



## **E-cattie: modular robotic system with gaiting and climbing abilities**

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### **ABSTRACT**

E-cattie modular robot adopts a holistic approach to the problem of robot walking, aiming at innovatively and efficiently addressing a series of significant research and technological challenges: a) flexibility and diversity with respect to the requirements of heterogeneous tasks, b) negotiating all types of surfaces, regardless of their roughness, c) traversing of cluttered environments, and d) vertical climbing and upside-down walking. The introduced robotic platform consists of identical, autonomous, bipedal systems that have the ability to merge, with other bipedals, and form multiple modular morphologies. Apart from the required sensory and computational components, bipedals are also equipped with appropriately designed vacuum-suction cups, that facilitate robust adherence to any surface.

The in-depth theoretical and scientific foundation of the involved kinematic, gait and physical models, under a unified formalism for all assumed morphologies, facilitates dynamic modularity, according to the constantly changing requirements of each mission, utilizing varying number of bipedal systems. On the other hand, the detailed, biologically inspired, design of each autonomous system assures stable walking and high adaptability on any surface. The crucial factor in this is the -unique in robotic systems- constant utilization of the suction cups, while walking and also in climbing mode, which, in combination with a properly designed vacuum-suction system -consisting of a vacuum generator, a vacuum chamber and four solenoid valves per bipedal- have the capability of instantaneous attachment and detachment.

This novel design and revolutionary utilization of the integrated vacuum system adds a plethora of advanced functionalities to contemporary ground-based robotic systems, considerably expanding the scope of research, while the flexibility, modularity and climbing capabilities of the proposed robotic system are highly beneficial for cutting edge applications such as search and rescue (after e.g. earthquakes or fires), monitoring and surveillance, inspection and maintenance of large infrastructures etc.