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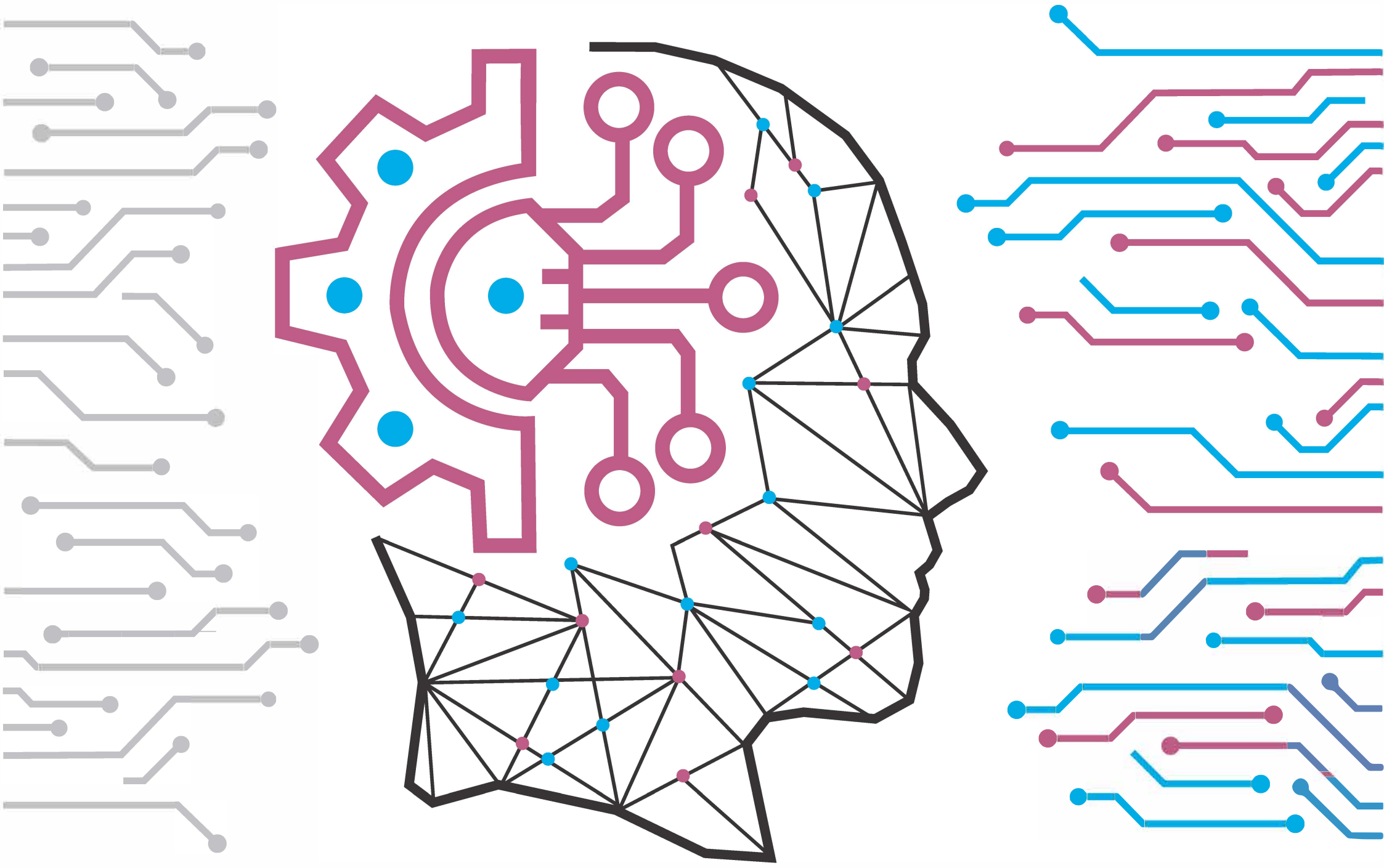

13TH IIDES 2024

ENVIRONMENTAL • SOCIAL • GOVERNANCE

THE 13TH INTERNATIONAL INNOVATION, INVENTION & DESIGN COMPETITION 2024

EXTENDED ABSTRACTS

e-BOOK

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THE 13th INTERNATIONAL
INNOVATION, INVENTION &
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SOLAR PANEL FOR INTEGRATED IRRIGATION SYSTEM

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ABSTRACT

Agriculture is a crucial sector in society for fulfilling food needs. However, there are numerous challenges faced in contemporary Indonesian agriculture. One of them is the El Nino climate phenomenon, which leads to a decrease in water availability for irrigation. Hence, innovative solutions are needed for agricultural irrigation while remaining environmentally friendly, utilizing solar panels that harness sunlight. Solar-powered irrigation is expected to meet the watering needs in the agricultural sector. This research will discuss the implementation of solar panels for agricultural irrigation systems to support agricultural productivity.

Keywords: climate, solar panels, irrigation system.

1. INTRODUCTION

The global reserves of energy derived from fossil fuels are gradually dwindling. This is highly relevant considering the continually increasing energy consumption each year. According to data on energy usage by the Central Statistics Agency, there was a rise in final energy consumption in 2022 of approximately 45.0%, or 6,914,802 terajoules. With this issue at hand, we are compelled to explore new technologies as sources of renewable energy.

Indonesia is famous as an agrarian country due to the majority of its population working in the agricultural sector. However, now, the agricultural sector has begun to be overshadowed by the industrial sector. This shift cannot be overlooked because Indonesia holds promising agricultural potential if managed effectively. Efforts are needed to establish a modern agricultural system that captures the interest of Indonesian youth. One solution is the utilization of solar energy for agricultural irrigation systems.

The abundance of sunlight in tropical countries like Indonesia presents an opportunity for solar energy to be utilized as an alternative source of renewable energy. Solar power does not produce emissions, making it more environmentally friendly compared to the use of diesel engines that rely on oil-based fuels. Solar panels can aid agricultural irrigation systems by generating electricity to power water pumps used for irrigation purposes. Furthermore, sunlight can be converted into electrical energy through solar panels, which can help enhance agricultural productivity.

2. METHODOLOGY

The research begins by identifying agricultural irrigation systems in Indonesia, highlighting related issues, exploring and analyzing ideas to address these issues, and concluding with the development of a new product. The use of diesel engines as the primary tool for agricultural irrigation presents several other drawbacks, such as high carbon emissions, difficult engine maintenance, higher taxes, and loud noise. Aside from these, diesel engines face common challenges in obtaining access to high-quality fuel, especially given Indonesia's high energy consumption, which rapidly depletes non-renewable

energy sources. Therefore, there is a need for renewable innovation aimed at understanding the issues with diesel engine use, effective strategies to address these issues, and alternative product innovations to replace the use of diesel equipment.

To create this innovation, a study of this research needs to be conducted. The initial step is to conduct a literature review on the use of diesel engines in agricultural irrigation systems and identify several related products. The review reveals the strengths and weaknesses that need to be considered in developing a superior product. Next, data collection from the developed innovation is necessary to determine characteristics, energy efficiency, benefits, and operational costs. This is crucial to assess whether the innovative product can address issues in the irrigation system. Finally, a literature review on the use of diesel engines in agricultural irrigation systems is conducted. This literature review is carried out by gathering data from papers, articles, and journals. The innovation is tested and crafted to address the analysis phase. Data analysis is performed once the results are obtained. After the analysis process, the innovation is developed into a new product. Using the data collected from the literature review, literature study, and data analysis, it can be determined whether the innovation can solve the discussed issues and offer a better alternative for all stakeholders involved.

3. FINDINGS

As an agrarian nation, the success of agriculture has significant impacts on food security, societal well-being, and the country's economy. However, to achieve optimal agricultural outcomes, various aspects supporting plant growth need to be considered, one of which is irrigation. Irrigation is a crucial endeavour in agriculture to provide and manage water to support plant growth. However, many rice field areas lack electricity access, making it difficult to implement irrigation systems. Therefore, a compact, easy-to-use, and affordable portable irrigation system is needed. To support and facilitate farmers' irrigation systems, we are revolutionizing the process by harnessing solar panels to convert sunlight into electrical power. Sunlight is absorbed by solar panels, then converted into electrical energy and stored in batteries. Subsequently, the stored electrical energy is used to power water pumps. These pumps will draw water and distribute it to the rice fields. Figure 1 below is an illustration of the process by which solar panels work for irrigation systems.

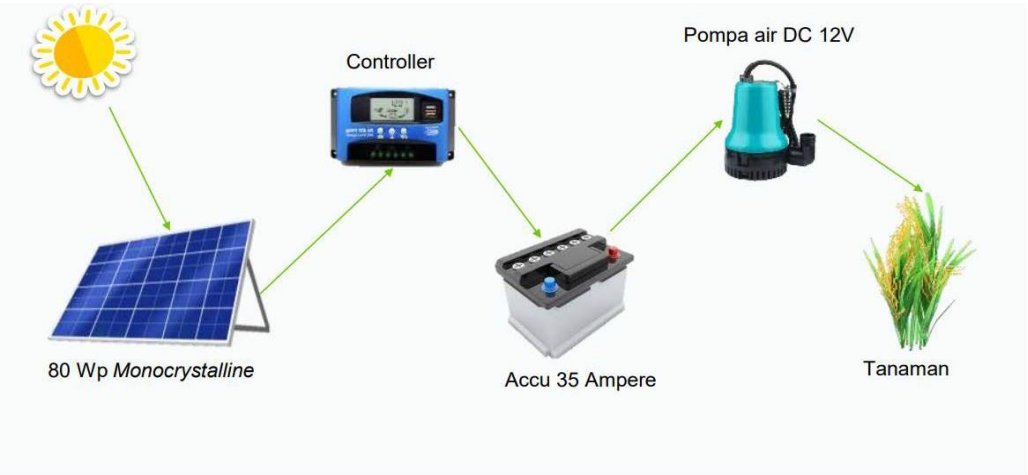

Figure 1 Process of Harnessing Electricity Using Sunlight through Solar Panels for Irrigation

Simulation of Battery Charging Calculations from Solar Panels
Capacity = Imp X Time
Time = 100Ah / 17.45A = 5.7 Hours
Simulation of calculating the usage time of a water machine with a load of 750W
Time = Capacity / I_Load
Time = 100Ah / 3.4A = 29.4 Hours

The challenges faced include the high initial cost of the installation of solar panels due to the rarity of equipment and supplies being sold in offline stores (controllers and DC pumps). The solution lies in government subsidy and incentive schemes, micro-financing models, and partnership programs. Additionally, the availability of electricity and internet infrastructures in rural areas remain limited. The solution involves improving electricity and internet infrastructure and developing off-grid renewable energy solutions. Moreover, technical knowledge and skills are required, and farmers need training and education on the use and maintenance of solar panel irrigation systems. The solution to these challenges is to implement farmer training and mentoring programs, develop educational materials, and provide practical guides.

4. CONCLUSION

The utilization of solar panels for agricultural irrigation presents an innovative and sustainable solution to enhance irrigation efficiency, increase crop productivity, and strengthen food security. Existing challenges can be addressed through a combination of government policies, flexible financing schemes, farmer education and training programs, and infrastructure development. With proper implementation, the solar panel-based irrigation revolution can empower farmers, improve community welfare, and support sustainable rural development.

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