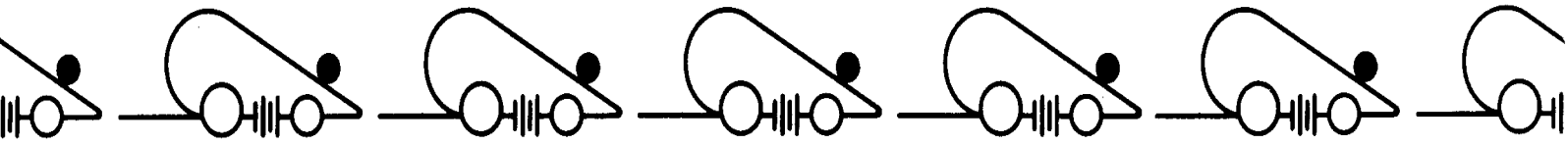

APEC 28th Annual Micromouse Contest

The goal of the contest is to design and build a robot that can navigate from the corner of a 10-foot square maze to the center in the shortest time. For most entrants the contest is divided into two phases, the search phase and the run phase. During the search phase the mouse determines at least one path from the start to the center and may seek additional paths in hopes of finding a faster one. During the run phase the mouse goes as quickly as possible from the start square in the corner of the maze to the center of the maze along the previously determined optimal path. Scoring is based on 1/30th 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 has not crashed or been manually restarted prior to the start of a run, a bonus of 2 seconds is subtracted from the score.

List of Contestants for APEC '14 Micromouse Contest

Mouse Name	Affiliation	Country
Tsubasa	Lunghwa University of Science and Technology	Taiwan
Microtaur	Portland Oregon	United States
MM-7A	Shinichi Yamashita	Japan
PicOne Turbo	Derek Hall, Jim Chidley	UK
MITEE 13	MIT	United States
Turtle32U	Lunghwa University of Science and Technology	Taiwan
Zeetah VI	Harjit Singh, Pierre Hollis	United States
Fab 1	Derek Hall, Jim Chidley	UK
Dao-Hu	Lunghwa University of Science and Technology	Taiwan
Green Giant V4.1	University of California, Los Angeles	United States
Decimus 4B	Peter Harrison	UK
Diu-Gow	Lunghwa University of Science and Technology	Taiwan
Tetra	Yusuke Kato	Japan

Tsubasa, **Turtle32U, Dao-Hu**, and **Diu-Gow** are all designed and built by students at Lunghwa University of Science and Technology in Taiwan. Their specifications are shown in the table below.

Specifications	Diu-Gow	Dao-Hu	Tsubasa	Turtle32U
Designer	Xin-Han Cai	Tsung-Chun Ho	Sheng-Hung Lin	Tsung-Yu Yu
Dimensions	95 mm x 79 mm x 21.5 mm	98 mm x 76 mm x 21.5 mm	94 mm x 74 mm x 25 mm	90 mm x 73 mm x 25 mm
Weight	91 g	88 g	94 g	86 g
Drive Motor	1717T006SR+IE2K512 x 2			
Tire size	22 mm dia x 9 mm wid	22 mm dia x 9 mm wid	25 mm dia x 8 mm wid	25 mm dia x 8 mm wid
Gear	60:16	60:16	40:12	40:12
CPU	Renesas RX62T	Resesas RX62T	STM32F103RET6	STM32F103CBU6
Flash / RAM	32KB / 16KB	32KB / 16KB	512KB / 64KB	128 KB / 20 KB
Wall Sensor	OSRAM SFH4550 x 4 TOSHIBA TPS601A x 4	OSRAM SHF4550 x 4 TOSHIBA TPS601A x 4	OSRAM SFH4550 x 4 TAOS TSL262R x 4	OSRAM SFH4545 x 4 TEFT4300 x 4
Gyro	ADXRS620	ADXRS620	ADXRS610	ADXRS620
Top speed	3.8 m/sec	3.8 m/sec	4 m/sec	4.5m/sec
Turn speed	120 cm/sec	120 cm/sec	120 cm/sec	120 cm/sec
Display	RGB	RGB	OSRAM SLO2016	none
Power Source	Lithium Polymer 120mAh2S(7.4V)			

PicOne Turbo is a modified PicOne Micromouse Kit. Their original concept was to promote awareness for Micromouse throughout schools and colleges with a simple to build low cost kit. It uses a Pickaxe 28x2 with 512 bytes of RAM. This is a Microchip 18 series PIC with a built in basic interpreter. It is driven by two low cost 6v motors, has three TSL262R sensors to detect the walls, and two phototransistor wheel counters with a sampling resolution of 1 count per 1.5mm. It is programmed in Basic and runs without any interrupts.

Microtaur was designed and built by Devon Griggs, Devin Helmgren, Emilia Holbik, and Janel Raab from the University of Portland in Oregon. It is comprised of a Microchip PIC18F27J13 microcontroller, a Microchip 23LC1024 1Mbit SPI Serial SRAM, 3 SHARP GP2D120 Optoelectronic Device Distance Sensors, 2 Pololu Optical Encoders, 2 TOSHIBA TA8080K Motor Drivers, 2 Pololu 100:1 DC Micro Metal Gearmotors, 2 SolarBotic RW2i drive wheels, and 2 stability wheels. It was coded with Microchip MPLAB 8 IDE and programmed using a Microchip ICD3 In-Circuit Debugger System. Its artificial intelligence agent runs a modified A* search algorithm. Testing was performed on a full-scale home built maze.

MM-7A, was designed by Shinichi Yamashita of Tokyo Japan. It uses a 5M-pixel camera supported by an expandable boom. It takes photos of the entire maze and analyzes the whole maze with image processing. It can then run through the shortest route. It uses a custom designed 32bit CPU implemented on an FPGA for image processing and run control. This website has a brief explanation in English and points to the designer's website in Japanese. It has some links to video on it. {http://www.micromouseonline.com/2013/12/03/micromouse-uses-camera-solve-maze/#more-2937}

MITEE Mouse 13 is designed and built by of David Otten, a staff member at the Massachusetts Institute of Technology. It came in 24th out of 34 in the finals at the All-Japan Micromouse Contest last year.

Zeetah VI was designed and built by Pierre Hollis and Harjit Singh. Zeetah VI implements a four wheel drive system. The mouse uses the STM32F103 microcontroller. Power comes from two LiPo 100 mAh cells. The motors are MicroMo 1717T003SR with IE-512 encoders. The mouse measures 92 mm x 74 mm and weighs 82 g.

FAB 1 parodies the Thunderbird's pink Rolls Royce. It uses a STM32 processor running at 72 MHZ with 96k of RAM. It has 6 TSL262R sensors and 100mAh LiPo batteries. The total weight of 100g is driven by six powered wheels, allowing the mouse to accelerate and decelerate at much higher speeds. The two centre wheels are mounted 0.5mm lower than the others, allowing uncompromised high speed cornering. It measures 115mm(L) x 75mm(W) x 22mm(H).

Green Giant V4.1 is designed and built from scratch by Green Ye, an undergraduate student from UCLA. It uses 4 infrared sensor pairs, a single axis analog gyro, and 2 Fauhalber 1717 6V motors along with IE2-512 encoders as its motion and feedback to make a robust closed-loop positional PD control. The STM32F405RG, which is a Cortex Arm M4 MCU, is used to manipulating the robot. A 4 character alpha numeric LED display, one magnetic buzzer, and 9 LEDs are used as user interface to simplify the debugging process. A customized 7.4V 120 mAh 2s1p 25C Lipo battery is used to power the entire system. The mouse measures 93.5 mm x 75 mm x 24 mm. It can achieve a straight path speed of up to 4.5 m/s with variable acceleration rates up to 13.5m/s^2. Green is working on a project to teach others about micromouse. The web site is listed here {http://micromouseusa.com/?p=1433}.

Decimus 4B is a classic micromouse by Peter Harrison from the UK. Based on the now common four-wheel style, it has proven to be a significant step up in performance over previous mice and was placed 10th in the last All-Japan contest. The use of 3D printed parts has greatly simplified the mechanical design and construction of this mouse. Decimus 4B has demonstrated repeatable turns at more than 1.4g of centripetal acceleration and straight-line accelerations of up to 11m/s^2. The ARM cortex M4 processor is an STM32F407. Running at 72MHz, 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. Peter's web site has a great deal of information for anyone interested in micromouse {http://www.micromouseonline.com/}.

Tetra was designed and built by Yusuke Kato. He is the originator of the tremendously popular 4-wheel drive configuration and the winner of the 2013 All Japan Final. The specifications of his latest entry are given below. His website has information on other mice he has built {http://seesaawiki.jp/w/robolabo/d/Tetra}.

Size	74 mm (W) x 90 mm (L) x 22 mm (H)
Weight	71 g
Wheel	D: 22 mm x W: 8.5 mm - Mini'Z Tire
Processor	STM32(64MHz)
Motor	FAULHABER 1717-003SR + IE2-512
Gear Ratio	16:60
Battery	Li-ion 70mAh 2cell
Motor Driver	LTC4442 + ECH8659
PWM Freq.	64kHz
Sensor	infrared light sensor (SFH4550 + TPS601) x 4
Gyro	ADXRS610
Top Speed	4.50 m/s
Acceleration	15.0 m/s^2
Turn Speed	(90L)1.60 m/s, (90V)1.35 m/s, (180)1.40 m/s, (45)1.60 m/s, (135)1.35 m/s
User Interface	Push Button SW x 1, 2 color LED x 3

The maze design for this year's contest was prepared by Mr. Gerado Molina. He has designed the mazes for all the recent APEC contests. He has a "Maze Solver" app on the App Store if you are interested.