

DSTA SCIENCE & TECHNOLOGY CAMP

Members:

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Space Exploration

Anglo-Chinese School (Independent)


We are a team of six students from ACS (Independent) who participated in the YDSP Science & Technology Camp.

We were tasked to build a Mars rover prototype that could:

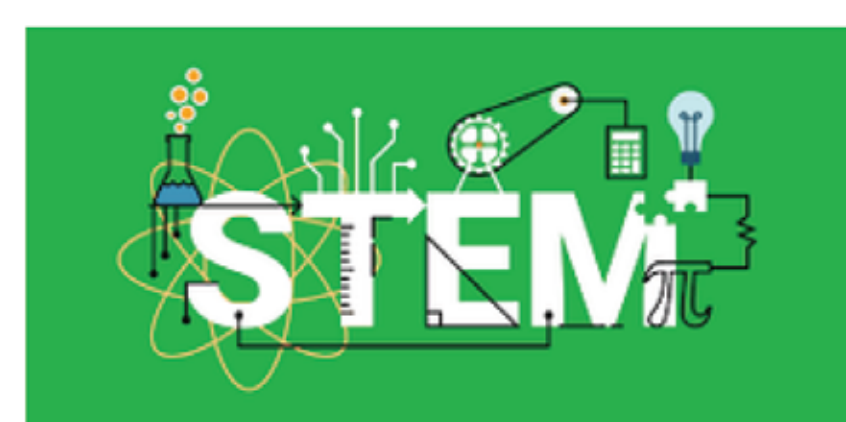
 Navigate surroundings autonomously

 Detect thermal radiation

 Pick up and place objects

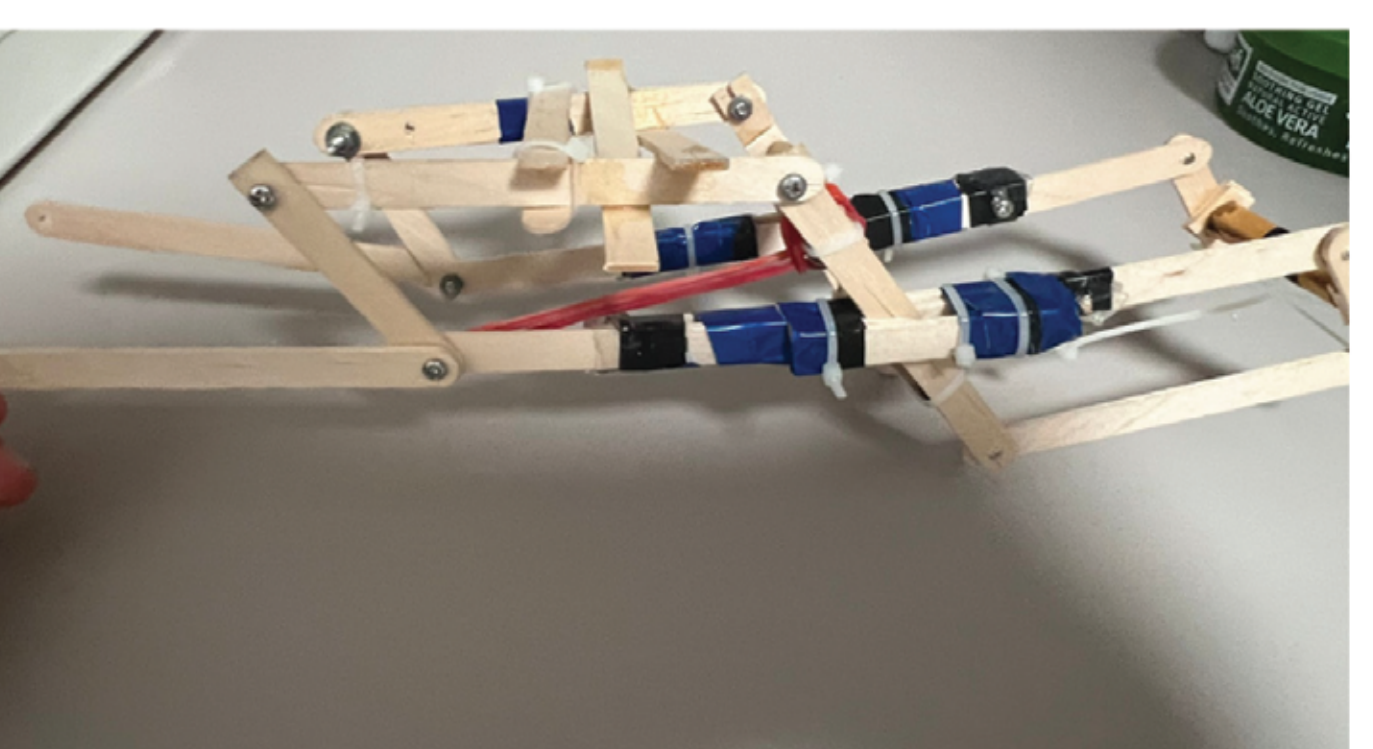
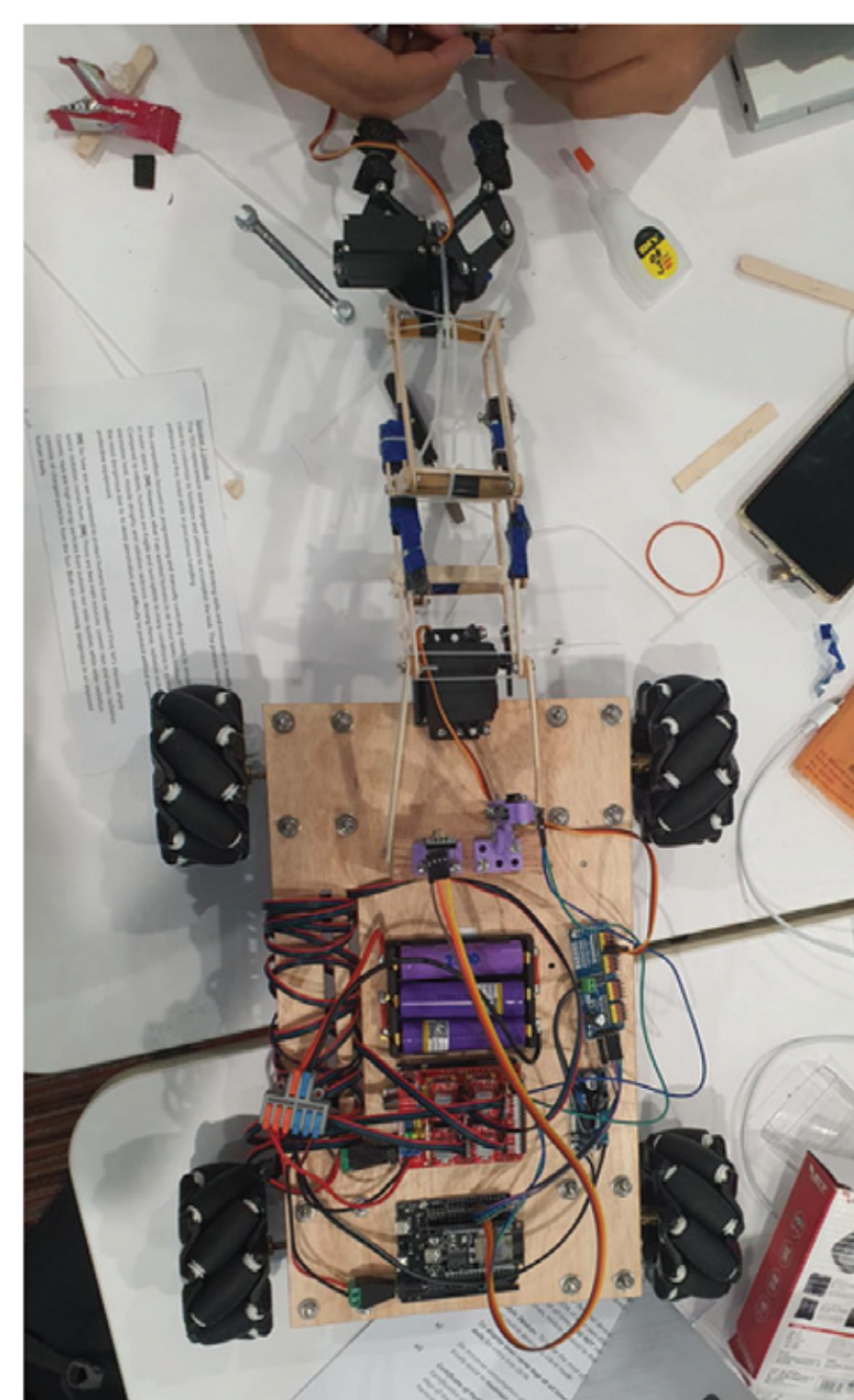
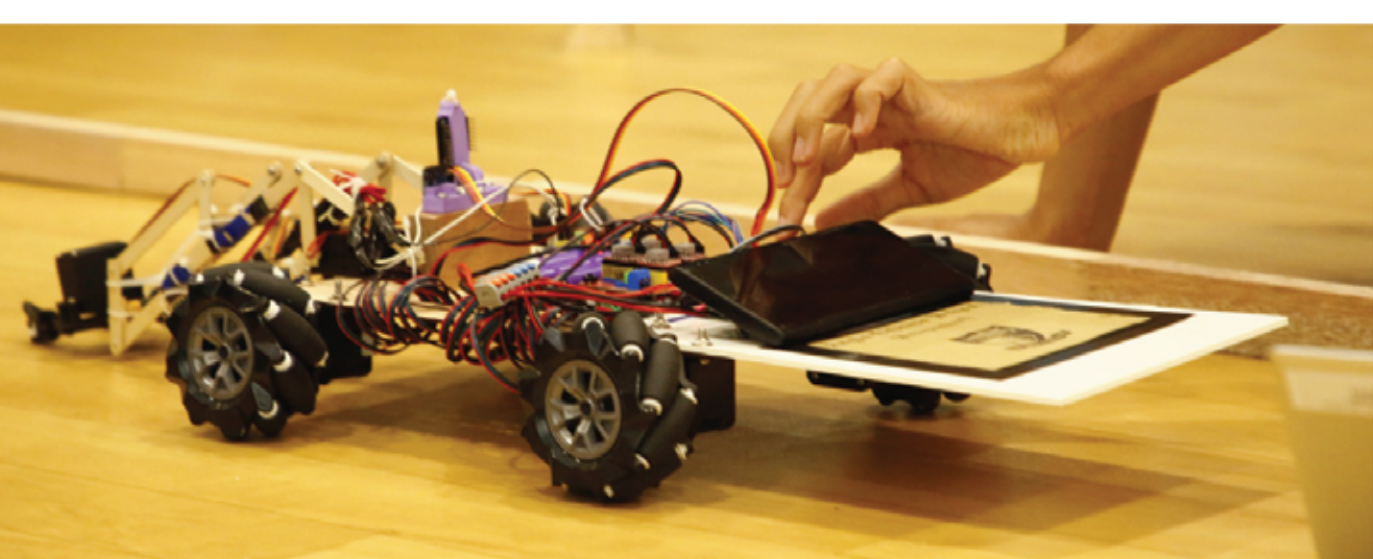
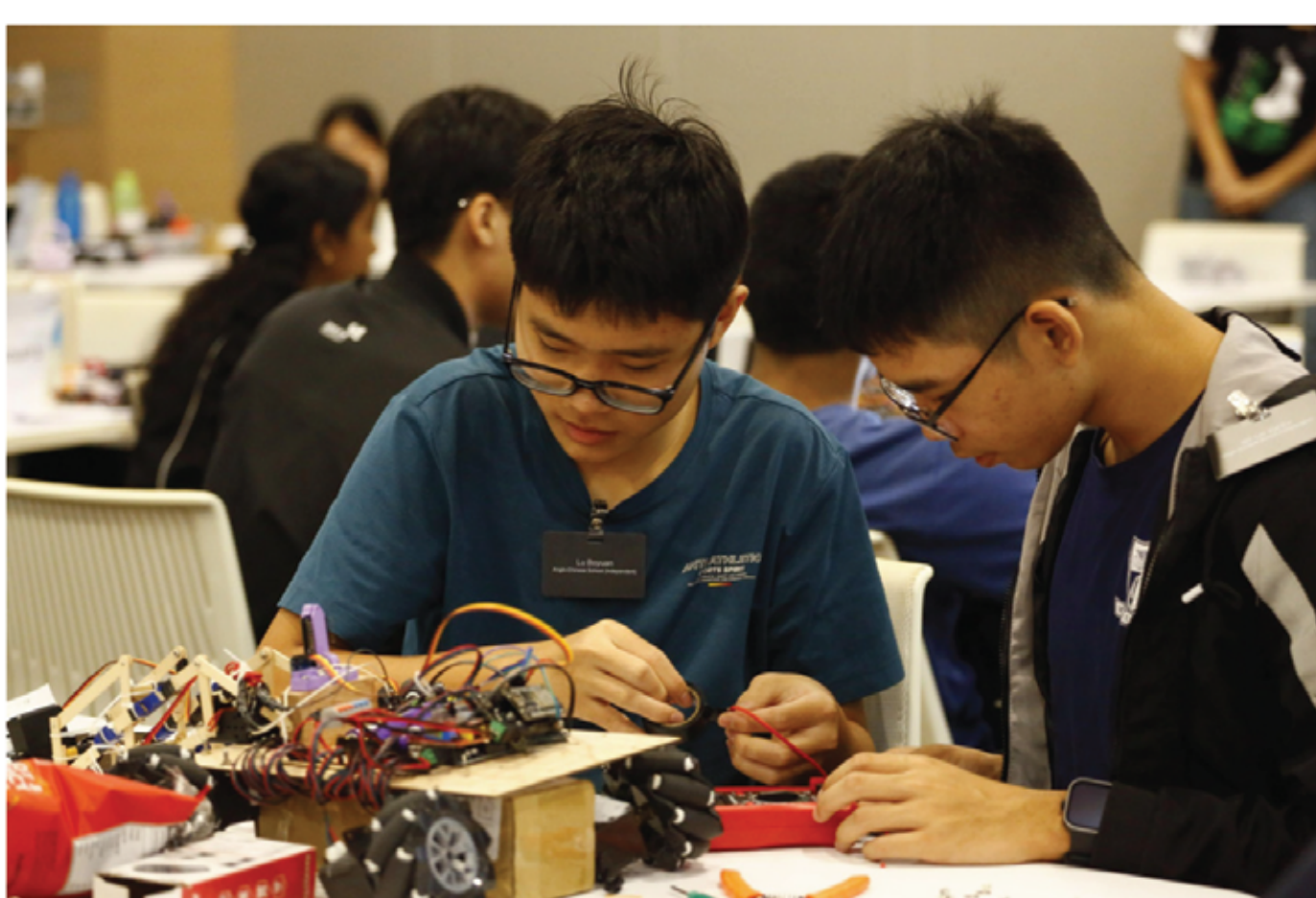
 Rescue an astronaut

 Stack blocks to build shelter



Our team faced significant challenges, including tight time constraints, laggy computer chips and low battery energy that slowed down our development process.

Despite these obstacles, we managed to adapt by prioritising tasks, optimising our workflow, and finding technical workarounds.



We worked hard to construct a robot capable of completing these tasks well. Here are some notable features our base robot had:



Mecanum Wheels: Provides the rover omnidirectional movement, allowing it to move in any direction without changing its orientation.



Camera Systems: The robot was equipped with RGB and thermal cameras which allowed the remote driver to better navigate the task environments.



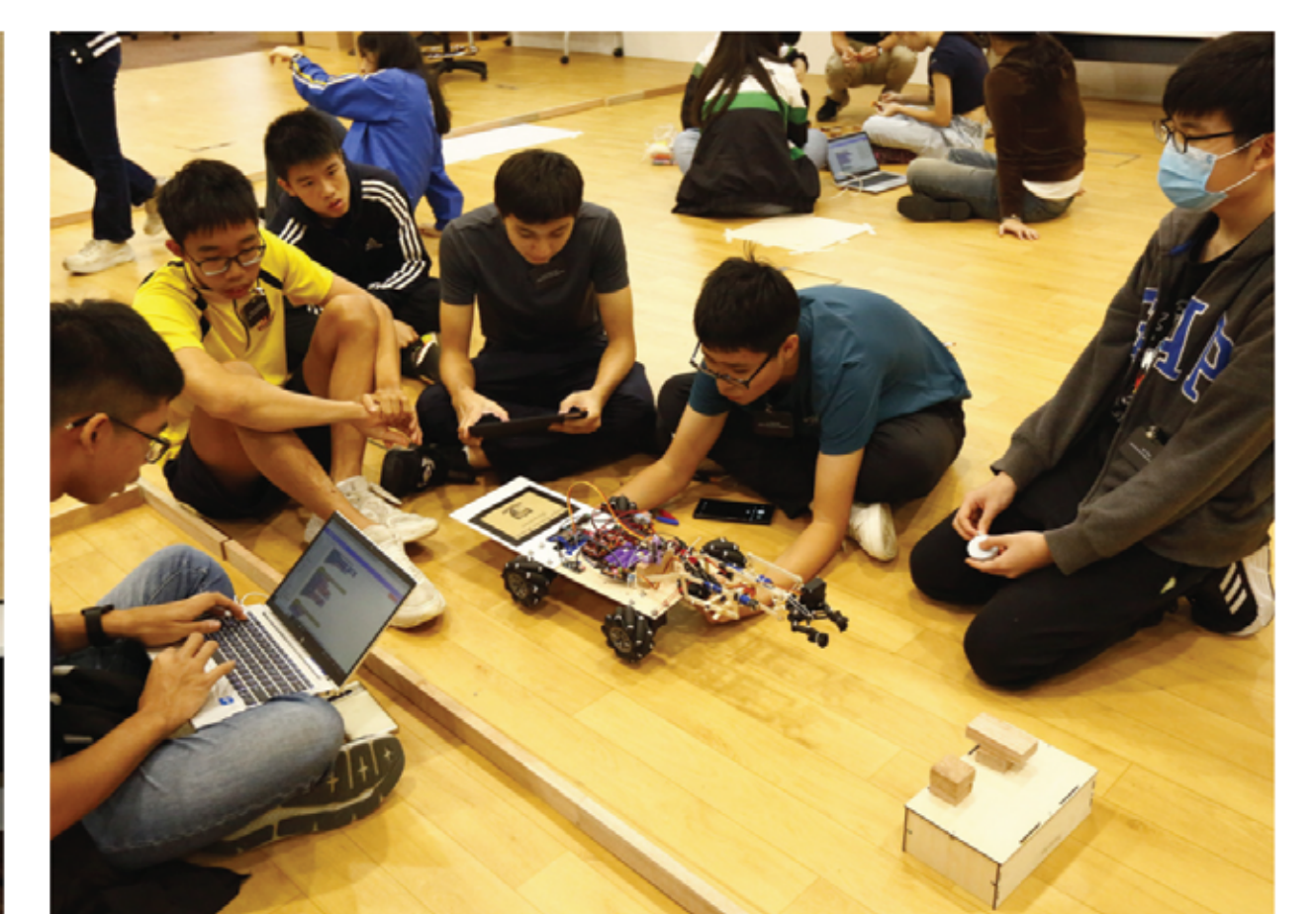
Arm and Claw Mechanism: The robot was equipped with a claw connected to a lifting arm, both controlled by servo motors.



Electronics: A PCA9685 servo controller and motor driver board were used in tandem with an ESP32 MCU to control the robot's peripherals. This ensured fast control loop iterations and reduced the load on the ESP32.



Technology: We replaced the rigid arm with a **6-bar lift** mechanism, increasing the claw's reach without an excessively large footprint, while ensuring that the claw would remain parallel to the ground at all times. To ensure stability, we braced the 6-bar lift to the camera mount with nails.



At first, our plan to tackle the block-stacking task was to simply elevate our robot for simplicity. However, due to time constraints and technical challenges, we realised this approach wouldn't be effective. Instead, we pivoted to building a **6-bar lift**, which, while more complex, ultimately allowed us to complete the task successfully despite the setbacks.

