VisoRobot

Introduction

Visisys is poised to introduce a line of robots to assist in surveillance and security. There are two options: one indoor and another outdoor. This document has a description of the functionalities and capabilities of both robots.

VisoRobot, as Visisys is calling this line of robots, will have all the functions controlled by monitoring/central station connected to the on-board computer. The operator, located at Visisys monitoring station, is capable not only to move the robot as well to see, hear and speak thru specific devices.

The image bellow (Figure 1) is an artistic representation of the solution envisioned as of today.
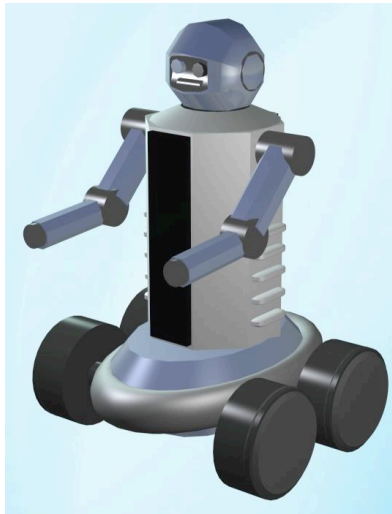

Figure 1

- Works robotics 24 x 7 x 365
- Video verifications for false alarms
- Reliable timely data gathering
- Operating in hazardous or precious asset
- Emergency trips to remote sites
- Construction sites, leased property (do not required fixed installations)

Vibot includes:

- Remote video from low-light, infrared, pan tilt (at 98" can be expended by telescopic lift to 180" in case of patrol perimeter with high fence) cameras and/or 360 omni-camera
- 2 Way audio at incident site with 27 voice changes
- Ability to translate into 27 different languages
- Moving object detection
    - sensitivity can be adjusted by size of the object so motion will not react on small animals only on human size
    - optical filters, system will not react on leafs, snow, rain
    - color sensitive can be adjusted on color motion detection
    - 5 Level of compression (up to 1:200)
    - special software which sharpened object like white dress on white snow
    - special software will identify if somebody try to cut wire to the camera, put gum or white paper in front of the camera, try to blind or defocus camera
    - Lost luggage detection, system will identify if somebody lost luggage unattended
- Robot will turn toward the object, which is then tracked onscreen, even in darkness
- Instant camera zoom optically via PTZ or digital by software (up to 32 times) to a point you click -- or program view into the robot's regular route
- Instant camera zoom guard areas with laser detection, alerting central station
- Snapshots with image or small video on demand
- Local video, audio storage on robot or back up to Central station on all events (can be instant, by schedule, by trip)
- Automated response sends the robot immediately to a point of alarm, intrusion for verification from Visisys integrated enterprise intelligent system
- Hazard, Gamma, radiology and other custom sensor options
- Integrated with existing security systems (access control, alarm, fire, SCADA)
- Shared knowledge based between all robots
- Facial capture and facial recognition (if one robot know the face any robot in one network will be able to recognize it and react according to the instruction)
- License plate recognition with shared databases of plates allowed at the location
- Voice recognition system
- Five level of access to the system with different right and priorities
- Second Command Center for redundant applications
- Event driven system, any even happened on a any robot or alarm can trigger any chain of reaction adjustable on a fly
- Flexible, since robots learn their tasks via special script downloadable remotely
- Optional; door and elevator operation
- Control all devise and robots in multiple locations from the map
- Motion, smoke, sprinklers sensor detection
- Rout and recording scheduler including day/night, holiday, weekday and weekend schedules with randomizing capabilities
- Monitor its charge and automatically return to its manual charging area
- Collaborate with other robots

- A charging Dock is defined for each robot and whenever the robot detects a low battery condition, will locate its dock and recharge.
- 802.11 n wireless Ethernet communication (long range available with special permit), so no special communication network or infrastructure needs to be added to the environment

PTZ Surveillance Camera

The on-board camera is for security surveillance use. The robot does not use it for navigation or object recognition.

4 Dimensional Audio

The VIBOT has an on-board microphone and speaker system. It can be used to interact with people remotely as an intercom. In addition, text can be converted to synthesized speech which allows the RoboSentry to interact with humans without operator intervention. Finally, the ability to play on-board .WAV files enables sirens and prerecorded messages to be annunciated.

ADA Compliant Indoor Use

The RoboSentry is designed to operate in an environment compliant with ADA (Americans with Disabilities Act) Guidelines.

iChat AV

Full audio, video, and text tele-conferencing using Apple's iChat AV. You control the robot's movements as well as interact with users remotely over the internet. Perfect for teleconferencing, telecommuting, telepresence applications.

SonarNL

Sonar Navigation and Localization is a low cost solution to autonomous mobile robot behavior. Not as precise as Laser-based navigation, it is adequate for many applications.

Laser Mapping and Localization

The VIBOT uses the same method of navigation and localization as do humans and other mobile life-forms. We all know what navigation is but the localization problem has been a tough nut to crack for robot researchers over the past 30 years. "Where am I?" is a question we humans can usually answer quickly with a little bit of information and contextual processing. Robots and computers on the other hand, while good at repetative tasks, are terrible at object recognition and contextual processing. Given an apple, a book, and a wrench, a computer will have a tough time distinguishing one object from another in a random setting. But like its biological counterparts, the VIBOT does create a "world map" in its mind. It quickly scans and learns where static objects are, like walls and doorways, and creates a map of the environment from the robot's point of view.

While it can avoid bouncing off the wall or running into a person, a human must decide for the robot what areas of the map are important to avoid and to set its boundaries and goals. The VIBOT's main task is to autonomously navigate to a goal once the command is given. The command can be manually issued (go to the last room on the left) or automatically generated (time to recharge, go back to the dock) or given by a linked system (fire detected at location B-12, go investigate).

Integration

SUPREX® Technology pioneered by Cypress and refined over the last 20 years, enables mobile robot platforms such as the VIBOT to be easily integrated into any security, access control, or building management system. For example, an alarm generated by the fire system can command the VIBOT to investigate. In doing so, the robot needs to call the elevator through the building management infrastructure to get to the 3rd floor. Upon arriving at the destination, it sends video, audio, and sensory information back to the operator. Onboard flame and smoke detectors register positive results, i.e., this is not a false alarm. Upon command (or automatically), the VIBOT releases the CO_2 supressant and audibly alerts evacuation tones or phrases. It also provides a beacon for fire-fighters to locate the fire. After a hard day of fire fighting and heading back to its recharging station, the VIBOT encounters a moving object in a previously defined "restricted" zone. It approaches the person and audibly asks for ID. The person must present his credentials to a card reader mounted on the robot, then the Wiegand (or any other format) data is sent to the access control system. An access granted signal is sent to the robot, it politely excuses itself and proceeds to the original goal. Otherwise, it sends an intrusion signal to the security system and sounds a local annunciator.

Communication

Command, control, and monitoring of the VIBOT is done via 802.11g wireless ethernet. It can co-exist on a building LAN or be given its own dedicated channels. Other than video, the bandwidth needed for normal operation is negligable. The robot only needs to receive override commands and report status over the wireless link. Depending on the camera system used, bandwidth can be an issue on a non-dedicated LAN but so is the case with any stationary camera system.

Vision

The autonomous platform isn't aware that it has a camera; it isn't used for navigation but rather for the "verification" or "reconnaissance" function. The human operator can monitor the VIBOT in real time with 802.11g link to the camera. PTZ or 360° lenses with anti-warping software provide remote surveillance. Any camera system can be used to integrate to existing security monitors.

From military to civilian

Robots tend to fall into two categories — remote controlled and autonomous. One becomes an extension of a human controller while the other functions on its own, following a programmed

set of tasks. The rapidly expanding military market favors the remote-controlled robot, where it becomes an extension of a soldier — who can direct the robot to disarm a roadside bomb in Iraq, for example.

Government and military venues have been the testing ground for robot technology. In many instances, advances in software and hardware achieved in government labs or on the battlefield have meant better solutions for the private sector.

Perhaps the greatest advantage of the roving platform is that it enables users to move other sensors such as motion detectors. Instead of mounting the devices in permanent, fixed locations, the patrolling unit can literally move the devices to spots where they are needed, thus allowing resources to be shifted to where they are needed most.

Robots on the battlefield

While the public may not see them in action very often, some of the greatest advances in robot technology have been driven by the needs of the military in the war on terror. Robots have joined the arsenal of the soldier on the battlefield and have literally changed the way the soldier fights.

"Robotics represents a disruptive technology," asserts former Rear Admiral Joe Dryer, executive vice president and general manager of iRobot's Government and Industrial Robots Division. "By disruptive technology, I mean one that changes significantly and relatively quickly the way business used to be done, relative to how it will be done in the future."

In the early days of the war in Afghanistan, American forces chased the Taliban into wild mountainous regions that offered vast networks of caves in which the enemy could hide. The U.S. Army's method of performing reconnaissance into these areas had changed little since World War I. It still consisted of a soldier with a rope tied around his waist and clutching a 12-foot long stick in his hands, feeling his way into the unknown.

With the introduction of the iRobot PackBot into the war zone, tactics shifted from the soldier facing the dangerous job of personally searching for the enemy to a machine carrying out the task. With the controller guiding the robot through the twists and turns of a cavern while seeing everything it encounters, the area could be quickly cleared without risk to anyone other than the enemy.

A new payload on the PackBot called "Red Owl" was developed to provide sniper protection through acoustic directional finding. Developed by researchers at Boston University working in conjunction with Insight Technologies, the new sensor enables sentries to hear an approaching enemy long before they are able to get into position.

More than 200 of the PackBots are also in Iraq, where they are helping to defuse deadly roadside bombs that have claimed thousands of lives.

Working in rugged terrain sometimes resulted in robots losing communication. Previously, the operator had to go find it and re-establish communication — defeating the purpose of sending the platform out to begin with. New technology now in development at iRobot will program the machine to back up and return to the last location where it had a strong link to its controller.

Other advances will program robots to get themselves upright if they turn over, and allow them to maintain course and speed without monitoring.

These security applications are slowly making their way into the civilian sector, where local police and fire have need for robots that can enter buildings where criminals may be hiding or areas where a chemical spill might have occurred. While military robots are controlled wirelessly over secure frequencies, law enforcement agencies can be skeptical of similar wireless applications that could be hacked.

Vibot

Specification	
Body	Lightweight aluminum weather protected
Length	98"
Width	98"
Height (body)	88"
Body clearance	14"; designed to be driven on plowed roads/packed snow.
Unladen weight	1800 Lbs
Temperature	-4/+122F operating environment (-20C to 50C). cover.
Battery access	Slide-out tray
Assembly	Allen hex screws
Battery	72V sealed,800Ah lead-acid
Charge	4800 Watt-hr
Run time, base platform	16 hours
Recharge time, manual	8 hours for full charge, less for opportunity charge
Auto-charge station	Included, 3.2 hrs
Drive	4 Wheel
Wheel composition	Full density tire with tread
Drive Wheel diam.	38"
Drive Wheel width	18"
Suspension	Active suspension
Steering	Independent motor, all wheel drive
Pushing force	500 Lbs
Turn radius	On center
Translational speed max	40 MPH

Grade capability, unladen, max	40% grade
Traversable \ terrains	Field, pavement, warehouse, garage, industrial.
Tethered joystick	Yes
Bumpers	Yes
Low-light Surveillance Camera	Pan-tilt
Remote video from low-light camera	Yes
Onboard computer	Capacity for 7 optional Intel® Pentium® PCs
Wireless	802.11n/b/g radio & antenna included
Watchdog	Yes
Main power switch	Key switch / E-stop
Remote power switch	Yes
Aux power switch	Yes
Arm Lifting Capacity	900 Lbs per arm
On Board Software	
Pan Tilt remote control	Yes
Motion detection	Yes
Snapshot on demand, sent to Central Station	Yes
Size adjustable (human only) motion detection	Yes
Color driven motion detection	Yes
Similar object discrimination	Yes
Video compression	5 levels
Control from the map	Yes
Smart threat detection	Yes
Dropped luggage detection	Yes
Video pattern detector	Yes
Optical zoom	Yes
Digital video zoom	up to x 32
Event Log	Yes
Ultrasonic sensors	Pulso lobe
Infrared camera	Yes
Onboard pushbuttons	Optional
Radio elevator & door control	Optional
IR input sensors	Optional
Barcode	Optional
RFID	Optional
Event scheduler: day/night, holiday, weekday	Yes
Central Station	
GUI remote control	Yes
GUI remote administrator	Optional
User rights	Up to 5 Level
SMS enable	Optional

Automated response/sends the robot	Optional
to a point of itnrusion	Optional
Multiple robot navigation	Optional
Wireless joystick	Optional
Radio call button	Optional
Browser-based	Optional
Centralized archiving software	Up to 10 years per rob/camera
Software Options	
Mobile server	Optional
Central Server for robot fleet control	Optional
Second command center control room	Optional
Remote Operator	Optional
Remote administrator	Optional
Facial capture	Optional
Facial recognition	Optional
Multi robot facial recognition	Optional
License plate recognition	Optional
Container number recognition	Optional
Railroad track recognition	Optional
3D video (frame merger)	Optional
Video stabilizer	Optional
Object detect, tracking	Optional
Voice recognition	Optional
Voice synthesis	Optional
Speaker	Optional
2-WAY AUDIO at the incident site	Optional
Privacy mode	Optional
Microphone	Optional
Smart audio sensor	Optional
Car engine sound detection	Optional
Shut gun sound detection	Optional
MANIPULATION	
Operator force feedback arm	Optional
Camera lift	Up to 180"
Security monitoring arm	Optional
Mobility	
Snow, sand, mud terrains	Optional
Communication	
Ultra long range antenna	Optional
NAVIGATION PACKAGES	
Indoor Autonomous navigation	Optional

Outdoor & Outbuilding Navigation	Optional
GPS	Optional
None GPS localization hardware/software	Optional
Mapping and autonomous navigation	Optional
Sensors	
Laser	Optional LMS 200 or 220
Omni-directional	Optional
StereoCam Rangefinder	Optional
Gyro	Rate gyro optional
Position encoders	64 tick encoders
Temperature	Optional
Sprinkler detection	Optional
Motion detection	Optional
Active smoke detection	Optional
Directional heat sensor	Optional
Gamma sensors	Optional
Chemical sensors	Optional
Nuclear sensors	Optional
Biological sensors	Optional
Olfactory sensors	Optional
Indoor Air Quality (IAQ)	Optional
Humidity sensors	Optional
Deterrent Options	
Ultra bright flash	Optional
Highly directional ultra loud sound	Optional
Teaser	Optional
Rubber bullet gun	Optional
Spinnet	Optional
Pepper spray gun	Optional
Tier gas	Optional
Polycarbonate shields	Optional
Laser blinder	Optional
Electrolyze robotic shield 10,000 Wt	Optional
Fire extinguisher	Optional
HLON	Optional
UV spray	Optional
Kevlar module	Optional