Minimally Actuated Robotic Walker - MAE151A

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Sponsored by Professor John Michael McCarthy

Executive Summary:

The Robotic Walker features a minimally actuated two-legged design, capable of forwards and backwards movement with a 360° range of turning.

❖ Controls facilitated by Arduino Mega
❖ Uses Bluetooth Module for remote control
❖ 2 DC Gearmotors for leg mechanism activation
❖ Powered by 12V lithium ion battery

Chassis:

❖ Baby Yoda in Hover Crib
❖ 10 x 12 x 8 inches
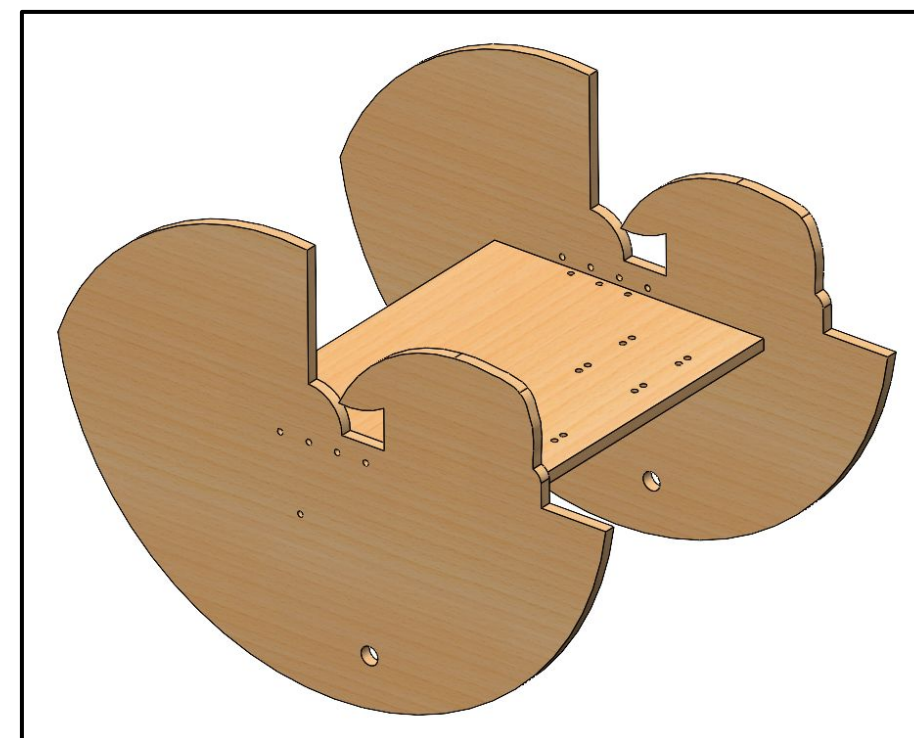❖ Steerable with forwards & backwards movement
❖ Laser cut plywood

Fig 2. Assembled Chassis

Leg Linkage:

❖ Plantigrade motion performed with linkage pieces, screws, spacers, hubs, bearings, and shafts
❖ Binary Links (Fig 4.): two force members with M3 thread for shafts
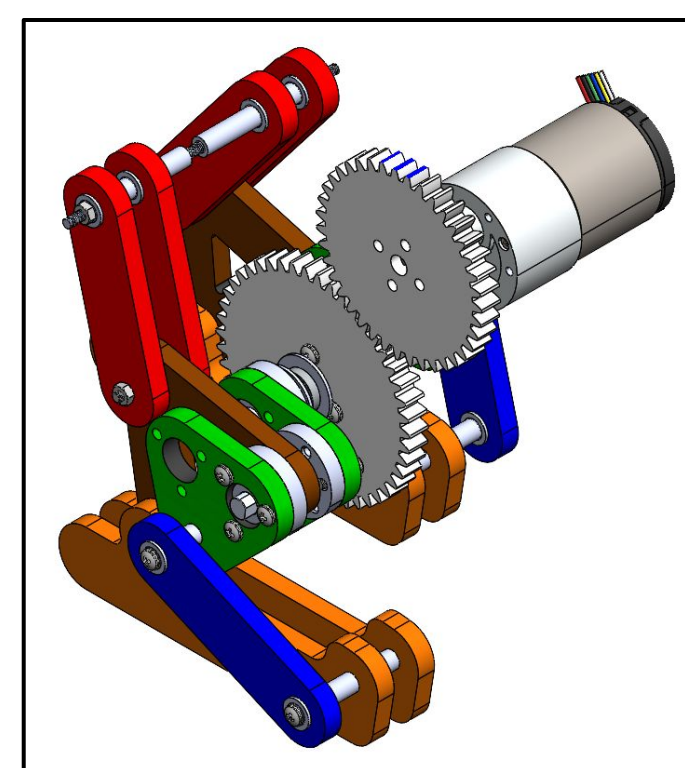❖ Ternary Links (Fig. 5) use ¼" D-shaft to transmit torque load to Binary Links
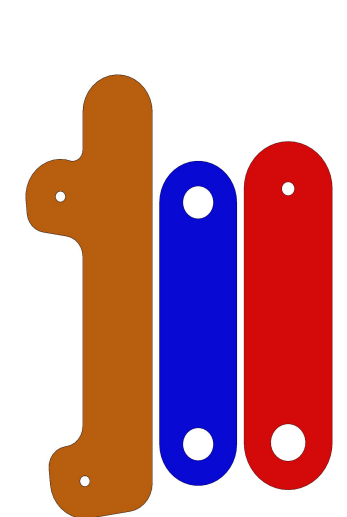

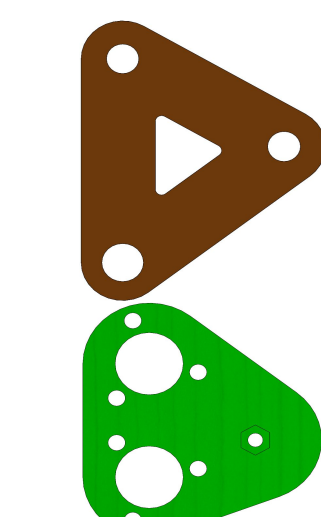Fig 3. 3D View of Linkage With Gears

Fig 4. 2D View of Binary Links

Fig 5. 2D View of Ternary Links

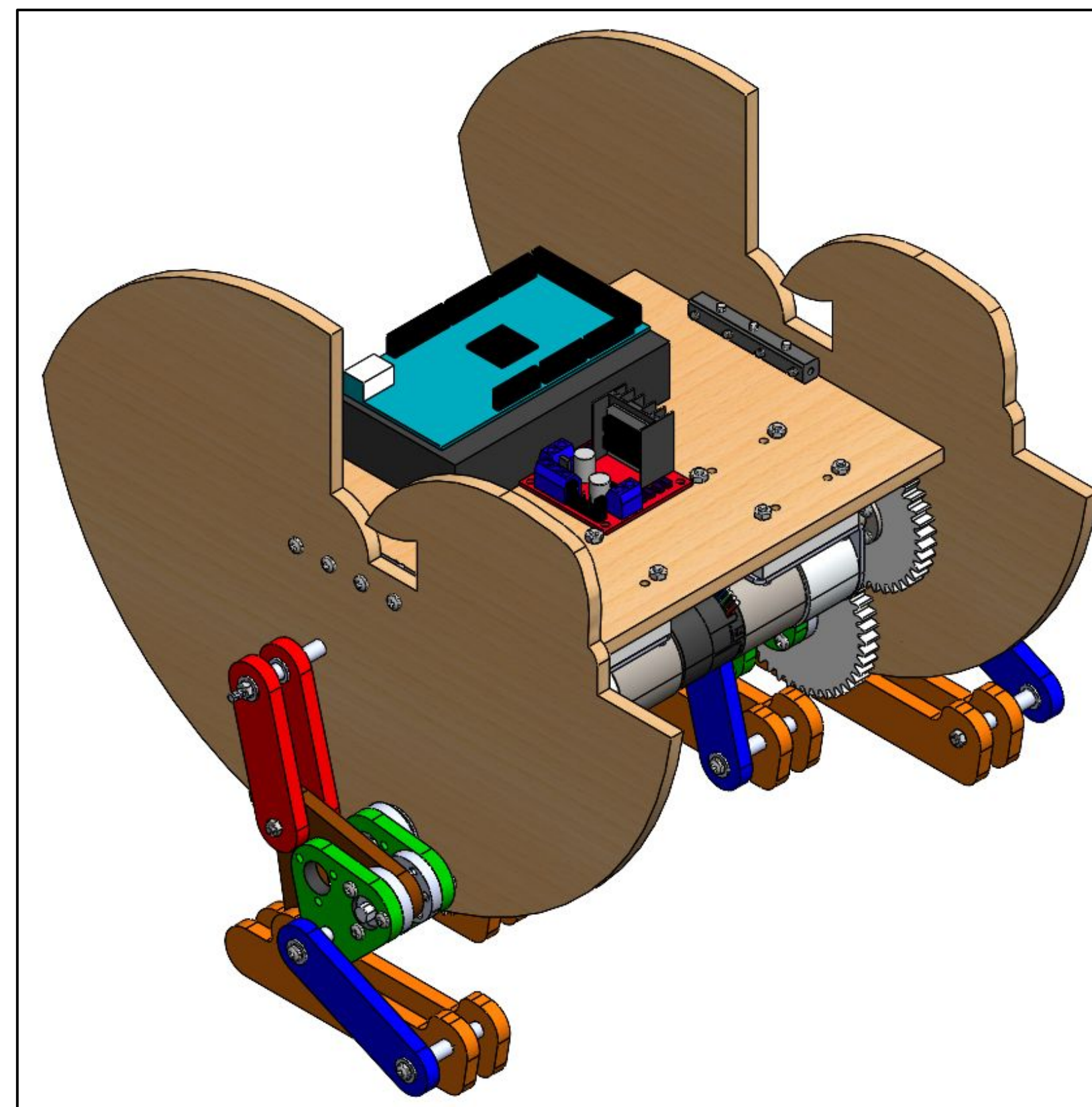Fig 1. Isometric View of Full CAD Assembly

Electronics:

❖ Arduino Mega 2560 REVA
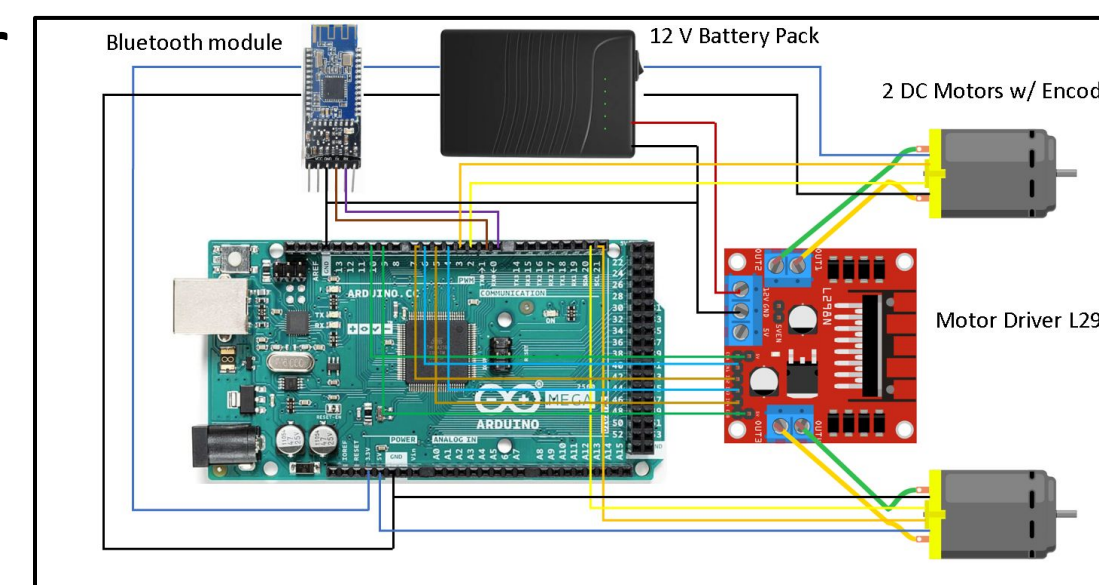❖ Bluetooth Module controlled
❖ L298N Motor Driver
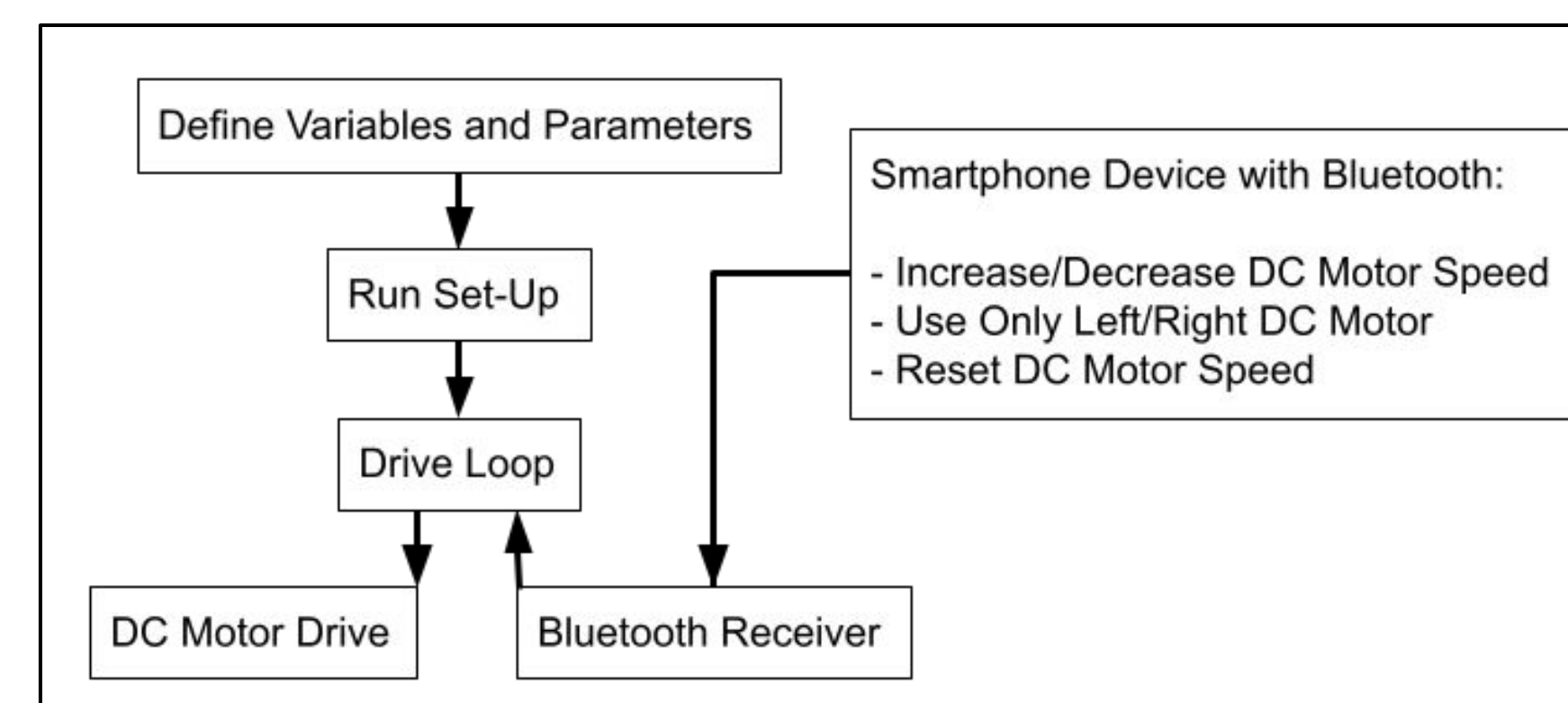

Fig 7. Wiring Diagram

Software:

❖ Arduino IDE:

Fig 6. Arduino Code Flowchart with Bluetooth Functions

Engineering Analysis:

Motion Analysis:
❖ Analyzes motion of full assembly
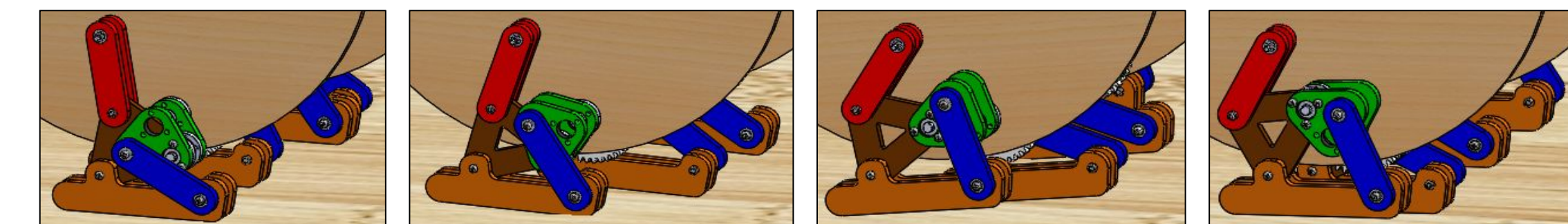❖ Simulates how successful the model will perform when interacting with the floor

Fig 8. Motion Analysis Stills of One Cycle of Linkage Rotation

Hardware Performance:

❖ Bluetooth Range 100m (HM-10)
❖ Reference Speed: 150mm/s
❖ Gear ratio of 0.85:1
❖ Mechanical advantage of 1.18

Future Improvements:

❖ Fully Autonomous
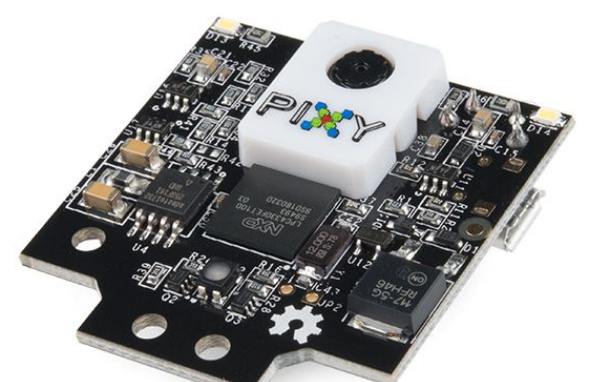❖ PixyCam with Raspberry Pi
❖ Sensor Integration

Fig 9. PixyCam

Acknowledgements:

Thank you to Professor McCarthy for advising and guiding us. Thank you to Jiaji Li for assisting us throughout the project.

References:

1. J. Li, C. Liu, K. Nguyen and J. M. McCarthy, "A steerable robot walker driven by two actuators", Robotica. https://doi.org/10.1017/S0263574723001558