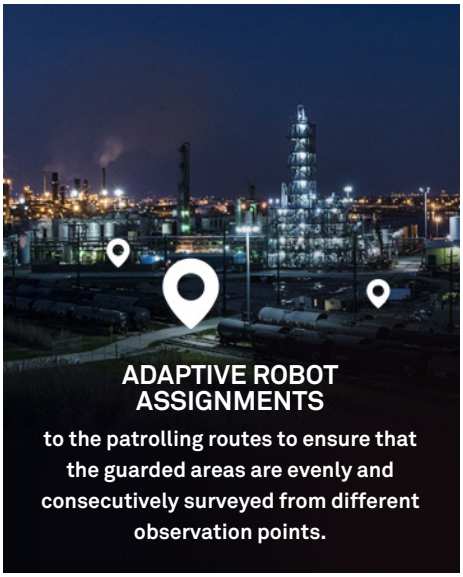
Our company is interested in installing robots to address surveillance challenges at large-scale facilities, where the conditions are complicated. Our specialists will perform the installation work and will provide support during the test period. Where necessary, we will develop additional software modules that take into account the characteristics of a particular facility.



Estimate efficiency of the security robots today. Check out our website new service of virtual robot deployment. Create a patrolling route for your facility using Google Maps. We'll estimate how many robots are required for your high security.

We are open to cooperation with companies that provide security for large-scale facilities. We believe that our robots can maintain a high level of security while reducing the costs.

The aspects of swarm technology for security patrolling

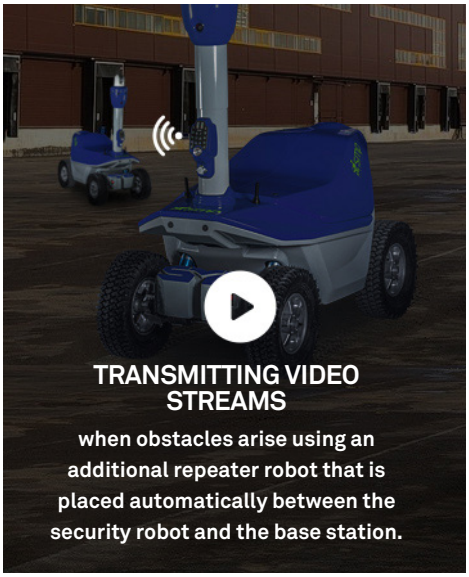


ADAPTIVE ROBOT ASSIGNMENTS

to the patrolling routes to ensure that the guarded areas are evenly and consecutively surveyed from different observation points.

REASSIGNING THE PATROLLING ROUTES AMONG THE ROBOTS

for an uninterrupted surveillance of the entire premises when a robot leaves to be recharged, or for maintenance.



TRANSMITTING VIDEO STREAMS

when obstacles arise using an additional repeater robot that is placed automatically between the security robot and the base station.

Installing Robotics Security Systems

Installation of robots at a guarded facility solves two tasks: laying of patrol routes and integrating security robots into an existing video surveillance system.

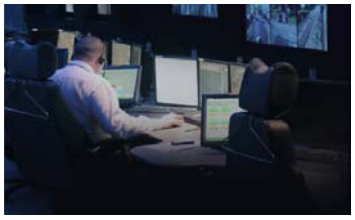
Subject to the task, a robot may patrol the premises to detect humans and alarm the operator if a human being appears. If a robot is connected to a face recognition server, the system will enable human recognition and gives an alarm in case of trespassing.

The robot's integration into the security system is accompanied by software tweaking, and generally requires no additional equipment to be installed.

Installation of automatic motion control and automatic patrolling system requires deployment of additional equipment for communications and automatic charging of robot's batteries. Apart from that, reliable operation of a robot needs a test period to refine the travel in the patrol route and select optimal observation positions. It generally takes about a week.

SMP Robotics professionals perform all the work to install robots at a guarded facility. The operating robots are tracked by local staff that completed a training at SMP Robotics. The Virtual Monitoring Center of SMP Robotics maintains remote control of robot condition and informs the local operating personnel if physical interference is needed.

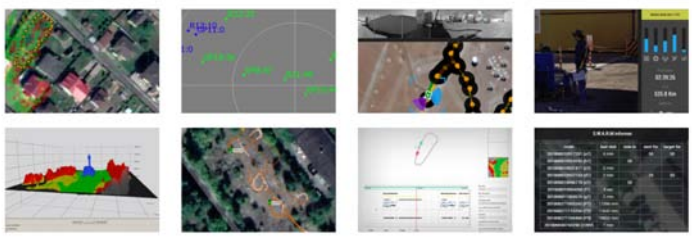
Integrated Security Solutions



In some cases, it is advisable integrating the security robots into the existing stationary video surveillance system. With this goal in mind, the robot's intelligent video surveillance system supports ONVIF communication protocol. Integrating the robot in the VMS allows using standard data exchange feature between ONVIF devices. For the ONVIF Video Management System, interacting with a security robot is similar to how a conventional ONVIF video server serving six AHD cameras works.

The Video Management System operator can monitor video six surveillance cameras

If a human appears on the video, the on-board video analytics system sends an alarm to the VMS operator and highlights the detected person. The on-board video server supports the edge recording mode from ONVIF Profile G. This function allows buffering video data transmission. When using wireless communication channels, it is difficult to guarantee uninterrupted broadband access, and signal can fade out or become disrupted. Edge recording mode helps ensuring uninterrupted video surveillance.



There is no need to upgrade the Video Management System software

One of the video streams transmitted by the robot displays a map of the facility and the robot's location on it. When using this solution, there is no need to upgrade the Video Management System software in the control center. The VMS operator will be able to see the robot's current condition and its direction of movement, along with other video streams from the CCTV cameras.

Mobile Software for Security Robots

In order to remotely control the robots and give notifications about the changes in the operation modes, there exists a software solution called Security Robot Messenger. This application uses Telegram instant messaging service to inform the robot's users when a person is detected, or when the robot makes an unscheduled stop, or about its health; it permits playing an audible warning phrase, or switching to an intercom to speak with a person located beside the robot. This service makes the robot convenient to operate, both for security officers located directly on the facility's premises and for a security supervisor located somewhere else.

Multi-Robot System Virtual Monitoring and Control

While operating the robot, you can substantially cut costs by subscribing to the Virtual Monitoring Control service. In this case, our engineering team will continuously monitor the operation of the robots in order to minimize downtime. If necessary, they will make minor adjustments remotely, and streamline the robots' patrolling routes. In case any problem arises that cannot be resolved remotely, the robot owner's local technical personnel will be informed, and recommendations regarding troubleshooting the robot on-site will be made. Remote evaluation of the robot's hardware condition helps ordering spare parts on time, and performing swift maintenance work on the robot.

Privacy Protection in Video Surveillance System

We are committed to protecting the privacy of our customers. Neither the team that provides support for Virtual Monitoring Control nor local service personnel have access to videos from the CCTV cameras. Moreover, encrypted VPN traffic is used when transmitting videos from the security cameras via public networks. VPN permits reliably protecting video data from unauthorized access.

Safe Cloud Storage for Patrolling Routes

The Virtual Monitoring Control service stores the patrolling routes and data from the navigation systems in a cloud data storage. This allows improving navigation by choosing the best routes, and ensuring that the routes remain uncompromised, regardless of the integrity of any specific robot. Besides that, when installing a new robot on a route there is no need to train it: just copying the route from cloud storage is enough.

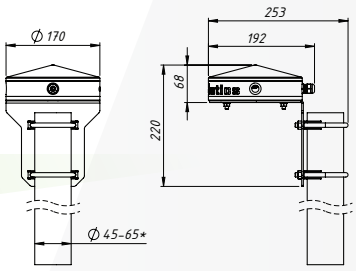
Additional Equipment for Outdoor Security Robots SMP S5.2 Series.

SMP Security Robot S5.2

The GPS Base Station **BS 5**

The GPS Base Station BS 5 is designed to work as GPS support station to make adjustments in the GNSS RTK navigation system. The BS 5 forms a real-time flow of corrective data for any model of autonomous mobile robots produced by SMP Robotics. The data from the station permits all autonomous mobile robots that are located in a 10-kilometer radius from it to determine their own positions with down-to-the-centimeter accuracy. The base station required to be installed outside, with the percentage of clear skies not less than 85%. Roof of a building is the best location to place the station, if there are none, install it on stand-alone mast. The set includes a bracket for fastening the unit to a mast. The GPS Base Station achieves accuracy over the course in several dozen minutes. When the electricity supply is unstable, it is necessary to use additional AC/DC converters to feed power to the GPS Base Station BS 5

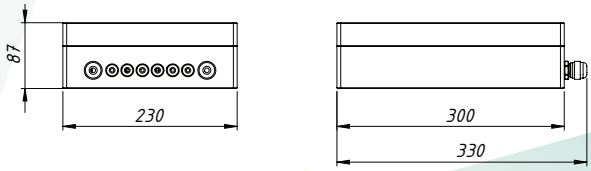
Global Navigation Satellite System	GPS/GALILEO/SBAS L1, GLONASS L1	
Number of channels	32	
Satellite access mode	All-in-view	
Data rate, up to	20Hz	
Interface		
Ethernet	10/100 Mb, RJ45	
Visual	Three LED: Power, Receive, and Ethernet connect	
Power supply	PoE 24V	
Power consumption	3.6W	
Waterproof and dustproof level	IP66	
Operating temperature range	-20°C to +70°C	-4°F to 158°F
Storage temperature range	-40°C to +70°C	-40°F to 158°F
Body	Aluminum alloy and Capralon	
Dimensions	220 x 253 x 170 mm	8.6" x 9.9" x 6.7"
Weight	2kg	4,4 lb
Connected equipment		
Communication unit	Abox 5, produce by SMP Robotics	



Communication unit **Abox5**

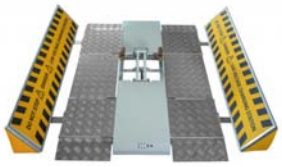
The Abox5 is designed to transmit data from the GPS Base Station BS 5 via a 4G or Wi-Fi wireless communication channel to any model of robot produced by SMP Robotics. The unit allows to connect the robots Wi-Fi network to a stationary video surveillance system via a 10/100 Mbit/s Ethernet cable. The Abox5 enables copying the robots' video surveillance system archives via a dedicated short-range Wi-Fi connection. The unit supports a PoE-powered base station, and up to two AC Radios with Dedicated Wi-Fi Management via Bullet M2 access point. The built-in AC/DC converter is designed to hook up to batteries for an uninterruptible power supply in conditions where power grid operations are unstable. It is recommended that the Abox5 placed either inside a room or under an awning to protect it from direct sunlight and precipitation. For reliable work, of short-range Wi-Fi necessary to allow the robot to approach at a range of 5-10 meters, with direct visibility between the externally placed antennas from the Abox5 to the robot. The antenna can be fixed to a window or external wall of a building.

Interface		
Wireless	Shot Range WiFi, 4G, 3G, LTE, GSM/EDGE	
Ethernet	3 x 10/100 Mb, RJ45, PoE 24V 8W Active 2 x 10/100 Mb, RJ4	
Power consumption	110- 220VAC, UL/CSA, 40 W	
Battery for buck up	Lead acid 2 x 12.6V 4.5A/h GP12045	
Waterproof and dustproof level	IP66	
Operating temperature range	-20°C to +45°C	-4°F to 113°F
Storage temperature range	-40°C to +70°C	-40°F to 158°F
Body	ABS plastics	
Dimensions	230 x 323 x 87 mm	9" x 12.7" x 3.4"
Weight	2 kg	4,4 lb
Connected equipment		
Long range Wi-Fi	Bullet AC, produce by Ubiquity	
GPS Base Station	BS 5, produce by SMP Robotics	

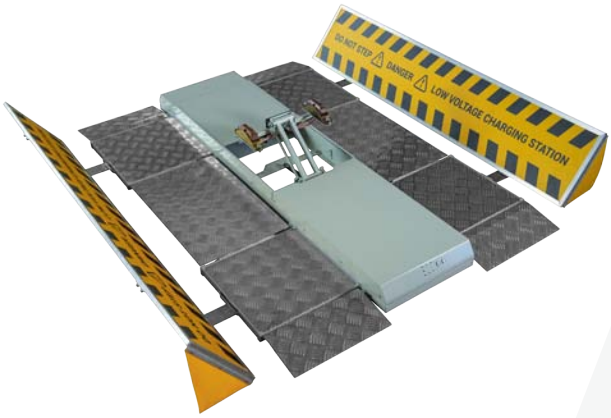


Additional Equipment for Outdoor Security Robots SMP S5.2 Series.

SMP Security Robot S5.2

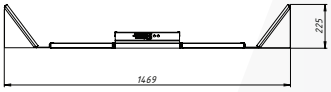


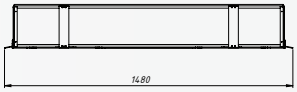
The Automatic Charger Station **ACS 5**



The Automatic Charger Station ACS 5 is designed to automatically - with no human participation - charge the batteries for the S5.xx series robots that are produced by SMP Robotics. ACS enables hooking up a pair of two electrical pins to current-conducting plates that are located on the bottom of the robot. When the robot stops over the ACS 5, a set of contacts rises up out of it. When robots batteries are finished charging, the set of contacts goes back down, and covered by a sliding cover. The ACS 5 is equipped with components that indicate operation mode and control stance of the sensors. The device have a manual operation mode to perform scheduled maintenance and inspections. The ACS is supplied by external power supply source that has a voltage of 48 Volts. The ACS provides a place to install a small-sized battery that allows the charging mechanism to be safely stored in the event of a power outage. To avoid damaging the ACS, if the external power source is functioning unreliably then installation of the battery is mandatory. It is recommended using anchor bolts to fasten the ACS to a hard surface at the location where the robots are charged.

Power source	48 Volts DC up to 2x1200 W	
Voltage of charger robot	48 Volt DC	
Stand-by power consumption	0.6W	
Max power consumption	120 W	
Battery for buck up	Lead acid, 12.6V 2.2A/h, DTM12022	
Interface		
Power	Plastic connector IP68	
Visual	LED: Power, Alarm, Charger; Four pedals,	
Audio	Alarm	
Waterproof and dustproof level	IP66	
Operating temperature range	-20°C to +70°C	-4°F to 158°F
Storage temperature range	-40°C to +70°C	-40°F to 158°F
Frame	Steel	
Body	Aluminum alloy	
Dimensions	1480 x 1469 x 225 mm	58.2" x 57.8" x 8.8"
Weight	40 kg	88,2 lb
Connected equipment		
Power supply	HLG-600H-48A, produce by Mean Well	

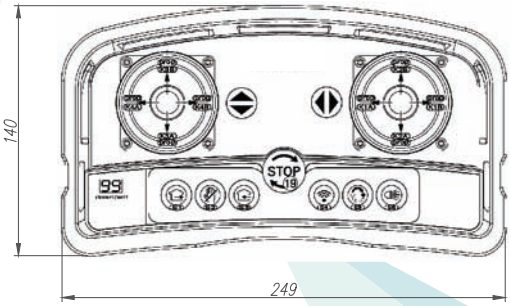




Rugged Remote **Control System**

The Remote Control System is designed for manual robot operation. The operator must remain in close proximity and take cautious judgment of the robot movement risks. Use the manual control to set up new routes, take robot off from existing routes, or for maintenance and repairs. Two manual control modes are supported: (1) via Bluetooth and an Android app, or (2) via optional accessory – rugged remote control (RC) unit and a receiver installed inside the robot. The rugged RC unit is useful at the start of the robots lifecycle, when setting up new routes. When operating multiple robots, it is recommended to have one or two robots equipped with the rugged RC option, and use the Bluetooth remote control on others for maintenance or for taking the robot off route in case of emergency. The rugged RC unit has a wide effective range and operates in the ISM band range, which does not requires special permissions to use.

Frequency band:		
USA, Latin America, Australia	915 MHZ	
EU, United Arab Emirates	434.05 – 434.75 MHZ, F-band	
EU, United Arab Emirates	866 – 870 MHZ, G -band	
RF output	less or 10 mW	
Operating range	less or 300m	
Interface	2 x Joystick, 6 buttons, Stop Switch,	
2 x seven segment led display		
Sound indicator		
Battery	2xAA Mignon, 1.5V battery or NiMH 1.2V accumulate 1900mA	
Operation time	40 hours	
Waterproof and dustproof level	IP 65	
Operating temperature range	-20°C to +60°C	-4°F to 140°F
Storage temperature range	-40°C to +70°C	-40°F to 158°F
Dimensions RC	175 x 127 x 99mm	6.9 x 5 x 3.9 in
Weight RC	690q	1,83lb

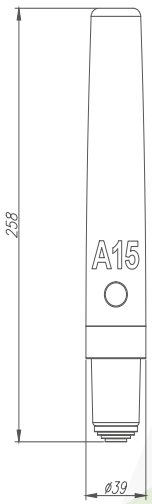


Additional Equipment for Outdoor Security Robots SMP S5.2 Series.

SMP Security Robot S5.2

RFID anchor

A local navigation system is used to guide robot when visual navigation or GPS signal is unavailable. It may happen when the robot is traveling under metal roof or forest canopy. The local navigation system can locate the robot via additional devices – RFID anchors – deployed at the site. In order to identify the coordinates reliably, at least 4 RFID anchors must be placed in the corners of a rectangle that encompasses a section of the robots navigation route. Robots navigation system measures the distances to all visible radio frequencies of ID anchors. The RFID anchors are energy-efficient and can be powered by an external low-power source, such as a solar cell. An embedded battery is used to power the device for an autonomous operation during night time.



Operating range	up to 70m	
Frequency band	3.4944 or 3.9936 or 4.4928 GHz	
RF output	less or 1 mW	
Power supply	12V	
Power consumption	1 Watt	
Rechargeable battery	3V, 1400mA; Li-Ion, 14 500 type,	
Operation time	8 hours	
Waterproof and dustproof level	IP 65	
Operating temperature range	0°C to +45°C	32°F to 113°F
Storage temperature range	-40°C to +70°C	-40°F to 158°F
Dimensions	258mm x DIA 32mm	
Weight RC	150g	0,33 lb

Emergency situations

SMP Security Robots extremely important in emergency situations. If during an emergency the entire personnel needs to be evacuated from the enterprise, then robots are the only source of information about what happens during accidents or disasters. Robots can operate absolutely independent during fires, smoke, leakage of harmful substances and other emergencies.

Outdoor Security Robot
SMP S5.2 series

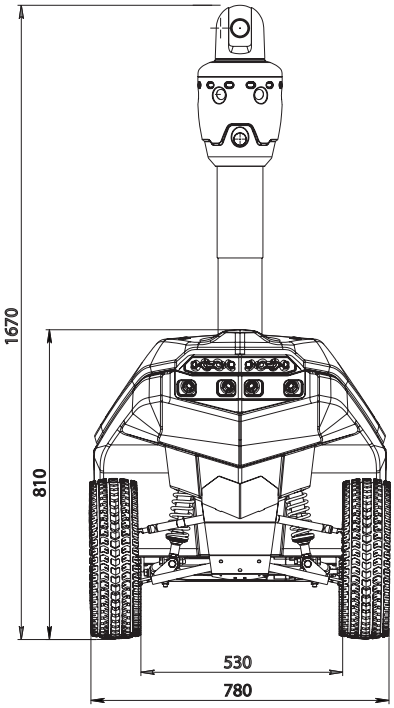
SMP Security Robot
S5.2

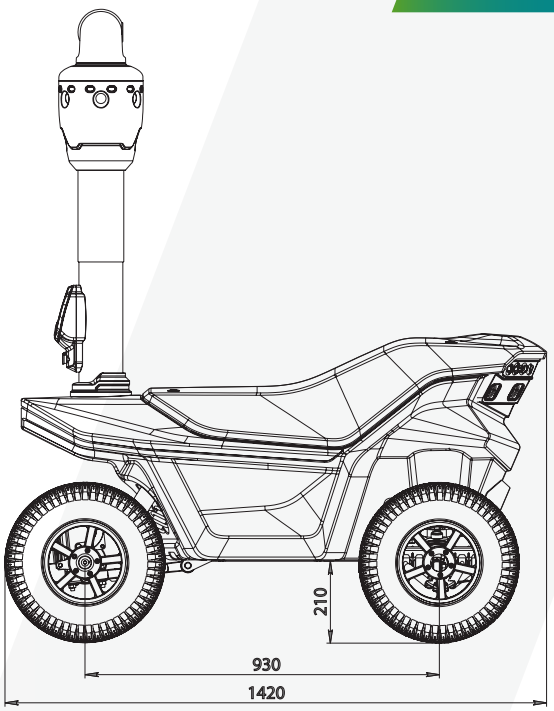
The comparative characteristics of S5.2 series security surveillance robots

Name	Promt	Picard	DJet	Kepler
	Built-in nVidia Jetson TX2	Built-in nVidia Jetson TX2		
Part number	S5.2 IS	S5.2 PTZ IS	S5.2 IP	S5.2 PTZ IP
720P panoramic cameras	AHD	AHD	IP	IP
Sensitivity of panoramic cameras	0.005 lx	0.005 lx	0.004 lx	0.004 lx
1/2.8" PTZ camera, optical zoom/resolution	none	x20 720P	none	x20 1080P
Sensitivity of PTZ camera	none	0.1 lux	none	0.1 lux
Cameras for object detection	panoramic	panoramic and PTZ	none	none
Long-distance detection of pedestrians,daytime, up to	100 ft (30 m)	300 ft (100 m)	none	none
Embedded computer for video analysis on a base of Jetson TX2	Jetson T9	2pcs T9	none	none
Records	constantly or on pedestrian detection		none	none
Bitrate and storage size per channel	2048Kb/s or 4096 Kb/s	0.9GB or 1.8 GB	2048Kb/s	2048Kb/s
SSD size, standard	64GB	64GB	none	none
Wi-Fi MESH and Ad Hock antennas	8dBi	2dBi	6dBi	2dBi
Estimated operating time	12 hours	10 hours	16 hours	14 hours
Charging time	4 hours in fast mode or 6 hours in normal mode			
Price	average	high	low	average
Current time for delivery	8 weeks	10 weeks	6 weeks	6 weeks

SMP Security Robot
S5.2

Outdoor Security Robot
SMP S5.2 series





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Technical specifications

Cruising range at +5°C (41°F) , up to	24 km	15 miles
Accuracy of check-point drive-through circle radius	0.8 m	2.5'
Minimum illumination for visual navigation	6 lux	
Minimum illumination for obstacle avoided systems	0 lux	
Speed while traveling autonomously	4-6 km/h	2.5-4 mph
Width of patrol route path,	min 0.9	m 3.0'
Turning radius,	min 5	m 16.4'
Ground Clearance	14 cm	5.5"
Climbing Angle	15°	
Dimension	1420x 780x1320mm	56"x 31" x 52"
Weight (with batteries)	110 kg	240 lb
Waterproof and dustproof level	IP65	
Operating temperature range	-20°C +45°C	-4°F 113°F
Storage temperature range	-40°C +70°C	-4°F 158°F
Acoustic noise	64dB (A)	

Body and Chassis

Body	Fiberglass
Frame	Aluminum alloy, Hard Anodizing
Standard	Color Blue, Orange, Green
Tires	145/75 R8

Vehicle Power

Drive System	Rear differential drive
Motor drive	24 Volts DC 500W
Brake System	Electromagnetic
Battery for regular use	2 x 12.8V 200 A/h Lithium iron phosphate LiFePo4
Battery for trial use only	2 x 12.6V 120A/h Lead Acid
Battery Charger	48 Volt DC/ 110-250VAC, 600W, UL/CSA, off board
Charging time	4 hours in fast mode or 6 hours in normal mode
Remote Control	915 MHz or 434.05-434.75 MHz, ISM band

Interface

Wireless	4G, Wi-Fi, Wi-Fi Ad Hock, Bluetooth
Audio	IP Intercom, Audio file playback
Visual Color	Beacon and Alarm Button
Remote Control 915 MHz or 434.05-434.75 MHz, ISM band	

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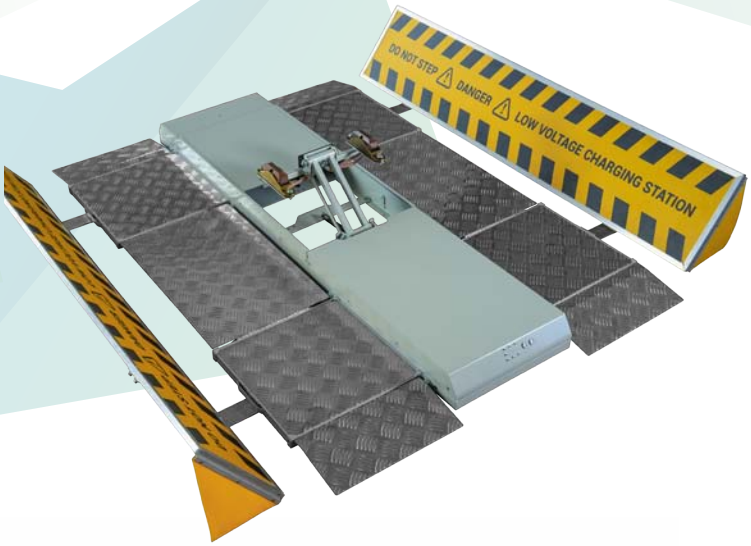
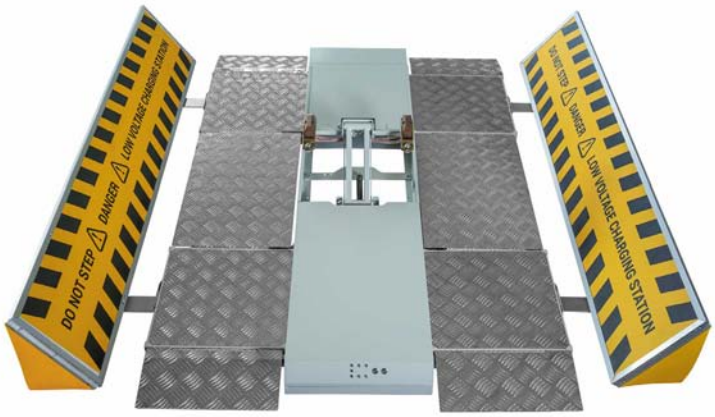
Automatic recharging system





SMP Security Robot

S5.2

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S5.2

Robotics as a Service (RaaS)

SMP Security Robot
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Autonomous security robots is the foundation of Managed Security Robotics Services (MSRS)

Using robots provides the opportunity to increase the level of security on the premises, and decrease the number of security officers on patrol. 2-3 security officers can guard a facility of virtually any size, if there are enough security robots. Operator's attention will be required when an intruder is detected, but robots can handle routine premise patrolling on their own.

Companies that provide robotic security services will shape the landscape of the future market for security services in the near future

Just like the appearance of solid state video cameras twenty years ago caused a revolution on the security market, mobile security robots will turn this market on its head over the next few years.

Routine patrols around the premises that cost $20 per hour will be a thing of the past, as will having an endless number of cameras with kilometers of cabling connecting them. Teams of secu selves around the premises on their own, identifying the most obvious areas of risk, synchronizing how their positions change and making concealed intrusion onto the guarded premises impossible It is also of no small importance that autonomous robots allow avoiding conflicts if there are any unintentional attempts made to infiltrate the premises; by using a voice alert system, they can make a person aware that entering the premises is forbidden.

To deliver highly cost-efficient robotic services, it is advised to set up a fleet of several dozen robots, instead of just a few

A security robot is a complex device, and its maintenance requires special expertise and qualified personnel. In addition, specialists that are capable of doing this work need to have a sufficiently high level of basic technical qualifications. This means, their salaries cannot be low. At the same time, the robots do not need a specialist to be continuously present, and servicing is done at regular intervals, with installation at the facility performed a single time. That is why creating a team of specialists to support the performance of 5-10 robots is not efficient. It is much more efficient to provide a full-time workload for people by having them service the maximum number of robots possible.

An important circumstance that determines how efficiently these specialists perform their work is the fact that they have to make trips out to the field, where the robots are operated. This makes it desirable for the guarded facilities to be located closely together.

A Good Profit Margin for a New Business

The price of the robots, when combined with using them as a fleet, allows earning good profit. This makes Managed Security Robotics Services, MSRS, extremely attractive as a new type of business with enormous growth potential.

The existing market for security services that works according to the old principles, which include using a large number of security officers, enables a quick growth. Replacing a person on patrol with a robot is something that is unavoidable, and there will be no alternative to it.

A robot fleet decrease expenses to their operate

The new product - a security robot, along with robotized security services that use it - allows a fleet of robots to come into recently created premises, thanks to decreased expenses to operate them. This is especially topical for large-scale facilities being created by government agencies or by the titans of business.

Fleets of robots compete easily with traditional security companies that use security officers on patrol

And the larger the guarded facility is, the more efficient it is to use robots on its premises. Consequently, competitive advantages of using robots become even more real: a high level of security, reliability, continuous maintenance for them, and a competitive price.

One competent manager able to service several objects

In modern-day conditions, when an uncontrolled inflow of immigrants and refugees creates additional security risks for both private property and public infrastructure facilities, the growth in demand for security services is obvious. It will be difficult to satisfy the growing demand by using manual labor. Training personnel and continuously keeping track of them - all of that fades into the past when robotic security is used. The necessary number of robots is delivered to the extent that the need for them arises; they are suitable for immediate use in addressing the challenges associated with ensuring security.

Controlling the work done by teams of security robots is easy, and is accomplished remotely, with one competent manager able to service several objects.

Robotic security will add to the attractiveness of newly created facilities for investment due to their increased security and lowered costs associated with security personnel.

SMP Security Robot
S5.2

Tasks that need to be accomplished when organizing a fleet of robots

As is also true for most businesses, when a robot fleet is created there are three fundamental, important goals: creating a team, finding the customer, and attracting investment.

1. Creating team
2. Finding the customers
3. Attracting investment

At the initial stage, three or four employees are needed: a sales representative to look for clients, a technician to install and service the robots, and a manager.

1. A sales representative
2. A technician to install
3. A technician to service
4. Manager (Sales and operation)

Financial investments in robotic security services

The robots' competitive price ensures a quick return on investment. From the time the robot fleet starts to operate, it starts to receive a substantial flow of money that can be channeled into reinvestment by buying new robots.

It is worthwhile to steadily grow the number of robots in a fleet, since implementing them at a guarded facility takes time. New facilities, and the numbers of robots on them, should be commissioned in a gradually increasing manner, as the patrol routes are worked out. This permits decreasing the financial risks during the initial stage, and starting a business with a limited amount of financing.

The lengthy operational lifetime guarantees that profit will be earned by using the robots over the course of several years. Distributors can take advantage of leasing programs after they buy several robots on their own.

The best facilities for robotic security

When choosing a facility where the robots will operate, it is preferable to start with those that are unmanned and can potentially use a large number of robots. A significant number of robots at one facility sharply increases the commercial viability of using them. The lack of third parties at a guarded facility will eliminate unexpected situations from arising, and decrease the number of trips to the field made by technicians to resolve them. Open-air patrol routes where the horizon can be observed are the most attractive; this makes it easier for the robot's navigation system to do work by receiving a stable flow of data from the GPS system.

SMP Security Robot

S5.2

Business plan for a security company's fleet of robots

1. Acquire three robots to demonstrate how they work in experimental operating conditions.
2. Accept sales and equipment for work.
3. Conduct training for personnel.
4. Take part in security industry exhibitions Security robots unfailingly attract the attention of visitors, and provide the ability to establish contact with advantageous clients that would be virtually impossible to get to otherwise.
5. The goal for a sales representative is to find potential clients, and - along with the technician - go on trips to the field to show how the robots work at the customer's facility.
6. Evaluate a facility for how suitable it is to be patrolled by robots; not all facilities are suitable for robots to patrol, and it is the job of specialists to choose the most suitable ones.
7. Sign a service contract for robotic security services.
8. Install one robot, select the best patrol route. Along with that, the auxiliary equipment needed for the robot to work in a stable fashion can be installed on-site, or it can be stored in a specially equipped minivan.
9. Conduct experimental operations, ensure that the patrol routes selected are reliable and provide optimal positioning for observation, and think of how the security officers and team of robots will work together.
10. Have the consumer approve the results of the experimental operations, and determine the number of robots needed for the reliable patrolling operations. Evaluate the expenses to integrate the video surveillance systems into the existing stationary security system, if necessary.
11. Acquire the necessary number of robots from a distributor.
12. Sign a contract with a distributor for virtual, round-the-clock work monitoring the robots on a 24/7 basis.
13. During operations, it is necessary to:

- Quickly response to a call from a global monitoring service's operator or the client by dispatching a technician for an on-site visit.
- Service the robots on-site no less than once every five-seven days.
- Take away the robots and service them in conditions present in a service center once every six months.

SMP Robotics Support of the security robot distributor:

- Virtual operations support, 24/7
- Guaranteed delivery made from two plants
- Training programs for personnel
- An operational lifetime of no fewer than 3 years
- Free-of-charge software updates
- Spare parts for the robot delivered throughout its service life
- Leasing program provided by the distributor

Outdoor Security Robot
SMP S5.2 series

SMP Security Robot
S5.2

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