APEC 32st 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 crashed or been manually restarted *(touched*) prior to the start of a run, a penalty of 2 seconds is added to the score.

List of Contestants for APEC '18 Micromouse Contest

Mouse Name	Affiliation	Country
PicOne Turbo	Jim Chidley	UK
EduMouse 1.2	Lunghwa University of Science and Technology	Taiwan
Zeetah VI	Harjit Singh, Pierre Hollis	United States
Lightening McQueen – Turbo V1.0	Tiajin University	China
Fab 1	Derek Hall	UK
Haseshumouse V4.0 or V5.1	Shun Hasegawa	Japan
Long – Turbo V2.0	Tiajin University	China
Decimus 5A	Peter Harrison	UK
Red Comet	Masakazu Utsunomiya	Japan

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 and has three TSL262R sensors to detect the walls. It is programmed in Basic and runs without any interrupts.

EduMouse 1.2 was previously designed by Juing-Huei Su and Chen,Chao-Wei for educational and experimental purposes. It uses observer-based sensor fusion algorithms to improve the encoder resolutions. It will be used in project oriented courses at Lunghwa University of Science and Technology in 2018. EduMouse 1.2 modifies slightly the PCB design, improves a little bit of its running speed, and can now be programmed through the mini USB interface.

Juing-Huei Su has been working in Lunghwa University of Science and Technology, Taiwan since 1996. He now runs the Embedded Control System Laboratory in the Department of Electronic Engineering.

EduMouse Specifications

Length/Width/ Height/Weight	100mm/89mm/24mm/~110g
Drive Motor	JD20-L002A229-1 x 2
Tire size/ Gear ratio	Diameter : 24mm, Width : 9mm/45:9
CPU	dsPIC 33EMU806
Flash ROM/ On chip RAM	128KB/64KB
Wall Sensor/ Gyro	OSRAM SFH4550 x 4, TSL262 x 4/ MPU6500
Top/turn speed/ Display	1.5m/s, 50cm/s, / RGB x 2
Power Source	Li-Polymer 240mAh 2S(7.4V)

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.

Lightening McQueen – Turbo V1.0 was designed by Shuai Zhang, Yadong Li and Zhangqi Kang, who are students at the School of Electrical and Information Engineering, Tianjin University. It is an updated version of "Lightening McQueen" with a suction fan.

Long – Turbo V2.0 was designed by Yao Zhao, Jiashuo Liang and Xiangkun Li, who are students at the School of Electrical and Information Engineering, Tianjin University. It has been improved from its former version - "Long", with a suction fan to enhance its speed and stability. It was the champion of the "2017 Micromouse Contest for University Students" in Tianjin, China.

Technical information for the Tianjin University Entries

Robot Name	Long – Turbo V2.0	Lightning McQueen – Turbo V1.0
Length/Width	99mm/78mm	99mm/77mm
Height/Weight	34mm/117g	35.5mm/115g
Drive Motor	FAULHABBER 1717T-006SR+IE2-512 *2	FAULHABBER 1717-006SR+IE2-1024 *2
Motor Driver	MAX4427	MAX4427
Vacuum Motor	CHAOLI8520(7.0V)	CHAOLI8520(7.0V)
Tire Size	Diameter:22mm, Width: 8.5mm	Diameter: 22mm, Width: 8.5mm
CPU	STM32F405RGT6	STM32F405RGT6
Gyroscope	ADXRS620	ADXRS620+ LY3200ALH
Power Source	LiPo 200mAh 2S(7.4V)|	LiPo 200mAh 2S(7.4V)|
Infrared Emitter	SFH4550 *6	SFH4550 *6
Infrared Sensor	TPS601A *6	TPS601A*6
Max Speed	4.0m/s	4.2m/s
Turn speed	1.8-2.2m/s	1.8-2.4m/s
User Interface	Button + Buzzer + 8*LED	Button + Buzzer + 10*LED

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).

Haseshumouse V4.0 or V5.1 was built by Shun Hasegawa from Japan. At the time the program was printed, he had not decided which mouse he wanted to run. Ver 3.0 which he ran at APEC '15 had two counter rotating vacuum fans so whichever one he decides to run should be interesting.

Decimus 5A is a classic (full size) micromouse by Peter Harrison from the UK. It came second in the 2017 All Japan contest. 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. In a straight line, Decimus 5A could out accelerate a Tesla Roadster - until Elon Musk strapped one into a rocket.

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

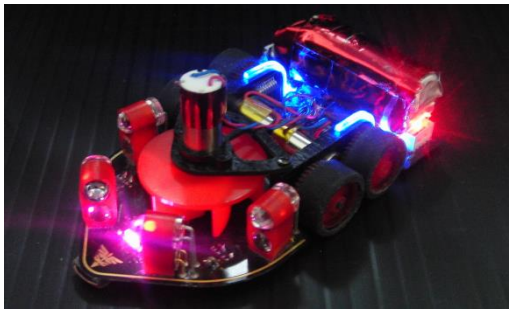
The ARM cortex M4 processor is an STM32F407 with 1Mbyte of flash and 192kbyte RAM. Running at 144MHz, it performs all the navigation, solver and control functions using floating point throughout while still only taking up less than 10% of the available processor power.

Improvements to the 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. New turning and navigation algorithms have contributed to better stability through the run.

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 1516T003SR with IEH2-512 encoders
Motor driver	1x DRV8835 drives both motors
Battery	2S LiPo 240mAh 25C
Gyro	Invensense MPU-6000

Red Comet is extremely small size mouse equipped with 4 wheels and suction fan. My previous mouse (APEC 2015) is heavy and big. To improve this, I reconsider all parts. Most mechanical parts (include gears) were made by home CNC & lathe. As a result, this mouse is 1/4 lighter and smaller than previous model. The advantage of this small mouse can turn quickly with small torque and reduce the risk of bump into wall.



Technical information for Red Comet

Robot Name	Red Comet
Designer	Masakazu Utsunomiya
Dimension	Width:45mm Length: 76mm Height: 30mm
Weight	30.2g
MCU	Renesas:R5F562TABDFM (ROM:256k RAM:16k Flash:32k)
Motor	Drive CL0614-10250-7 Vacuum d:7mm (Unknown)
Motor Driver	TI:DRV8835
Wall Sensor	OSRAM: SFH4550 x 4 TOSHIBA: TPS601A x 4
Gyro Sensor	TDK :MPU6000
Battery	Lipo:160mAh 2S(7.4V)
Gear ratio	9:36 (M0.3)
Tire Size	Diameter :13.5mm Width:6mm
Top/Turn speed	5.0m/s ,1.6~ 2.1m/s