NTU unveils Singapore's first 3-D printed concept car

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NV 8 (left) and NV 9 (right) driving down the running track at NTU Singapore. Credit: NTU Singapore

Nanyang Technological University (NTU) students have built Singapore's first urban solar electric car with an innovative 3D-printed body shell that has 150 parts.

Mounted on a carbon fibre single shell chassis, the NTU Venture (NV) 8 will race in the Urban Concept category at this year's Shell Eco-marathon Asia.

NTU students have also built the NTU Venture (NV) 9, a slick three-wheeled racer which can take sharp corners with little loss in speed due to its unique tilting ability inspired by motorcycle racing.

NV9, featuring hand-made silicon solar cells, will be NTU's entry in the Prototype category at the Shell Eco-marathon Asia which will take place in Manila from 26 Feb to 1 March.

Designed from scratch by NTU undergraduates and built over a year, these two eco-cars will aim to attain the highest fuel efficiency.

Associate Professor Ng Heong Wah, who mentored the two teams, said the students had taken a leap of faith and decided to go with disruptive innovations instead of making improvements over the previous versions.

"Using the latest engineering techniques learnt from their studies in NTU, the students have developed innovations such as silicon solar cells that can be contoured to follow the car's shape. This allows for maximum harvesting of the solar energy and a tilting mechanism in NV9 that can 'lean' in the direction of the turn to avoid losing speed," Prof Ng said.

"We are extremely proud to have designed and assembled a 3D printed body shell for the electric car, which is Singapore's first and probably Asia's first 3D-printed concept car," said Prof Ng. "The 3D printed car body was pushing existing technology to the limits and we are so pleased that it has paid off."

Unique honeycomb design for NV 8 -- Singapore's first Urban Concept car with a 3-D printed body shell. Credit: NTU Singapore

Ilmi Bin Abdul Wahab, a year 4 computer engineering student who led the development of 3D-printed NV8, said, "We decided to go with a 3D-printed cabin made from lightweight plastic, as we wanted to maximise the internal space and driver's

comfort while still being able to keeping the weight to a minimum. Despite being an Urban Concept car, it is no slouch and can reach a top speed of 60 kilometres per hour, while maintaining low energy consumption."

Team Manager of the three-wheeler NV9 team Winston Tan, a final-year electrical and electronic engineering student said, "We took our inspiration for the tilting mechanism from motorcycle racing, where racers would lean left or right during sharp turns to maintain their handling and speed. For the car's body, we aimed for it to be as streamlined as possible. The resulting design looks like a fusion between a F1 race car and a glider plane, with an all surround canopy for increased visual awareness."

NTU's new eco cars - NV 8 (left) and NV 9 (right) - with the student team who built them. Credit: NTU

An interdisciplinary and multi-partner collaboration

The two NTU teams consist of 16 students from the various engineering schools. Over a year, they had built the cars at the Innovation Lab housed at the School of Mechanical and Aerospace engineering.

With as many as 150 parts that had to be 3D-printed, the students collaborated with various NTU schools and research centres, as well as sponsors and institutions such as Stratasys, Creatz3D and The Singapore-MIT Alliance for Research and Technology (SMART).

The designer of the NV8 electric car, mechanical engineering student Kam Sen Hao, said, "Initially we wanted a supercar concept, but after taking into consideration the dimensional requirements for the competition, we ended up with a sensible cute micro-car with vertical opening doors, which will appeal to all ages."

His co-designer, also from mechanical engineering, Ng Jun Wen, said it was a challenge to assemble the shell of the car which was produced in different parts separately by the various 3D printers at NTU and at other sponsor companies. The printing and assembly took the team three months' worth of effort.

"For it to be lightweight, thin and yet strong, we integrated a honeycomb structure and a unique joint design to hold the parts together. When seen against the light, the structure has a translucent see-through effect, like a dragonfly wing. It is a sight to behold!" Ng said.

With annual events first in Asia, then the Americas and Europe, the Shell competition challenges students to design, build and drive a vehicle that can travel the furthest distance using the least amount of energy.

"For Shell, sustainable mobility means helping our customers to be more fuel efficient while finding new innovations to deliver a cleaner transport system for tomorrow. The Shell Eco-marathon plays an important part by inspiring young generations of engineers and scientists to think creatively about fuel efficiency, and to put new ideas into practice," said Mr Jason Leow, General Manager, Communications, Shell Singapore.

Participating teams may enter vehicles using any of the following seven energy types: hydrogen (fuel cell), battery electric, gasoline, diesel, Shell Gas to Liquids (GTL), compressed natural gas (CNG) and Ethanol E100.

Student teams participate in either the Prototype or Urban Concept categories. For the Prototype category, teams enter futuristic prototypes focused

on maximising fuel efficiency through innovative design elements. For the Urban Concept category, teams enter more "roadworthy" fuel-efficient vehicles.

Provided by Nanyang Technological University

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