Self-Reconfigurable Transformer Robot

Visvesvaraya National Institute of Technology, Nagpur, India

Sapan Agrawal, Shalini Addepalli, Vinit Sarode, Yogesh Phalak, Rajeshree Deotalu, Rohan Thakker and Shital Chiddarwar

INTRODUCTION

Figure 1. (a): Search and rescue operations being carried after the earthquake occurred in Mexico, 2017.

- Unpredictable scenarios in search and rescue operations demand need of various robots capable of accomplishing specific task at hand.

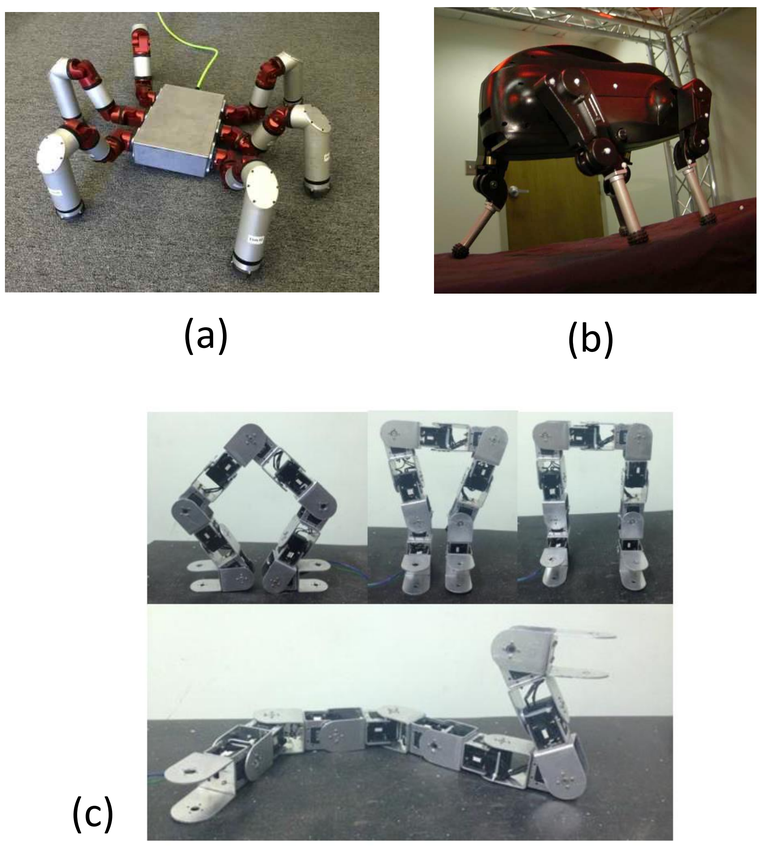

Figure 1. (b): (a) Snake Monster Robot, H. Choset *et al* [1] (b) Little-Dog, D. Pongas *et al* (c) ReBiS Robot, Rohan T. *et al*

- Legged robots excel in locomotion where precise foot placement is required and stability is prioritized.
- Snake robots are extremely versatile on rough terrains.
- Hence, a reconfigurable robotic system is required capable of changing its morphology on its own.

MECHANICAL DESIGN

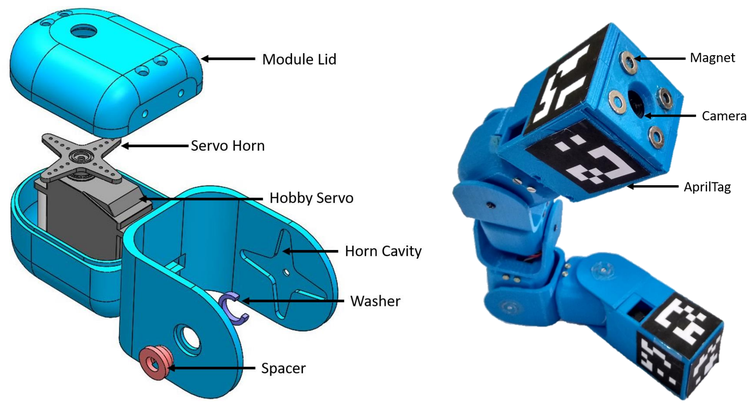

Figure 2. (a): Exploded view of module (left) and fabricated snake robot(right)

- Basic building block of our modular system is a 4 degree of freedom snake robot as shown in the Fig 2 (a).
- The chassis is fabricated using 3D printing technology.
- The snakes can attach or detach through magnetic sites at each end.

- The Raspberry Pi Zero W microprocessor empowers the system with gait generation and vision on-board processing.
- Software for each snake is implemented using ROS Indigo framework in Raspbian Jessie.
- The snake robots can be remotely operated over Wi-Fi.

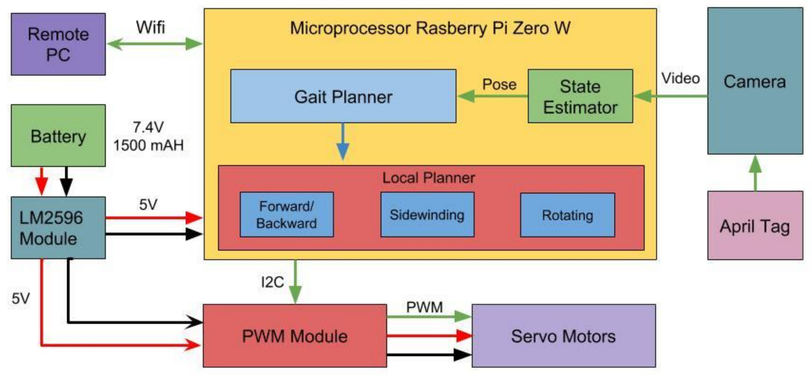

Figure 2 (b). : Cyberphysical Architecture

TRANSFORMATIONS

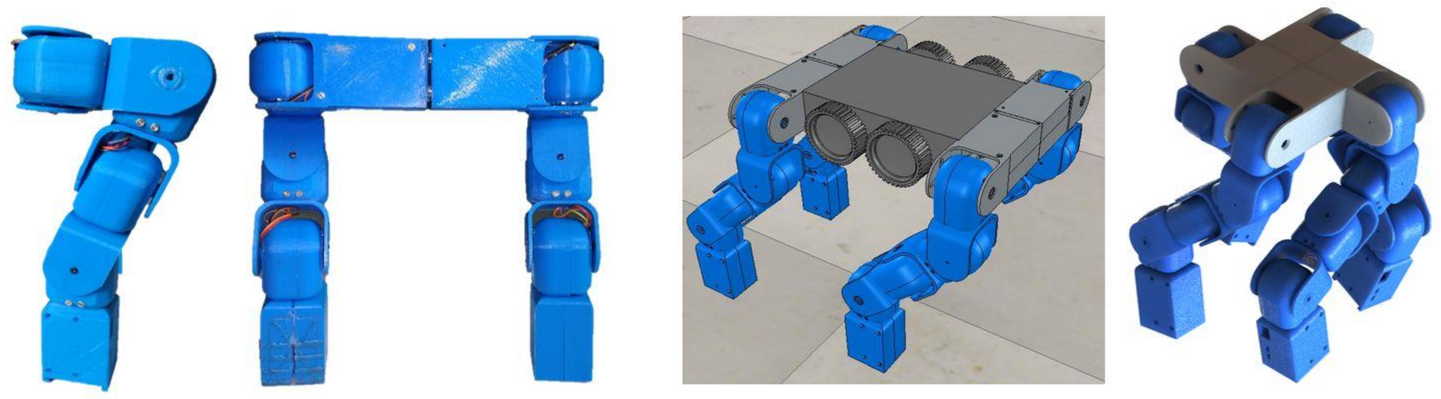

Figure 3. : Fabricated biped Configuration (left), Quadruped Robot simulation in Vrep (middle) and Rendered Quad-Monster (right)

- Once uniquely identified and localized, the snake module traverses to the obtained position and attaches to the magnetic connectors.
- Hence, a modular robotic system is formed which could reconfigure itself to attain required legged robot configuration shown in Fig. 3.

REFERENCES

[1] S. Kalouche, D. Rollinson and H. Choset, "Modularity for maximum mobility and manipulation: Control of a reconfigurable legged robot with series-elastic actuators," 2015 IEEE IISSRR, West Lafayette, IN, 2015, pp. 1-8.

[2] D. Pongas, M. Mistry and S. Schaal, "A Robust Quadruped Walking Gait for Traversing Rough Terrain," Proceedings 2007 IEEE International Conference on Robotics and Automation, Roma, 2007, pp. 1474-1479.

[3] R. Thakker, et.al, "ReBiS - Reconfigurable Bipedal Snake robot," 2014 IEEE/RSJ International Conference on Intelligent Robots and Systems, Chicago, IL, 2014, pp. 309-314.

ACKNOWLEDGEMENTS

- Visvesvaraya National Institute of Technology (VNIT), Nagpur
- Rohan Thakker and Shital Chiddarwar, VNIT.
- IvLabs – Robotics Lab, VNIT.