

Materials List for:

Insect-machine Hybrid System: Remote Radio Control of a Freely Flying Beetle (*Mercynorrhina torquata*)

T. Thang Vo Doan¹, Hirotaka Sato¹

¹School of Mechanical and Aerospace Engineering, Nanyang Technological University

Correspondence to: T. Thang Vo Doan at vodo0001@e.ntu.edu.sg, Hirotaka Sato at hirosato@ntu.edu.sg

URL: <https://www.jove.com/video/54260>

DOI: [doi:10.3791/54260](https://doi.org/10.3791/54260)

Materials

Name	Company	Catalog Number	Comments
Mecynorrhina torquata beetle	Kingdom of Beetle Taiwan		10 g, 8 cm, pay load capacity is 30% of the body mass Approval of importing and using by Agri-Food and Veterinary Authority of Singapore (AVA; HS code: 01069000, product code: ALV002).
Wireless backpack stimulator	Custom		TI CC2431 micocontroler The board is custom made based on the GINA board from Prof. Kris Pister's lab. The layout of GINA board can be found at https://openwsn.atlassian.net/wiki/display/OW/GINA
Wii Remote control	Nintendo		Bluetooth remote control to send the command to the operator laptop
BeetleCommander v1.8	Custom. Maharbiz group at UC Berkeley and Sato group at NTU		Establish the wireless communication of the backpack and the operator laptop. Configure the stimulus parameters and log the positional data. Visualize the flight data.
GINA base station	Kris Pister group at UC Berkeley		TI MSP430F2618 and AT86RF231
Motion capture system	VICON	T160	8 cameras for a flight arena of 12.5 m x 8 m x 4 m
Motion capture system	VICON	T40s	12 cameras for a flight arena of 12.5 x 8 x 4 m
Micro battery	Fullriver	201013HS10C	3.7V, 10 mAh
Retro reflective tape	Reflexite	V92-1549-010150	V92 reflective tape, silver color
PFA-Insulated Silver Wire	A-M systems	786000	127 µm bare, 177.8 µm coated, 3 mm bare silver flame exposed at tips
SMT Micro Header	SAMTEC	FTSH-110-01-L-DV	0.3 mm x 6 mm, bend to make a 3 mm long slider to secure the electrode into the PCB header.
Beeswax			Secure the electrodes
Dental Wax	Vertex		Immobilize the beetle
Insect pin	ROBOZ	RS-6082-30	Size 00; 0.3 mm Rod diameter; 0.03 mm tip width; 38 mm Length Make electrode guiding holes on cuticle
Tweezers	DUMONT	RS-5015	Pattern #5; .05 mm x .01 mm Tip Size; 110 mm Length Dissecting and implantation

Scissors	ROBOZ	RS-5620	Vannas Micro Dissecting Spring Scissors; Straight; 3mm Cutting Edge; 0.1 mm Tip Width; 3" Overall Length Dissecting and implantation
Potable soldering iron	DAIYO	DS241	Reflow beeswax
Hotplate	CORNING	PC-400D	Melting beeswax and dental wax
Flourescent lamp	Philips	TL5 14W	Light the entire flight arena with 30 panels (60 x 60 cm ²). Each panel has 3 lamps. 14 W, 549 mm x 17 mm