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NOVEL APPROACH TO AUTOMATED SOLAR POWERED HYBRID DNA ELECTROPHORESIS EQUIPMENT

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Due to a lack of domestic repair and manufacturing, Sri Lanka faces a shortage of several instruments important for research activities. Agarose gel electrophoresis equipment is a simple but vital tool in biomedical sciences specially in the areas of genetics and molecular biology. It is used to separate mixtures of DNA, RNA, or proteins according to their size and charge. There are various versions and agarose gel electrophoresis uses an electric field to separate a mixed population of macromolecules in an agarose matrix. Conventional gel electrophoresis setups further require additional separate devices such as power supplies and UV illuminators to visualize DNA. This increases the cost and requires manual monitoring during an analysis. This study addressed these issues by presenting a novel, low-cost gel electrophoresis machine that could test DNA samples, specifically to be used in Sri Lankan laboratories. The machine utilizes readily available materials in the country and integrates the gel running unit, power unit, and illuminator into a single system. User-friendly features include a high-end display with a graphical user interface (GUI), an in-built illuminator with image processing functionalities, cloud-based data management, and Raspberry Pi programmed with the help of AI to control for stand-alone operation. Additionally, the machine incorporates solar power as a secondary source and a battery management system for enhanced reliability. The cost of production is extremely lower than the current market price in the country. Therefore, this low-cost, locally sourced machine offers a sustainable solution for Sri Lankan laboratories, reducing reliance on imported equipment and minimizing maintenance costs.

Keywords: AI, Biomedical sciences, Electrophoresis, Machine learning, Renewable energy