

Urban Hopper Program



As part of a Defense Advanced Research Projects Agency (DARPA) project, Sandia National Laboratories has developed a small, shoebox-sized, GPS-guided, unmanned ground vehicle that can jump over and/or onto obstacles over six meters high. With an estimated range of two kilometers, the robot can drive using motor-driven wheels or it can hop using a rotatable combustion-driven piston actuator.

The Mobility Challenge

In general, small robots or unmanned ground vehicles (UGVs) are severely limited by their ability to negotiate obstacles. This hopping capability allows small UGVs to overcome up to 30 obstacles that are 40-60 times their own size. In addition, hopping mobility has been shown to be five times more efficient than hovering for obstacles at heights less than or equal to 10 meters, which allows longer station-keeping time for the same amount of fuel.

The Need

The urban battlefield is characterized by isolated small squads often converging on a common target; close combat fights with high expenditure of resources; rapidly changing conditions quickly redefining a squad's responsibilities; and a three-dimensional battlefield. This program developed a semi-autonomous wheeled robotic platform that adapts to the urban environment in real-time and provides precision payload deployment to any point of the urban jungle while remaining lightweight and small.

The Technical Challenges

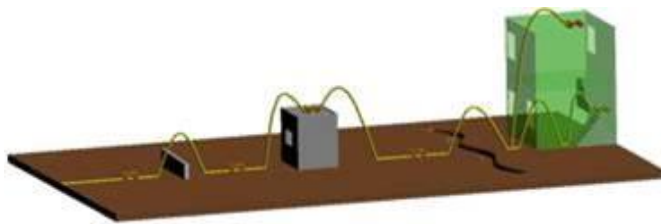
To make this capability operational, we had to overcome several technical challenges. These challenges included appropriate shock management during landing (limits hopper mass), controlling hop height off of varying terrain (concrete, asphalt, sand, vegetation), and controlling the landings to limit tumbling. Furthermore, as is true for all autonomous robotic systems, self-localization and mapping in a 3D dynamic environment had to be addressed.

Applications

The Urban Hopper robot is expected to provide the squad/platoon level infantry of a special operations unit with a revolutionary capability. The hopping robots will provide enhanced situational awareness for shaping the outcome of the immediate local combat situation. Their compact, lightweight design makes them man-packable, and their semi-autonomous capability greatly reduces the work-load burden of the operator. The overall net effect should be a measurable reduction in casualties in the urban combat environment with low collateral damage. In addition, the Urban Hopper capabilities have implications for use in other communities such as local law enforcement, homeland security, and search and rescue applications in challenging terrain and even aiding in planetary exploration.

Technology Transfer

As part of our program goals and objectives we are working closely with our industry partners to transfer this technology out of the laboratory and into a deployable system. Partnership opportunities exist for further technology and application development.



Urban Hopper Capabilities



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Boston Dynamics Tilt Body Hopper

