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ROBOTICS, STEM & IoT: LEADING THE MALAYSIAN STUDENT GENERATION TOWARDS A SUSTAINABLE FUTURE

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ROBOTICS AND IoT IN EDUCATION: FROM SCHOOLS TO UNIVERSITIES

Robotics, a discipline within computer science and engineering, emphasizes the design, construction, and control of intelligent mechanical devices. Interest in robotics has been growing, not just among university students but also at the school level. Early exposure to robotics often begins in primary schools through various competitions, offering students the chance to delve into this rapidly advancing field. The Malaysian Ministry of Education has established numerous platforms and competitions to nurture students' skills in robotics. Additionally, these contests incorporate elements of STEM (Science, Technology, Engineering, and Mathematics), the Internet of Things (IoT), and the Sustainable Development Goals (SDGs).

Participation in robotic competitions offers numerous benefits for students, enhancing both their academic and personal development. These events improve students' communication, teamwork, problem-solving, and critical thinking skills [1][2]. They also increase interest in robotics, programming, and STEM subjects while fostering social skills and creating bonds between participants [3][4]. Robotic competitions boost students' self-confidence and robot knowledge [1], serving as a valuable tool for educators [4]. The collaborative nature of these events is crucial for their educational impact, with teamwork being a prerequisite for success [3]. Moreover, participation in international competitions like EUROBOT can significantly increase student motivation and provide opportunities to develop transversal skills in university studies [2].

ROBOTICS COMPETITIONS FOR SCHOOL STUDENTS

Exciting competitions such as state and national-level Minecraft Education and national-level Pikabot encourage students to integrate SDG principles like 'No Poverty,' 'Good Health and Well-being,' and 'Affordable and Clean Energy.' These competitions challenge participants to develop digital solutions promoting environmental sustainability.

The National Robotic Challenge (NRC), which employs Lego Education as its platform, enables students to explore robotics and IoT technology firsthand. In this engaging competition, students build IoT-integrated robots using Lego sets and tackle real-world challenges like natural disasters. This not only enhances their understanding of local disaster scenarios but also allows them to design, construct, and program their robots. By blending design, engineering, programming, and smart technology, the competition reinforces essential STEM concepts.

Figure 1: National Minecraft Education Challenge 2024
Source: https://mcedumy.com/mec-2024

ADVANCED ROBOTICS FOR HIGHER EDUCATION STUDENTS

For higher education students, the importance of robotics, IoT, and STEM education takes on a more advanced and research-focused dimension. At the university level, students have the opportunity to engage in hands-on projects that address real-world issues, from developing agricultural automation systems to creating disaster management technologies. Universities offer robotics and IoT courses, research opportunities, and industry partnerships, allowing students to work on innovative projects that solve complex problems.

ROBOTICS COMPETITIONS AND COLLABORATIONS FOR UNIVERSITY STUDENTS

Competitions such as the National Instruments Autonomous Robotics Competition (NI ARC) and the RoboCup provide university students with platforms to showcase their advanced robotics skills. These competitions encourage participants to develop autonomous systems capable of solving challenges in fields like industrial automation, healthcare, and environmental conservation. Such events also give students the chance to collaborate with experts in the field, pushing the boundaries of what robotics and IoT can achieve.

Beyond competitions, students at the tertiary level can explore internship programs with companies specializing in robotics, IoT, and artificial intelligence, gaining valuable industry experience. Many universities also encourage cross-disciplinary collaborations, where students from engineering, computer science, and even social sciences work together to integrate technology into various industries, such as agriculture, fisheries, and disaster management.

Figure 2: RoboCup Competition
Source: https://2024.robocup.org.my/

CULTIVATING FUTURE TECHNOLOGY LEADERS

Through these competitions and hands-on experiences, students not only foster interest and skills in robotics but are also exposed to the ever-evolving IoT technology. With continued support from the Ministry, schools, universities, and industry leaders, both school and higher education students can excel in robotics and IoT. This holistic approach will prepare them for future leadership roles in Malaysia's tech-driven economy and foster technological innovations that can contribute to critical fields such as agriculture, fisheries, and disaster management.

Figure 3: NI Autonomous Robotics Competition
Source: https://news.uitm.edu.my/uitmcpp-in-the-ni-autonomous-robotics-competition-2023/

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