Introduction

to

Smart Hybrid UGV (Unmanned Ground Vehicle)

Whitebox Robotics Co., Ltd.
I. Remote Controlled by Operator via line-of-sight and via forward-looking camera and sensors

II. Auto Navigation
- Detect obstacles and avoid them
- Navigate and see depression in known terrain without loosing stability
- Navigate tight passages (water, bushes, concrete wall, etc…) by sensing environment
- Choose navigation options through a local intelligent path planner
- Know its pose and navigate day/night in all weather condition
- Know position within a perimeter with respect to other items in the environment

Behavior
- Perform patrol continuously without human intervention
- Pass through and coordinate access to a constricted portal
- Complete section coverage at a specified frequency
- Monitor potential threats at a strategic observation point
- Confront intruder or deliver payload within an effective range of an intruder
- Listen and communicate with intruder

III. Collaboration
- Execute missions with other UGV’s
- Re plan missions based on the loss or addition of team members
- Reason and reactively plan in continuously changing environment
- Autonomously navigate, patrol and protect a known perimeter with collaboration
I. Smart Hybrid UGV in Remote Controlled Mode of Operation

- Based on the amphibious 6X6 platform.
- Hybrid engine, up to 12 hours of continuous operation between refueling. (200km max range)
- Multi-mission: patrol, observe, detect, respond & pursue.
- Multi-sensor platforms, positioning, mapping, obstacle detection & operational safety.
- Speed of up to 35Km/h on ground, 5Km/h in water.
- High traversing capability, including swamps and snow.
- Climbing capability up to 30 degrees with 350kg payload.

![Driver console](image1.png) ![Gunner's console](image2.png) ![Live Driving Video](image3.png)
**Stabilized Pan/Tilt Driver**

### Features

- Both Pan/Tilt motors are stationary
  - Low moving mass, less exposure
- Optical positional sensor – No drift
- Low speed (0.1°/sec) – Auto tracking
- High accuracy - 0.1°
- Sleep ring available - 360° x N

### Specifications

<table>
<thead>
<tr>
<th>Items</th>
<th>P/T Driver Specifications</th>
</tr>
</thead>
</table>
| Angles                 | Pan:350°  
+20°—70°              |
| Speed                  | Pan:0.1°—60°/Sec
Tilt: 0.1°—30°/Sec |
| Repeatability         | 0.2°
0.1°                  |
| Max Payload           | 20Kg
30Kg                  |
| Max Torque            | 29.4 N.m
44.1 N.m              |
| Backlash              | 0.2 ° max              |
| Presets               | 254                     |
| Motor type            | AC servo                |
| Input / Power         | 24V DC, 165 watts       |
| Environment           | -25°C~+50°C, IP66       |
| Weight                | 15Kg                    |
| Size (LxWxH)          | 190×108×330 mm          |

### Long Range Surveillance Camera

- Thermal Imager
- Long Range Camera
- Precision P/T Driver
- 2-axes Gyro Stabilization

### 7.62 mm MG Specialized RCWS

- Pedestal with Slip Ring
- 2-axes Gyro Stabilization
- Optics
- Firing / Cocking / Safety Mechanisms
- Electronics Box
- Ammunition Box / Feeder
Head Mount Display (HMD)

Full HD (High Definition) resolution HMD (Head Mounted Display)

<table>
<thead>
<tr>
<th>High Performance</th>
<th>User-friendly Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full HD (1920X1080) resolution LCoS (liquid crystal on silicon) image engine</td>
<td>Glasses or goggle changeable design</td>
</tr>
<tr>
<td>Wide viewing angle (FOV 45deg.)</td>
<td>Dioptr changeable clip</td>
</tr>
<tr>
<td>See-through optic configuration</td>
<td>See through ratio changeable (factory setting at 50 to 99%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Human friendly Design</th>
<th>Multifarious application</th>
</tr>
</thead>
<tbody>
<tr>
<td>None-injury optic configuration</td>
<td>Personal entertainments</td>
</tr>
<tr>
<td>Stereoscope</td>
<td>Industrial &amp; medical use for inspection and treatment, therapy</td>
</tr>
<tr>
<td>Good value factor of angular resolution</td>
<td>Military (Simulation, training etc.)</td>
</tr>
<tr>
<td></td>
<td>3D display with dual inputs (Option)</td>
</tr>
</tbody>
</table>

Specifications

- See-through optic configuration
- Stereoscope
- Resolution (LCoS, HD1920X1080P)
- FOV: 45degrees
- Screen size 80 inches (at 2meters)
- Exit pupil: 6 × 6 mm
Live Driving Video (LDV)

LDV System let operator experiences the telepresence, gives a feeling of sitting directly in the cockpit of the flying, driving, or floating objects.

- Onboard camera and LDV movements are synchronized
- Unique remote control system in real-time
- No delay between steering and response from object prevents simulator sickness
- The Images are instantly displayed on the helmet’s visor and external monitors
- Applicable for observation, search, and rescue mission
II & III. Auto Navigation & Collaboration

- A fully autonomous and collaborative security UGV, that can replace manned (human) security patrols.
- The perfect solution for missions which are repetitive, dangerous or in extreme weather conditions and punishing terrain.
- Can engage threats autonomously, as a single unit or, when required, in a flock.
- A cost effective solution with a short ROI.
Current UGVs

- Most UGV in service or in the development stage are:
  - designed for military missions
  - based on existing military platforms
  - are subject to ITAR restrictions
  - high procurement and operating costs
- Existing UGVs are remote-controlled or semi-autonomous.
- There are no known existing UGVs which have been developed specifically for security and rescue operations.
- The main mission of current-day UGVs is Explosive Ordnance Disposal (EOD).
Security UGVs

- Terrorism and other hostile activities threaten critical facilities including airports, military bases, correctional institutions, mines, solar farms, oil and gas installations, power plants and borders.

- The Unmanned Ground Vehicle is the best solution for parameter patrol, detection & pursuit operations, as well as rescue missions in hostile environments.

- The market for security UGV’s is estimated at 4000 units in the next 5 years.
UGV is a Cost effective solution

- Unmanned Ground Vehicles (UGV) as the first line of defense

- UGV replaces manpower
  - Keep armed forces and security personnel out of harms way
  - A cost effective solution

- Applicable to;
  - National borders
  - Armed forces
  - Civilian population
  - Airports
  - Water supply
  - Power grid
  - Communications
  - Refineries and symbolic targets.
Hybrid-UGV Layout

- All components are located low
  - Low C.G. and less tip-over possible
  - Larger available space

- Higher power motor

- Li-iron Phosphate (LiFePO4) battery
  - Higher power
  - Longer operation hours
  - Require smaller space
  - Anti-shock

- Communication options
  - 900MHz freq. (non-Line of Sight 10km)
  - 2.4GHz Image transmission
  - 5.8GHz High resolution image (Line of Sight +10km)

- Relocated Driver
  - Fatigue test
  - Better efficiency, durability

- cargo box / turret mount
  Located at Top
  - Frame provided, if required
## Specifications

<table>
<thead>
<tr>
<th>Body</th>
<th>Length x Width x Height</th>
<th>2.42 x 1.48 x 1.02 meter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ground clearance</td>
<td>0.2 meter</td>
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<tr>
<td>Power Train</td>
<td>Motor</td>
<td>45VAC 4KW x 2 each, 104Amp. 90Hz, 2666RPM max</td>
</tr>
<tr>
<td></td>
<td>Motor controller</td>
<td>CURTIS AC Induction Motor Controller 1236 x 2 each Power 48-80VDC, 300Amp</td>
</tr>
<tr>
<td></td>
<td>Battery</td>
<td>LiFeO4</td>
</tr>
<tr>
<td>Capacity</td>
<td>Weight</td>
<td>750 Kg</td>
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<tr>
<td></td>
<td>Load Capacity</td>
<td>250 Kg (can be extended)</td>
</tr>
<tr>
<td></td>
<td>Towing Capacity</td>
<td>500 Kg (can be extended)</td>
</tr>
<tr>
<td></td>
<td>Continuous operation</td>
<td>12 hours (or 200Km operational range)</td>
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<tr>
<td>Generator</td>
<td>Output</td>
<td>AC 2.8 KVA and DC 12V, 12A</td>
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<tr>
<td></td>
<td></td>
<td>Air cooled 4 cycle 196CC Gas Engine, 5.2 Hp / 3600RPM</td>
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<tr>
<td>Tire and Wheel</td>
<td>Tire</td>
<td>22 inch (AT22 x 10.00), GOODYEAR Rawhide III</td>
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<tr>
<td></td>
<td>Air pressure</td>
<td>5-7 PSI</td>
</tr>
</tbody>
</table>
| Frame         |                         | Steel cage construction, welded for high strength and durability  
|               |                         | Polyester power coated for lasting protection |
Applications

- Border patrol and military base protection
- Protects Governmental strategic facilities
- Mine detection and removal
- Unmanned fire control
- Airport security
- Nature observation