Organisers

Southeast Asian Ministers of Education Organization

MEXT MINISTRY OF EDUCATION, CULTURE, SPORTS, SCIENCE AND TECHNOLOGY-JAPAN

In partnership with

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2023 SEAMEO-Japan ESD Award

Theme: Promoting Environmental Education through Utilizing Renewable Energy

SUBMISSION FORM

PART I: DETAILS OF YOUR SCHOOL

1. Name of your school SEKOLAH KEBANGSAAN TELOK RAMUNIA
2. Full address SEKOLAH KEBANGSAAN TELOK RAMUNIA, 81620 PENGERANG JOHOR, MALAYSIA
3. Postcode 81620 4. Country MALAYSIA
5. School's telephone number (country code+city code+telephone number) +6078264899
6. School's Email Address jba3019@moe.edu.my
7. School website (if available) https://www.facebook.com/sekolahkebangsaan.telokramunia?mibextid=ZbWKwL3
8. Approximate number of teachers participated in this programme
9. Approximate number of students participated in this programme 3

PART II: INFORMATION ABOUT THE SCHOOL'S PROGRAMME

The information of part II from no.1 to 14 should not be over five (5) pages long of A4 in total. The information should be written in **Times New Roman/Calibri font, font size 11**.

1. Title of the school's programme

MICROBIT IRRIGATION SOLAR SYSTEM

2. Summary of the programme (maximum of 300 words)

Microbit Irrigation Solar System (MISS) is an automatic irrigation system that uses Microbit technology and solar power to optimize irrigation in agriculture. MISS is designed to monitor soil moisture levels using wireless soil moisture sensors and provide watering according to plant needs, ensuring that plants receive the appropriate amount of water for optimal growth and health. The system is entirely powered by solar energy, making it sustainable and environmentally friendly. The use of Microbit technology provides high usability and ease of maintenance. MISS is also a modular system, meaning it can be customized and expanded according to user requirements. The system can be configured with additional sensors, pumps, and controllers to accommodate different crops and growing conditions. MISS is connected to the MISS application, which provides information about plant environmental conditions and controls the pump for watering. Users can monitor and manage plants remotely using internet-accessible devices. The use of MISS reduces water waste and increases crop yields, making it a valuable tool for farmers. The modular

design of the system also makes it easy to install and expand, providing flexibility for farmers. The system has the potential to revolutionize irrigation in agriculture and provide a sustainable and effective solution to the challenges of water scarcity and environmental degradation.

3. Objectives/goals of the school's programme

The primary objective of the "Microbit Irrigation Solar System" project is to design and develop an innovative and sustainable solution that leverages micro:bit technology, solar energy, and IoT connectivity to create an advanced automatic irrigation system. By seamlessly integrating these components, the project aims to empower users with efficient control over their garden irrigation, fostering water conservation and promoting plant health. The project seeks to achieve the following key goals:

- **Hardware and Software Integration**: The project intends to seamlessly integrate hardware components such as micro:bit microcontrollers, soil moisture sensors, water pumps, and solar panels. Additionally, it will involve coding micro:bit devices to effectively sense soil moisture levels and control the water pump, ensuring precise and automated irrigation.

- **Remote Monitoring and Control**: Through the integration of an IoT module, the system will enable users to remotely monitor and control their irrigation setup using a dedicated smartphone application. This objective aims to enhance user convenience, allowing them to manage their garden's irrigation needs from anywhere with internet connectivity.

- **User-Friendly Smartphone Application**: The development of the "Microbit Irrigation Solar System" smartphone application is designed to provide users with an intuitive interface. The app will offer real-time visualization of soil moisture levels, enabling users to make informed decisions about when and how much to irrigate. Furthermore, the application will facilitate manual control over the irrigation system, ensuring users have immediate intervention capabilities.

- **Energy Efficiency and Sustainability**: By harnessing solar energy to power the system, the project seeks to minimize environmental impact and promote sustainable practices. The implementation of energy-efficient strategies will optimize power consumption, thereby extending the operational life of the system without compromising its functionality.

- **Water Resource Conservation**: One of the primary goals of the project is to contribute to water conservation efforts. The system's ability to automate irrigation based on real-time soil moisture data will prevent over-watering, reducing water wastage and promoting responsible water use in gardening.

- **Educational and Awareness Impact**: Beyond its functional objectives, the project aspires to raise awareness about the benefits of utilizing renewable energy and IoT technology in everyday scenarios. By showcasing the advantages of solar-powered, smart irrigation systems, the project aims to inspire a wider adoption of sustainable practices among gardeners and enthusiasts.

In summary, the "Microbit Irrigation Solar System" project aims to create an automated irrigation solution that aligns with modern technological advancements while addressing environmental concerns. Through hardware integration, software development, and the creation of a user-centric smartphone application, the project intends to provide users with a reliable, energy-efficient, and environmentally conscious means of managing their garden irrigation needs.

4. Period of the time when the programme has been started

February 2022 - June 2022: Initial Development and Testing

- Project kickoff and planning.

- Hardware setup and integration, including micro:bit, sensors, pump, solar panel, and IoT module.
- Software development to enable soil moisture sensing, pump control, and IoT communication.
- Cloud integration and establishment of communication protocols.
- Basic version of the smartphone application ("Microbit Irrigation Solar System") developed for real-time data display and manual control.
- Extensive testing of the integrated system to ensure reliability and functionality.

July 2022 - December 2022: Enhancement and Iteration

- Gathering user feedback from initial users who started using the system in February.
- Iterative improvements based on user feedback, bug reports, and usage patterns.
- Fine-tuning of the system's algorithms for more accurate soil moisture measurement and irrigation control.
- Expansion of app features to include historical data insights, customization options, and notifications.
- Refinement of power-saving techniques to optimize energy consumption from the solar panel.
- Continued monitoring and adjustments to ensure consistent performance and energy efficiency.

January 2023 - July 2023: Advanced Features and Scaling

- Incorporation of advanced features into the smartphone application, such as data trend analysis, energy monitoring, and multi-device support.
- Potential scaling of the system to accommodate more users and installations.
- Continued user engagement to gather insights for further improvements and enhancements.
- Integration of additional sensors or functionalities to enhance the system's capabilities, based on user demands or emerging needs.
- Ongoing maintenance and support to address any technical issues or challenges that arise.

August 2023 - Present: Sustained Operation and Innovation

- The system has been operational for over a year and a half, with a strong user base benefiting from its features.
- Regular updates to the smartphone application to provide new features, bug fixes, and improvements.
- Exploration of opportunities for partnerships, collaborations, or community engagement to expand the impact of the project.
- Continued focus on sustainability, energy efficiency, and promoting responsible water use in gardening practices.
- Monitoring of industry trends and technological advancements to ensure the system remains relevant and up-to-date.

It's important to note that the timeline provided is a general overview and can vary based on the specific project's pace of development, user engagement, and unforeseen circumstances. If the project has been operational since February 2022, it's likely that there have been multiple iterations, improvements, and updates to both the hardware and software components to enhance the user experience and system efficiency.

5. Activities (strategies/activities of implementation, and brief information of each activity)

1. Hardware Setup and Integration:

- **Activity**: Connect micro:bit, sensors, water pump, solar panel, and IoT module.

- **Brief**: Physically integrate all hardware components to form a cohesive system. Ensure proper wiring, power connections, and compatibility.

2. Software Development: Micro:bit Programming:

- **Activity**: Code micro:bit devices for soil moisture sensing and water pump control.
- **Brief:** Develop the micro:bit firmware to read sensor data, make decisions based on moisture levels, and control the water pump accordingly.

3. IoT Integration and Communication:

- **Activity**: Integrate IoT module for remote communication and data transfer.
- **Brief**: Set up communication protocols to establish a connection between micro:bit devices and the cloud server, allowing real-time data transmission.

4. Cloud Platform Setup:

- **Activity**: Configure the cloud platform to receive, store, and manage data.
- **Brief**: Create a secure cloud infrastructure to handle data sent by micro:bit devices, ensuring data integrity and accessibility.

5. Mobile App Development: User Interface (UI) Design:

- **Activity**: Design the user interface for the smartphone application.
- **Brief**: Create a visually appealing and intuitive UI that allows users to interact with the irrigation system's data and controls.

6. Mobile App Development: Real-Time Data Display:

- **Activity**: Implement the app functionality to display real-time soil moisture data.
- **Brief**: Enable users to view current soil moisture levels from their smartphone, providing essential insights for irrigation decisions.

7. Mobile App Development: Manual Control Feature:

- **Activity**: Develop the feature to manually control the irrigation system.
- **Brief**: Allow users to trigger irrigation manually through the app, offering immediate intervention when needed.

8. Mobile App Development: Historical Data Insights:

- **Activity:** Implement data visualization for historical soil moisture trends.
- **Brief**: Provide users with the ability to analyze past moisture data trends to refine their irrigation strategies.

9. Energy Efficiency Optimization:

- **Activity**: Implement power-saving techniques to optimize energy consumption.
- **Brief**: Ensure that the system maximizes energy harvested from the solar panel and efficiently utilizes it for operation.

10. User Testing and Feedback Collection:

- **Activity**: Deploy the system in a controlled environment for user testing.
- **Brief**: Gather feedback from users about system usability, app experience, and any issues encountered.

11. Iterative Improvements:

- **Activity**: Continuously refine the system based on user feedback.
- **Brief**: Regularly update the hardware and software components to enhance functionality, user experience, and efficiency.

12. App Updates and New Features:

- **Activity**: Develop new features and updates for the smartphone app.
- **Brief**: Keep the app up-to-date by introducing new functionalities, addressing bugs, and improving the user interface.

13. Scaling and Community Engagement:

- **Activity**: Explore opportunities to scale the system's usage and engage with the gardening community.
- **Brief**: Share the project's benefits with a wider audience and potentially expand the system's reach.

14. Continuous Monitoring and Maintenance:

- **Activity**: Maintain the system's operational status and address any technical issues.
- **Brief**: Regularly monitor the system's performance, ensuring its reliability and addressing any challenges promptly.

15. Sustainability and Innovation:

- **Activity**: Focus on long-term sustainability and explore innovative enhancements.
- **Brief**: Continue promoting sustainability in gardening practices and seek ways to incorporate emerging technologies.

6. Teaching and learning approaches/strategies that the school has integrated into the programme

To effectively integrate the Microbit Irrigation Solar System project into a school program, a variety of teaching and learning approaches can be employed to engage students and enhance their understanding of concepts related to technology, sustainability, and innovation. Here are some approaches that the school have consider:

- **Project-Based Learning (PBL):** Organize the project as a PBL initiative where students actively explore and solve real-world problems. This approach encourages critical thinking, collaboration, and hands-on learning as students work on different aspects of the irrigation system, from hardware integration to app development.

- **Interdisciplinary Learning**: Integrate various subjects, such as science, technology, engineering, mathematics (STEM), and environmental studies, into the project. This interdisciplinary approach helps students see the holistic connections between different fields.

- **Hands-on Workshops:** Conduct workshops that provide students with practical skills related to coding, hardware assembly, sensor calibration, and data analysis. These workshops can be

facilitated by teachers, industry experts, or even senior students who have expertise in these areas.

- **Collaborative Teams:** Divide students into interdisciplinary teams to simulate a real-world development environment. Each team can be responsible for different aspects of the project, fostering collaboration, communication, and problem-solving skills.

- **Inquiry-Based Learning:** Encourage students to ask questions and explore answers independently. This approach promotes curiosity and self-directed learning as students investigate topics like solar energy, IoT, soil moisture, and water conservation.

- **Field Trips and Guest Speakers:** Organize visits to solar energy installations, gardens, or tech companies to provide students with real-world context. Invite guest speakers from related industries to share their experiences and insights.

- **Research Projects:** Assign research projects related to the project's themes, such as the benefits of solar energy, the importance of water conservation, or the impact of IoT on agriculture. Students can present their findings to the class.

- **Prototyping and Testing:** Encourage students to build prototypes and conduct testing to validate their ideas. This hands-on approach helps them learn through trial and error, fostering a growth mindset.

- **Reflection and Documentation**: Incorporate reflective practices, such as journaling or blog writing, where students document their progress, challenges, and insights. This promotes metacognition and enhances their understanding of the learning process.

- **Showcase Events:** Organize a showcase event where students present their final projects to peers, teachers, parents, and potentially even members of the community. This provides a platform for students to demonstrate their accomplishments and receive feedback.

- **Peer Learning:** Allow students to share their expertise and learn from each other. Peer teaching and collaboration can enhance communication skills and create a positive learning environment.

- **Ethical and Environmental Discussions:** Include discussions about the ethical implications of technology use, the environmental impact of agriculture, and the responsibility of innovation in sustainable practices.

By integrating these teaching and learning approaches into the Microbit Irrigation Solar System project, the school can create a rich and engaging educational experience that not only imparts technical skills but also fosters critical thinking, collaboration, and a deeper understanding of sustainability and innovation.

7. Engagement with the community and sharing of school practices to the community

Here are our engagement with the community and sharing of school practice to the community about our Microbit Irrigation Solar System project.

Sharing with Nearby Schools:

- Collaborative Workshops: Organize workshops or presentations for nearby schools to introduce them to the project. Share insights about its objectives, technology components, and educational benefits.
- Hands-On Sessions: Offer hands-on sessions where students from other schools can interact with the irrigation system and experience its functionality firsthand.

- Guest Speaker Invitations: Invite students and teachers from neighboring schools to our school. Deliver presentations and provide guided tours of the project to give them an in-depth understanding.

Participation in Kembara Mahkota Johor:

- **Project Showcase**: Use the Kembara Mahkota Johor event as an opportunity to showcase your project to a wider audience, including Johor Royalty and event attendees.
- **Interactive Displays**: Create interactive displays that engage visitors and help them understand the significance of the project's technology and sustainability goals.
- **Engaging Presentations**: Prepare engaging presentations that highlight the project's journey, challenges, and achievements. Emphasize the benefits it brings to the community and the environment.

Continuously Sharing with SK Telok Ramunia Students:

- **Incorporate into Curriculum:** Integrate the project's concepts into the curriculum, ensuring that students are exposed to the project's themes during their regular studies.
- **Assemblies and Workshops**: Conduct special assemblies or workshops where students are updated on the project's progress, encouraging their curiosity and interest.
- **Student Demonstrations**: Encourage project team members to give demonstrations to students, showcasing the technology, data analysis, and positive impact on the environment.
- **Student-Led Initiatives**: Empower students to take the lead in sharing their knowledge about the project with their peers. Encourage them to create presentations, videos, or displays.

Social Media and Online Platforms:

- **Online Updates:** Share regular updates about the project's achievements, events, and milestones on the school's social media in Facebook.

Community Engagement Initiatives:

- **Parent-Teacher Involvement:** Involve parents and teachers in the project's journey. Organize parent-teacher sessions or workshops where they can learn about the project and its educational impact.

Feedback Collection and Engagement:

- **Interactive Booths:** Set up interactive booths at events or school fairs where visitors can learn about the project, ask questions, and provide feedback.
- **Feedback Forms:** Provide feedback forms for attendees to share their thoughts, suggestions, and ideas for future development.

Collaboration with Cenviro:

Joint Workshops and Seminars:

- Organize joint workshops and seminars with Cenviro, focusing on the intersections of technology, sustainability, and environmental conservation. These events can educate students and the community about innovative solutions and best practices.

Resource Sharing:

- Benefit from Cenviro's resources, such as research materials, case studies, and data, to enrich your educational content and provide real-world context to your students.

Project Collaborations:

- Explore collaborative projects that align with Cenviro's goals and expertise. This could involve waste reduction initiatives, awareness campaigns, or community-based sustainability projects.

Shared Events and Workshops:

- Co-host events, workshops, or competitions with Cenviro that focus on sustainability, waste reduction, and innovative technologies.

Shared Promotions and Publications:

- Collaborate on promoting your project's success stories and achievements through joint publications, press releases, and social media campaigns.

Engaging Cenviro's Network:

- Leverage Cenviro's network to involve other stakeholders, community members, and environmental enthusiasts in your project.

Long-Term Collaboration:

- Build a lasting relationship with Cenviro that extends beyond the project's timeline. Long-term collaboration can yield ongoing benefits for both parties and the wider community.

8. Monitoring and evaluation mechanisms

1. Monitoring Mechanisms:

Real-Time Data Tracking:

Utilize the IoT platform to continuously collect and monitor real-time data from the micro:bit devices, including soil moisture levels, energy generation from the solar panel, and system performance.

Automated Alerts:

Implement automated alert systems that notify relevant stakeholders via email or SMS in case of critical issues, such as low battery levels or sensor malfunctions.

Dashboard Visualization:

Create a user-friendly dashboard within the smartphone app or a web interface to display the system's current status, historical data, and any anomalies detected.

Remote Monitoring:

Enable remote monitoring of the system's performance, allowing administrators and users to check its status from anywhere with an internet connection.

Regular Check-ins:

Conduct regular check-ins and status updates with the project team to review progress, address challenges, and ensure timely implementation.

2. Evaluation Mechanisms:

Objective Measurement:

Define specific and measurable project objectives, such as energy savings, water conservation, or user engagement. Regularly assess progress toward these objectives.

Performance Metrics:

Establish key performance indicators (KPIs) related to the system's functionality, user satisfaction, energy efficiency, and environmental impact.

User Feedback Surveys:

Gather feedback from users through surveys or questionnaires to assess their experience with the smartphone app, the system's reliability, and any suggestions for improvement.

Data Analysis:

Analyze historical data trends to evaluate the effectiveness of the irrigation system in conserving water and optimizing plant growth.

Comparative Studies:

Conduct comparative studies between periods with and without the system to gauge its impact on water usage and plant health.

Stakeholder Interviews:

Interview relevant stakeholders, such as students, teachers, community members, and Cenviro representatives, to understand their perspectives on the project's benefits.

Technical Assessments:

Regularly assess the technical aspects of the system, including hardware performance, software stability, and energy efficiency.

Cost-Benefit Analysis:

Perform a cost-benefit analysis to determine whether the benefits achieved align with the resources invested in the project.

3. Review and Iteration:

Regular Review Meetings:

Hold periodic review meetings with the project team to discuss monitoring and evaluation results, identify areas for improvement, and make informed decisions.

Adaptive Management:

Implement adaptive management strategies based on the monitoring and evaluation findings. If necessary, modify project strategies to enhance outcomes.

Continuous Improvement:

Encourage a culture of continuous improvement by using evaluation results to refine processes, update the app, enhance user experience, and optimize system performance.

9. Measurable achievement of the school's programme to students, teachers, parents, and wider community

No.	Competiton / program	Achievement
1	Innovathon Astro,Program (July 2023)	People's Choice Award
2	Istec Bali, (May 2023)	Grand Award & Gold Award
3	SITC 2022 Utm Innovation Project Competition) Open	First place
4	Virtual Innovation Competition 3rd Edition 2022.	Gold Medal Top 5 Awards Junior Scientist.
5	Microbit Innovation & Robotics Competition (miRC) 2022	Gold Medal
6	iidex 2022 (Invention, innovation & design exposition 2022)	Gold Award
7	Ivediic 2022 (International Virtual Educational Design, Invention & Innovation Competition 2022) OPEN	The Special Jury Award for Product Pitching. Gold Award.

10. Plan for future

Looking ahead, the future of the "Microbit Irrigation Solar System" project is guided by a multifaceted plan that emphasizes continuous improvement, educational integration, community engagement, sustainability, scalability, student empowerment, and long-term sustainability. With a commitment to ongoing enhancement, regular feedback collection from users and students will drive iterative updates to the system, smartphone app, and user experience, ensuring the project remains aligned with user needs and technological advancements. Educationally, the project's integration into the curriculum will deepen, fostering cross-disciplinary learning and nurturing students' critical thinking and innovation skills. Through community workshops, partnerships with organizations like Cenviro, and frequent public demonstrations, the project will extend its impact, advocating for sustainable practices and environmental awareness. Sustainability will remain a core focus, with thorough environmental impact assessments, eco-friendly gardening advocacy, and exploration of cutting-edge technologies. Scaling the project's reach, both within the region and by encouraging replication, aims to create a broader influence on sustainability initiatives. Student empowerment takes center stage as students lead initiatives, propose innovations, and become project ambassadors. To ensure its long-term sustainability, maintaining collaborations with partners like Cenviro, involving project alumni, and establishing a legacy plan will secure the project's continued growth and impact, serving as a beacon of technological innovation and sustainable education for years to come.

11. Interrelationship of the school's programme with other Sustainable Development Goals (SDGs) (Please refer to page 2 in the Information Note or https://sustainabledevelopment.un.org/sdgs)

Microbit Irrigation Solar System implemented in a school's program can have several interrelationships with different Sustainable Development Goals (SDGs):

SDG 2: Zero Hunger: The solar irrigation system can enhance agricultural productivity, leading to increased food production. This aligns with SDG 2's goal of eliminating hunger and achieving food security.

SDG 7: Affordable and Clean Energy: The solar irrigation system utilizes renewable energy sources, contributing to the generation of clean and sustainable energy, which is a core objective of SDG 7.

SDG 13: Climate Action: By using solar energy for irrigation, the system reduces greenhouse gas emissions compared to conventional energy sources, aligning with the goal of mitigating climate change as outlined in SDG 13.

SDG 4: Quality Education: The solar irrigation system can serve as an educational tool. Students can learn about renewable energy, sustainable agriculture, and water management, supporting quality education and awareness related to SDGs.

SDG 6: Clean Water and Sanitation: Efficient water management through the solar irrigation system can contribute to responsible water use, thus supporting SDG 6's aim of ensuring clean water availability and sustainable water resource management.

SDG 9: Industry, Innovation, and Infrastructure: Implementing innovative technologies like a solar irrigation system demonstrates progress in infrastructure development and promotes technological innovation, in line with SDG 9.

SDG 11: Sustainable Cities and Communities: The solar irrigation system showcases sustainable practices that can inspire the local community, fostering a sense of sustainable development within the region, thus supporting SDG 11.

SDG 12: Responsible Consumption and Production: The efficient use of resources, such as water and energy, exemplified by the solar irrigation system, contributes to responsible consumption and production patterns as advocated in SDG 12.

SDG 15: Life on Land: Sustainable agricultural practices promoted by the solar irrigation system can help prevent soil degradation and land desertification, aligning with the goal of preserving terrestrial ecosystems outlined in SDG 15.

It's important to recognize that the success of such a program lies in its ability to address multiple SDGs simultaneously, illustrating the interconnected nature of sustainable development goals.

12. Link(s) to the information of school's programme in social media platforms such as facebook, website, youtube

https://www.facebook.com/sekolahkebangsaan.telokramunia?mibextid=ZbWKwL

13. Photos related to the activity/programme (Maximum of five (5) photos with captions in English)

(Discussion on building the prototype)

Photo 2

(Product presentation for District Education Officer)

Photo 3

(The process of upgrading the system)

Photo 4

(The finalist for a reality programme called Innovathon)

Photo 5

(Involve in the exhibition during Johor Royal Tour)