APEC MICROMOUSE CONTEST

APEC 37th Annual Micromouse Contest

The thirty-seventh annual APEC Micromouse Contest was held at the Henry B. Gonzalez Convention Center in San Antonio Texas on March 23th, 2026. A total of 15 mice were on hand for the contest, including 8 foreign entries. Decimus-5A from the UK came in first with the best score. KOGUMA-CHAN.Mk3 from Tokyo University of Science in Japan came in second, had the fastest run, and won the Best Student award. PIGGY-ONE, also from Tokyo University of Science in Japan, came in third. All the contestants are listed in the table below together with their best score.

List of Contestants for APEC 2026 Micromouse Contest

Mouse Name	Handler	Affiliation	Country	Score
Decimus-5A	Peter Harrison		UK	8.879
KOGUMA-CHAN.Mk3	Akihiro Suda	Tokyo University of Science	Japan	8.908
PIGGY-ONE	Kaito Suzuki	Tokyo University of Science	Japan	13.367
Biscuit 2	Allen Mons		USA	29.943
Mr. Fusion	Derek Hall		UK	35.314
FrankenMouse	Peter Lilley	University at Buffalo	USA	54.160
Cutting Through The Fog	Kevin Tain		USA	R
Tachyon	Matthew Komitsky		USA	R
Ratatouilli	Roham Nair	Georgia Tech Robojackets	USA	R
Serpent Scamper	Paul Busby	Liverpool John Moores University	UK	R
ZoroBot-A	Manuel Rodriguez	Spain	Spain	R
Victor E. Mouse	Kyle Folga	University at Buffalo	USA	R
Little Zippy	Brandon Wernick	UT Tyler Houston Engineering Center	USA	R
Theseus	Daniel Goncalves	Portugal	Portugal	R
ZoroBot-3.5	Alex santos	Spain	Spain	R

Cash prizes were awarded again this year. Decimus-5A received US$500 for first place. KOGUMA-CHAN.Mk3 received US250 for second place, US500 for the Best Student entry, and US150 for the fastest run. PIGGY-ONE received US$125 for third place.

The contest was held on Monday night starting at 7:00pm. Stadium seating to handle about 200 attendees was located on either side of the maze. The traditional aerial view of the maze was projected on a large screen behind the judge's table. The scoring system superimposed the timing information on the overhead view of the maze, so that everyone could see it in real time. The contest venue was located on one end of the exhibit hall making it easy for attendees to migrate over to the contest when the exhibits closed. The contest was run on a maze imported from Korea.

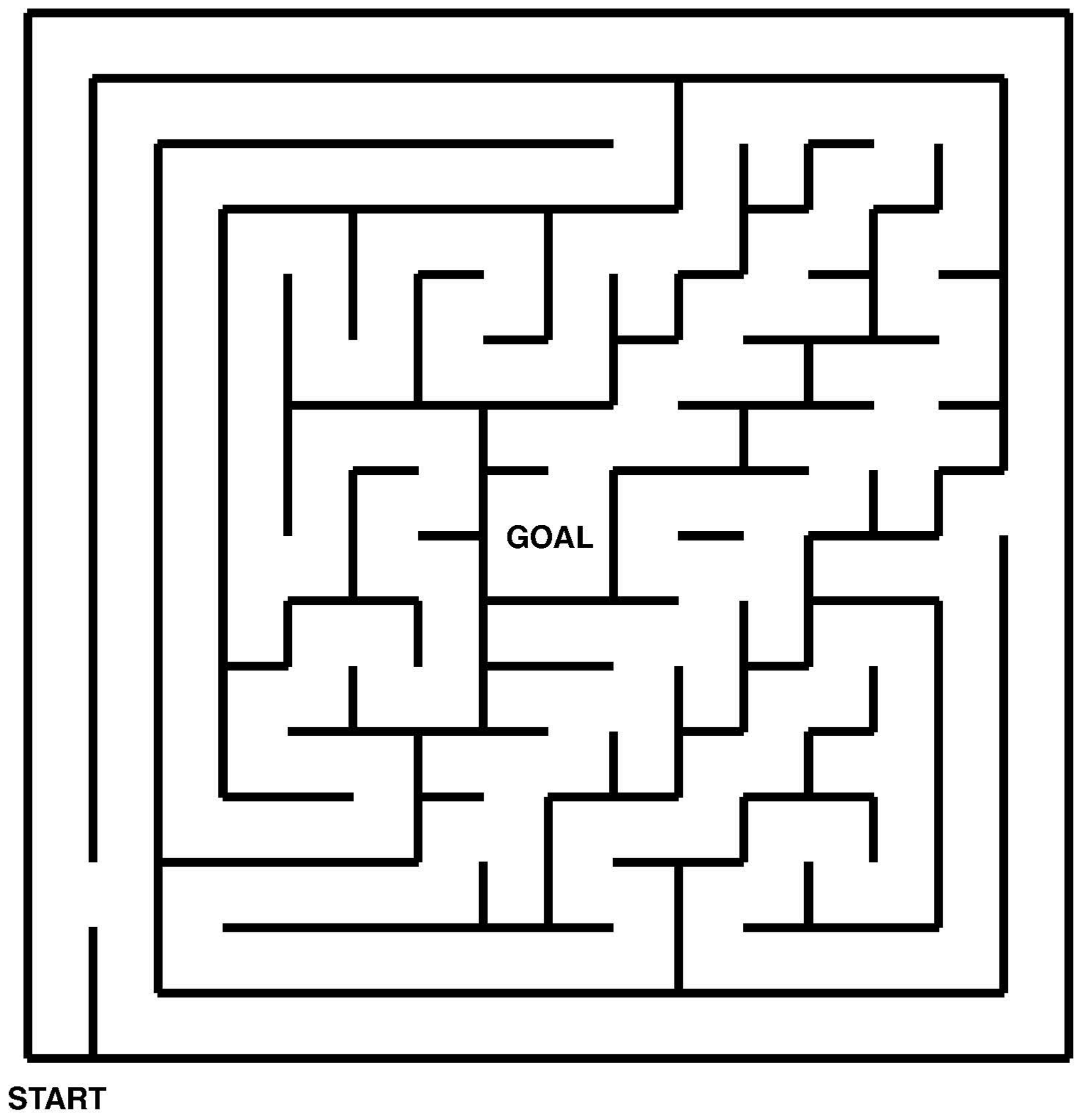
Gerardo Molina prepared the maze design once again. The maze is shown below.

The table below contains a list of the scores for each mouse that was able to solve the maze. The score is based on 1/30 of the time used to search the maze prior to the start of each run *(maze time),* and the time of that run *(run time).* If the mouse had been manually restarted prior to the start of a run *(touched)*, a penalty of 2 seconds was added to the score.

Scores for All Completed Runs of each Mouse

Mouse Name	Run No	Run Time	Maze Time	Penalty	Score
Deciumus5A	1	19.627	0	0	19.627
Deciumus5A	2	6.946	58.028	0	8.879
Deciumus5A	3	6.442	115.277	2	12.284
KOGUMA-CHAN.Mk3	1	32.134	0	0	32.134
KOGUMA-CHAN.Mk3	2	6.462	73.377	0	8.908
KOGUMA-CHAN.Mk3	3	6.308	119.939	2	12.305
PIGGY-ONE	1	66.551	0	0	66.551
PIGGY-ONE	2	17.433	92.822	0	20.527
PIGGY-ONE	3	8.717	139.509	0	13.367
Biscuit2	1	29.943	0	0	29.943
MrFusion	1	35.314	0	0	35.314
FrankenMouse	1	155.997	0	0	155.997
FrankenMouse	3	43.501	259.763	2	54.160
FrankenMouse	4	43.338	347.623	2	56.925

Best Score = 8.879 seconds - Fastest Run = 6.308 seconds



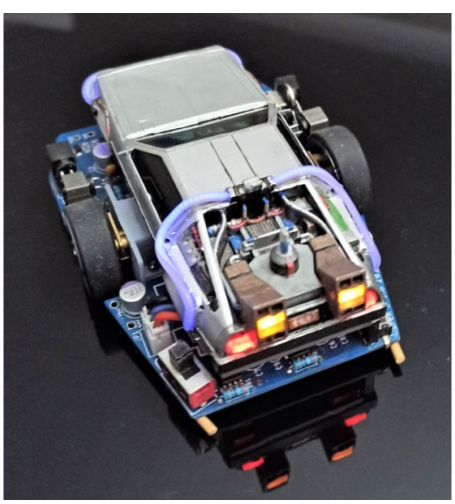
APEC 2026 MicroMouse Contest Venue

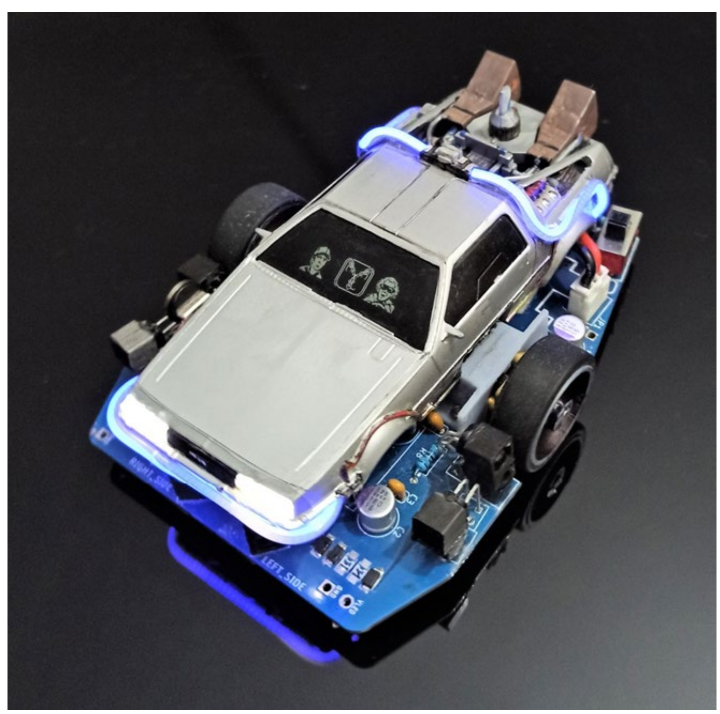
Mice Details supplied by their Handlers

Mr Fusion

Designed and built in 2020 by Derek Hall and Jim Chidley. It has 6 IR LEDs paired with 6 receivers detecting the walls, while the AMS magnetic encoders record 1750 counts per mm (overkill). The main processor is an Arduino 33 Nano BLE, with light effects and an animated screen controlled by a separate Pi Tiny 2040. We have added a Back to the Future theme for entertainment, as Doc Brown would say, "If you're gonna build a MicroMouse, why not do it with some style!"

Length- 105mm
Width- 76mm
Weight- 104g
Batteries- 3 x 180mah
Motors- N20 10:1





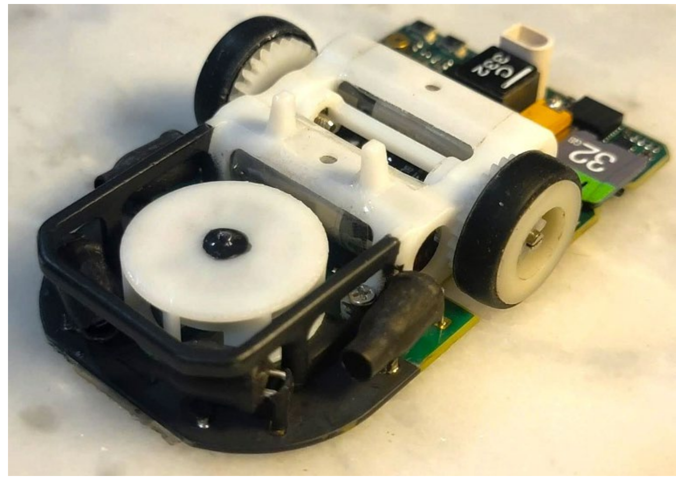
Cutting Through The Fog was built by Kevin Tain in 2026.

It is a small mouse but packs a lot of power for its size.

It is powered by a STM32H735 microcontroller running at 550 MHz, with 1 MB of Flash and 564 KB of RAM.

A boost converter steps up its single-cell battery to drive its tiny motors at 22V.

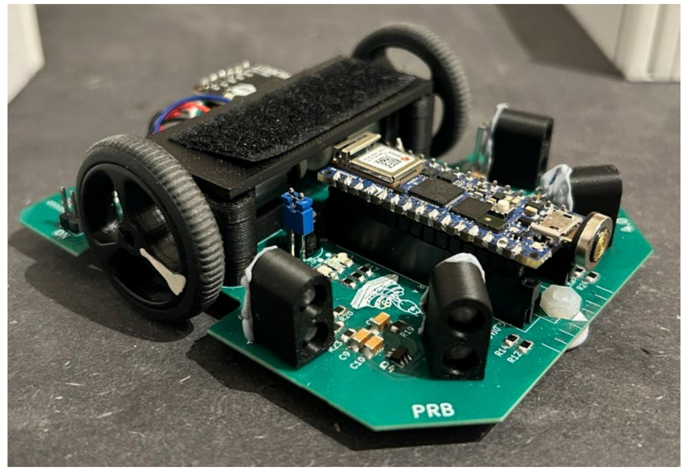
A BLDC driven suction fan generates up to 150g of downforce.



Robot Name	Cutting Through The Fog
Designer	Kevin Tain
Dimensions	69 x 42.5 x 19mm, 0.8mm 6-layer PCB
Weight	38g (31.5g without battery)
Motors	Maxon RE8 with 50 CPR encoders
Motor Driver	2 x MAX22201
Vacuum Motor	RCINPOWER GTS V3 1002 22000kV
Vacuum ESC	DYS XSD7A
MCU	STM32H735RGV6 (550MHz/1MB Flash/564K RAM)
Wall Sensors	4 x SFH4550, 4 x QTLP610
IMU	ICM45686
Battery	BetaFPV 1S 280mAh LiHV (3.8V, 95C)
Gearing	26:8 0.5M
Tires	PN Racing DF8845
User Interface	2 x Buttons, Buzzer, RGB LED
Power Regulation	TPSM82913 (3.0V), TPS61287 (22V), TPS22811
Daughter Board	Bluetooth Module, 60x32 Display
Other	MicroSD

Name of Micromouse: **Ratatouilli**
Name of Team Leader: Rohan Nair
School/University Entry: Yes
School/University/Company Name: Georgia Institute of Technology
Probability of being ready to run on March 23, 2026: 70%

Attached are some pictures of my mouse **Serpent Scamper**. This is the 4th iteration of the PCB and my first 4 layer board. APEC will be its first competition although previous version of the mouse have run in the UK before.

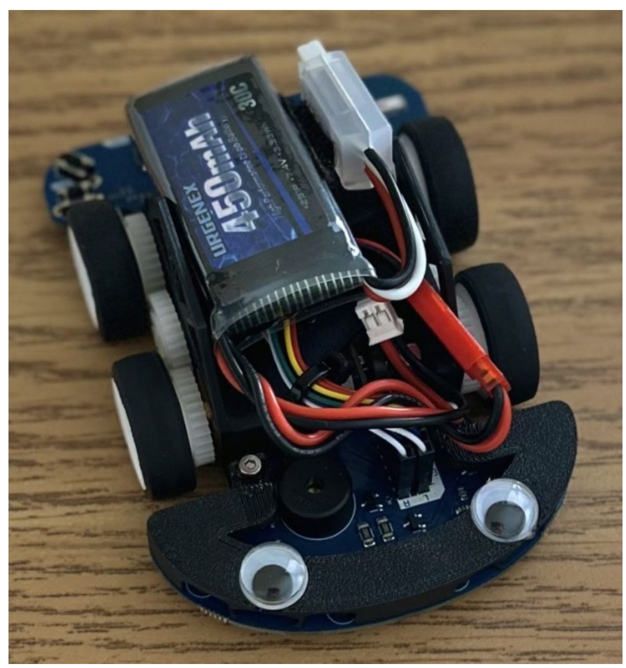


The mouse is built with the Arduino nano RP2040 connect, primarily for the 4 ADC channels that are available on the board with the chassis being dimensionally the same as the UKMARSBOT. The mouse is coded in micro python, which creates some interesting speed and memory challenges. Sensors are TLCR5800 Visible RED LED's with BPW96B Phototransistors housed in a 3D printed shield to help align and protect from ambient light. New on this version of the mouse is an updated constant current driver with each LED getting its own circuit.

Motors are the pimoroni 20:1 gear ratio DC motors with encoders. Custom resin printed encoder wheels replace the default 3 magnet with a wheels containing 14 magnets. Providing a much higher encoder resolution. Motors are driven by a dfrobot TB6612FNG controller. This gives a very theoretical top speed of just under 2 m/s.

The software has been constantly evolving for the last 3+ years. Initially based off of the UKMARSBOT maze runner core and manually re written into micro python. Initially maze flooding would take a horrifying 100+ms to complete but this can be done in less than 1ms while searching and uses the standard flood fill algorithm. On speed run the mouse will favour straight routes over the shortest route. The mouse is currently unable to handle diagonal turns and has an internal update loop of only 100hz.

FrankenMouse v3 was designed, built, and programmed by Peter Lilley over the course of 2.5 years as part of the University at Buffalo IEEE Student Branch. The robot includes a custom 4-layer PCB built around the STM32WB55CGU6 microcontroller. The robot is driven by 2 standard 6V Micro Metal Gearmotors (20:1), arranged in a unique configuration with motors driving the front right and rear left wheels and the remaining two wheels being geared to the driven wheels. This configuration made the small size of the robot (70mm x 100mm) possible while using cheap and widely available motors.



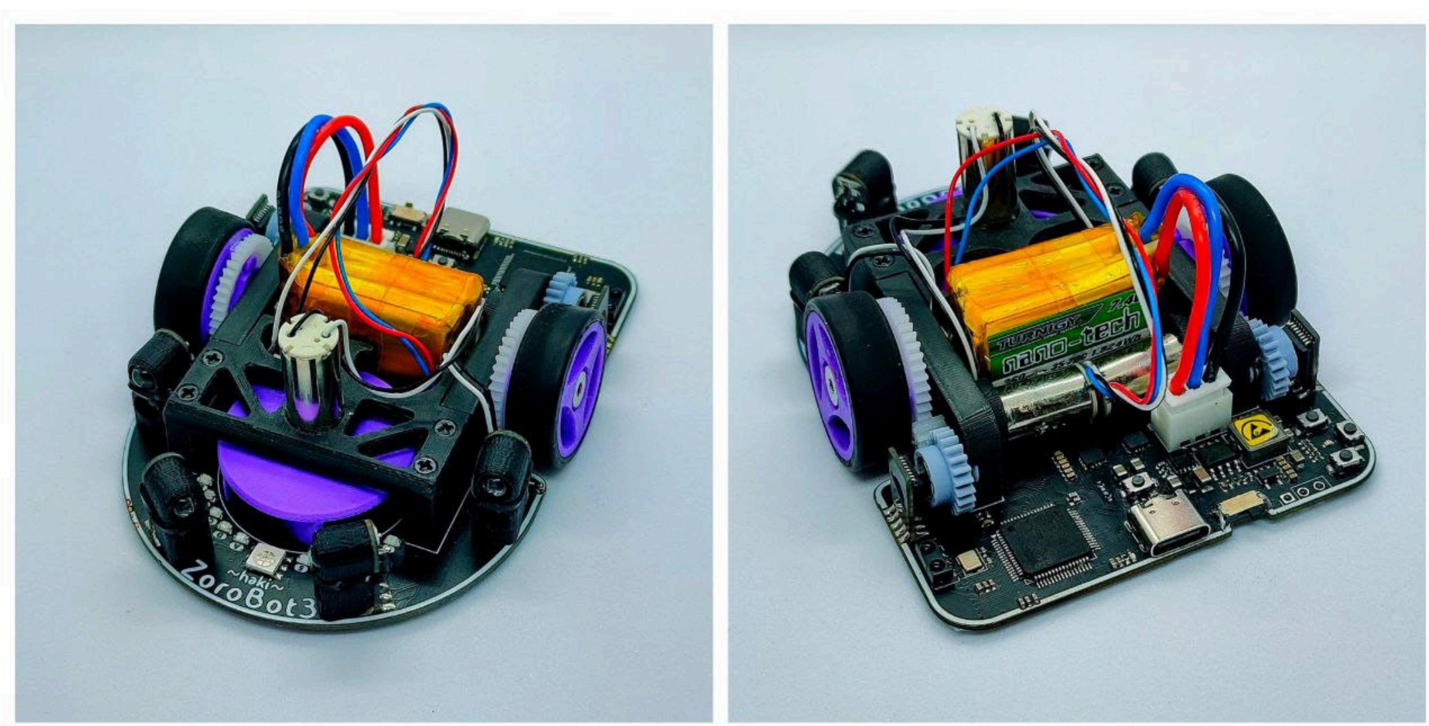
For sensors, FrankenMouse includes two standard hall encoders on each drive motor, four IR sensors mounted along the front of the robot for wall detection, and an ICM-42670-P 6-axis IMU.

When developing the software for FrankenMouse, much work was put into creating a custom 3D physics simulation environment where we could test the exact code that runs on the physical robot in a safe and convenient way. The simulator was created using the Godot game engine and communicates with a desktop-built version of the robot's firmware that publishes ROS2 topics instead of controlling the robot's hardware.

All the PCB+CAD design files and the source code for the firmware and simulator are open source and available on GitHub at https://github.com/UBIEEE/FrankenMouse

Specs:

Designer	Peter Lilley
Length/Width	10cm/7cm
Weight	69 g (w/o batt), 92 g (w/ batt)
MCU	STM32WB55CGU6
Motors	2x 6V Micro Metal Gearmotor (20:1)
Encoders	2x Micro Metal Motor Encoder
Motor Driver	DRV8835
IR Sensors	4x SFH4545+TEFT4300
IMU	ICM-42670-P
Buzzer	PS1240P02BT
Battery	2S 450 mAh Li-Po
Voltage Regulator	TPS564208DDCR
Max Speed	1 m/s
Wheel Diameter	2.5 cm



All information about Zorobot-A and Zorobot-3.5 is in https://github.com/OPRobots/ZoroBot3

Hardware

- **Microcontroller:** STM32F405RGT6 168MHz

- **Motor Drivers**: MP6551 20kHz
- **Giroscopio**: LSM6DSRTR 4000dps
- **Encoders**: AS5145B-HSST
- **Mosfets**: AO3400 (A09T)
- **Regulador**: CN3903 + LDO ME611C33M5G

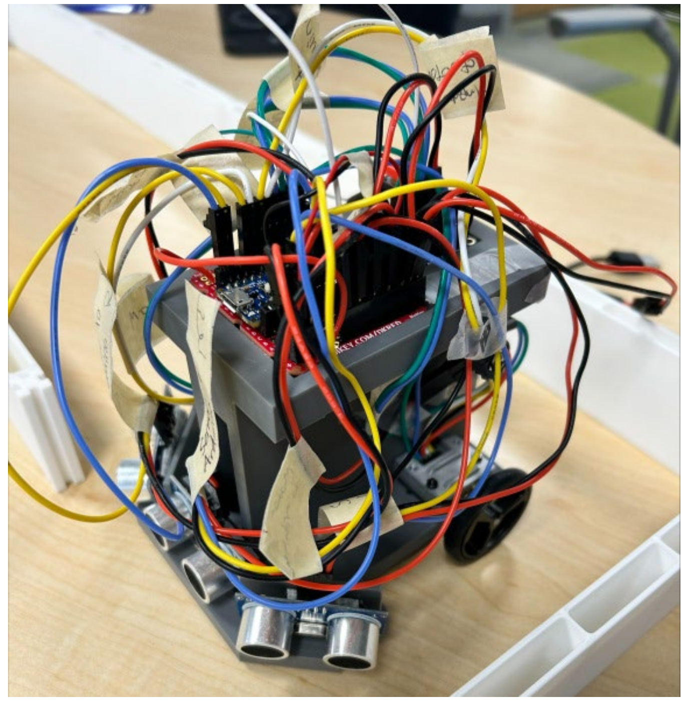
- **Battery:** LiPo 2S 260mAh 35-70C Turnigy nano-tech

- **Sensors:**
  - 4 Emisores IR SFH-4550
  - 4 Receptores IR ST-1KL3A
- **Tracción**:
  - 2x Motores Coreless 8520 7.4v (AliExpress)
  - Wheels Kyosho K.MZW39-30
  - motor pinion 8T 0.5M
  - Wheels gears 40T 0.5M
  - encoders gears 22T 0.5M
  - 4x bearings MR63ZZ (Ruedas)
  - 2x bearings MR52ZZ (Encoders)
  - 2x radial magnet 6x2.5mm

Parameters

	Max speed mm/s	Soft Accel mm/s^2	Hard Accel mm/s^2	Max Angular speed rad/s	Fan %
Explore	650	-	5000	-	30
Normal	3000	-	12000	15	60
Medium	5000	-	15000	17.5	65
Fast	5500	15000	20000	20	75
Super	6000	20000	25000	22.5	85
Haki	6500	25000	30000	25	90

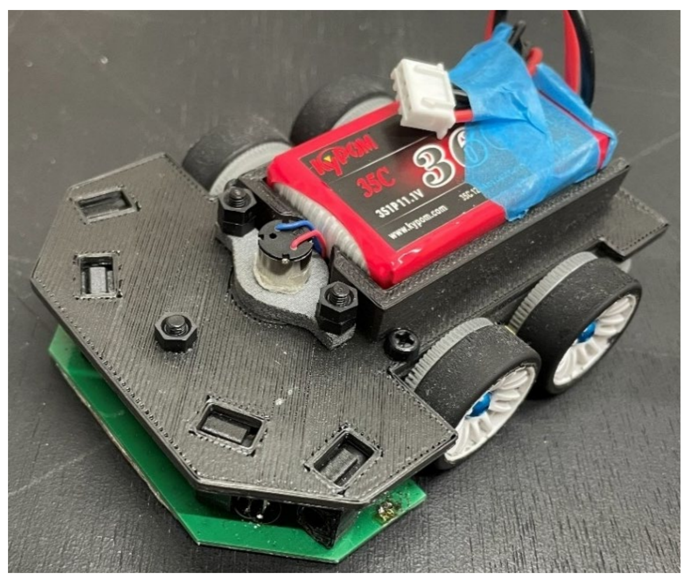
Victor E. Mouse is the first micro mouse design from the team of Haley Harblin, Kyle Folga, Nathan Smith, and Conor Swete, with special thanks to Peter Lilley for giving guidance and assistance throughout the project. The title is a reference to their university's mascot, Victor E. Bull of the University at Buffalo. The robot uses 2 wheels with a front “sled” design to minimize design complexity, and 3 ultrasonic sensors for detecting walls. It uses a standard flood-fill algorithm to navigate the maze.



Attribute	Description
Arduino (1)	Arduino Nano 33 BLE
Sensor (3)	HC-SR04 Ultrasonic Sonar Distance Sensor + 2 x 10K resistors
Chassis (1)	3D printed
Motor (2)	Micro Metal Gearmotor HPCB 6V with Extended Motor Shaft with encoder
Battery (1)	USB Li-Ion Power Bank with 2 x 5V Outputs @ 2.1A - 5000mAh
Motor Driver (1)	Adafruit DRV8833 DC/Stepper Motor Driver Breakout Board
Wheel (2)	2 cm radius, 0.6 cm depth

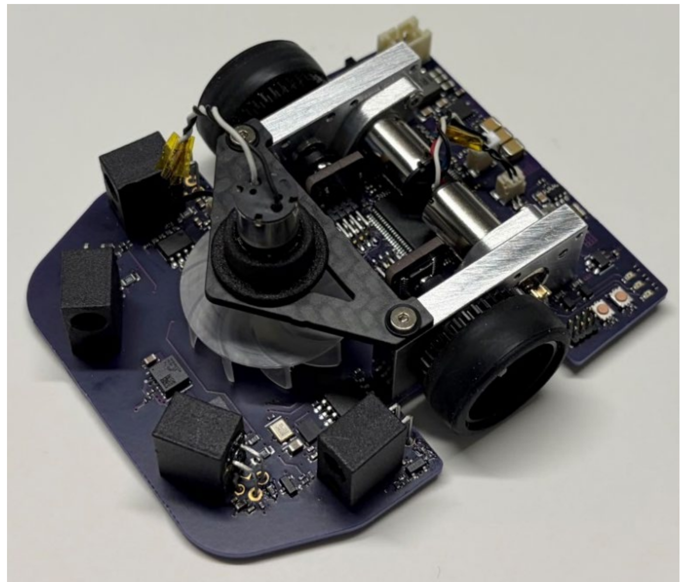
Name of Micromouse: **PIGGY-ONE**
Name of Team Leader: Kaito_Suzuki

PIGGY-ONE: Technical Overview



PIGGY-ONE is an independently developed 120g 4WD Micromouse. It features a suction fan for downforce and is controlled by an STM32F446RET6 MCU. Powered by a 3S LiPo battery, its 7.4V coreless motors achieve a top speed of 6.0 m/s and acceleration of 25 m/s². The robot utilizes SFH4550 IR sensors for wall detection and an LSM6DSR IMU for stability, maintaining a consistent turn speed of 1.5 m/s.

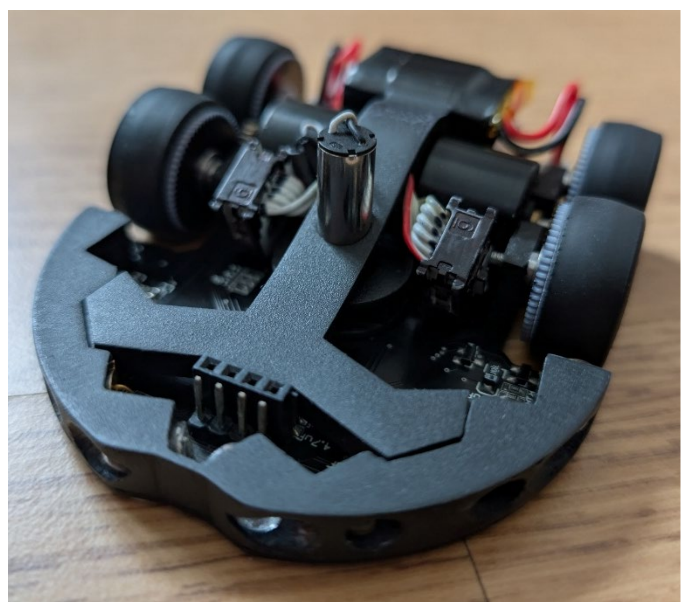
Name of Micromouse: **Little Zippy**
Name of Team Leader: Brandon Wernick
School/University Entry: Yes
School/University/Company Name: UT Tyler Houston Engineering Center
Probability of being ready to run on March 23, 2026: 100%



Biscuit 2 was designed and built by Allen Mons of Seattle, Washington. It is an evolution of Biscuit, which competed at APEC last year.

The robot measures 81 mm x 69 mm and weighs 65 grams without battery. It uses three coreless 8520 drone motors: two driving the wheels through 4.75:1 gearing and a third powering a suction fan. The electronics are based around an STM32H7 microcontroller with an ICM-42688-P IMU for inertial sensing. Wall detection is performed using SFH4545 emitters paired with TEFT4300 phototransistors. Wheel position is measured using AS5047P magnetic encoders.

Biscuit 2 incorporates a suction fan which can produce approximately 240 grams of downforce to improve traction during high-speed runs.



Robot Name: **Theseus**
Developer: Daniel Gonçalves

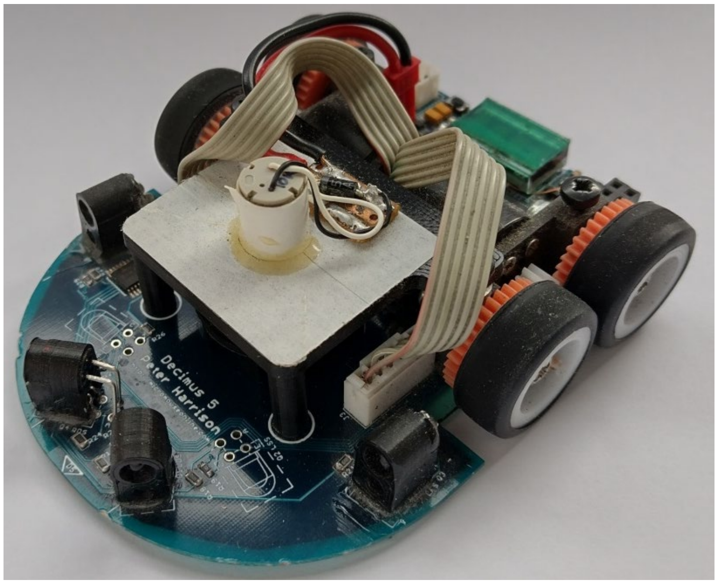
Background:
Theseus is the evolution of my previous robot, Vertigo. Built during the COVID-19 pandemic, it was designed as an exercise in both precision engineering and aesthetics. I wanted to build a platform where I could iterate, expand, and try new mechanisms without breaking everything apart. The design philosophy for Theseus was twofold: Structural Integrity and Control Precision. The chassis features a specialized custom built frame designed to house a vacuum fan motor while maintaining rigid alignment for the IR sensor array. This structure choice is particularly vital during the code development stage as it ensures the sensors remain perfectly positioned despite the frequent, high-speed crashes (common during code development testing).
Beyond the hardware, Theseus served as my learning and development bed for advanced control theory and signal processing. I usually spend most of my time diving deep into PID, Phase-lead, and Feedforward algorithms, as well as various digital filters and signal processing techniques (an area I found myself particularly drawn to).
Like I said above, Theseus is also an exercise in aesthetics. I believe robots can also look good and by balancing

technical performance with a clean, intentional aesthetic, I’ve created a robust platform that has remained reliable across multiple iterations and I'm happy with it.

Technical Evolution & Recent Work:
While I've been taking a kind of hiatus from my robots development since 2024 to take another Master’s degree in Computer Science (AI & Web Technologies), I still continued to work on micromouse projects. My thesis consists in the development of a 100% web-based Micromouse simulator (www.micromouse.app). I also helped in the development of the MicroPontiki micromouse (the robot featured in the simulator). Initially designed to be used in robotics classes, by students at UTAD (University of Trás-os-Montes and Alto Douro - organizers of the Portuguese Micromouse Contest), the simulator emulates real-world physics, sensors, and MCUs, allowing the exact same code used on the physical robot to run in the browser. While it currently supports the RP2040 and AVR (with ESP32 and STM32 coming soon), I have been expanding it to support other robots in the future.
Technical Specifications:
☐

Dimensions	72mm x 84mm
MCU	STM32F411CE @100MHz
Gears	60:18 mod 0.3
Wheels	4x 21mm x 9mm
Motors	2x Faulhaber 1717T006SR IEH-1024
Motor Driver	TB6612FNG
Fan Motor	7mm x 16mm Coreless DC motor
IMU	MPU 6500
IR Emitters	4x SFH4550
IR Sensors	4x BPW77NA
Battery	2x 1s 3.7 LiPo 250mAh 35C
UI	1x Button, 1x Wheel, 3x LED
Expansion ports	1x I2C / 1x UART
Debug ports	1x JTAG/SWI

Decimus 5A is a classic (full size) micromouse by Peter Harrison from the UK. Using the common four-wheel drive layout, this model sports a fan which creates a low pressure area under the mouse to provide additional downforce equivalent to more than twice the weight of the mouse and corresponding increased grip.



That amount of additional grip gives a significant increase in performance. Cornering can be 50% faster with centripetal accelerations approaching those found in F1 racing cars. Nearly 6g has been achieved in testing. High discharge rate batteries are essential to provide sufficient current.

Faster runs requires stronger parts in case of accident and magnesium alloy motor mounts coupled with heavy duty Delrin wheels help to ensure survivability. No crumple zones here.

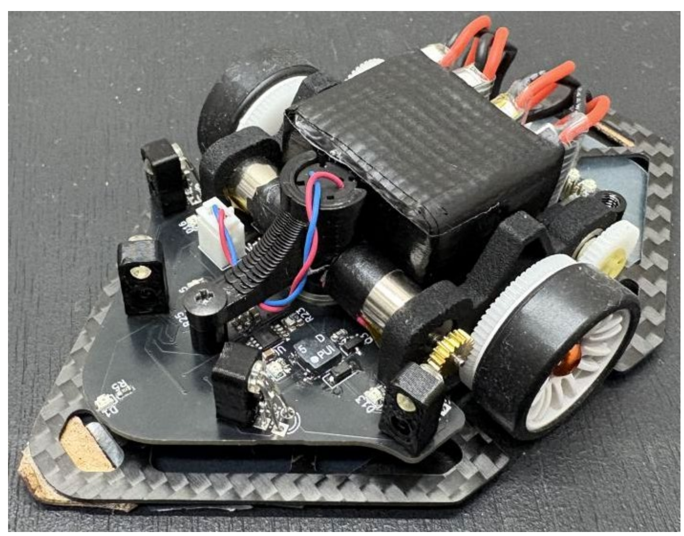
The ARM cortex M4 processor is an STM32F407 with 1Mbyte of flash and 192kbyte RAM. Running at 144MHz, it performs all the navigation, solver and control functions using floating point throughout while still only taking up less than 10% of the available processor power.

Searching and pathfinder algorithms attempt to find the most effective route by taking into account the mouse dynamics and the need to search as fast as possible.

Technical information for Decimus 5A

Designer	Peter Harrison
Dimensions	76mm x 97mm
Weight	115g
MCU	STM32F405RG @144MHz
Gears	35:10 mod.3
Wheels	4 x 22mm x 8mm
Turn speed	2400 mm/s max
Acceleration	28 m/s/s max
Top Speed	5 m/s max.
IR	SFH4550/TEFT4300 x4
Motors	Faulhaber 1717T003SR with IEH2-512 encoders
Motor driver	1x DRV8835 drives both motors
Battery	2S LiPo 240mAh 25C
Gyro	Invensense MPU-6000

Name of MicroMouse: **Tachyon**
Name of Team Leader: Matthew Komitsky
Private Entry X
Probability of being ready to run on March 23, 2026: 95%



KOGUMA-CHAN.Mk3 is a classic micromouse designed and built by Akihiro Suda from Tokyo University of Science Mice in Japan. It is equipped with torque-oriented motors and utilizes a 4-cell (15.2V) LiPo battery to compensate for the lower rotational speed. A major feature of this mouse is its high energy efficiency, rather than just pursuing overwhelming top speed on straightaways. Mechanically, it has graduated from a standard PCB chassis and now utilizes a rigid carbon fiber frame. Additionally, the encoder unit adopts a bearing holder system. For the wall detection sensor system, instead of common phototransistors, it uses a combination of photodiodes and operational amplifiers, paired with laser diodes and constant current devices for the emitters to improve sensing accuracy. This robot won first place in the classic maze competition at the 46th All Japan Micromouse Contest in 2026, and also won the championship at the Student Micromouse Contest in 2025.

[Specifications]

- **Designer:** Akihiro Suda / Tokyo University of Science Mice
- **Dimensions:** 120mm x 70mm x 30mm
- **Weight:** 78g
- **MCU:** STM32F446RE @180MHz
- **Wheels:** 24mm (Diameter) x 8mm (Width)
- **Turn speed:** 2.4 m/s max.
- **Acceleration:** 30 m/s/s max.
- **Top Speed:** 6.0 m/s max.
- **IR:** SFH 229FA / OPV332 x4
- **Motors:** NFP-D0816-3-3.4 (2 for drive, 1 for suction fan)
- **Motor driver:** MP6550
- **Battery:** 4S LiPo 180mAh
- **Gyro / Encoder:** LSM6DSRX / AS5047P