ABSTRACT

Used cooking oil, or waste cooking oil, is a byproduct of repeated frying and cooking processes, predominantly produced by the culinary sector, including restaurants, street food vendors, and households. As the consumption of fried foods increases, the volume of waste cooking oil also rises significantly. If not managed properly, this waste poses several negative impacts. From an environmental perspective, improper disposal contaminates soil and water bodies. From a health standpoint, repeated use of cooking oil generates harmful compounds, such as free radicals, that can lead to degenerative diseases. The primary issue identified in this study is the lack of efficient technology to separate used cooking oil, preventing its optimal utilization as a biodiesel feedstock.

To address this issue, this research proposes the development of a waste cooking oil separation system based on Internet of Things (IoT) technology. This solution leverages the principle of density differences between oil and water to achieve automated separation. The system is designed using ultrasonic and color sensors to detect water content in the oil in real-time and employs a gravity-based container with three valves to separate oil, water, and impurities. The integration of IoT technology enables remote monitoring and control of the process through digital devices, enhancing operational efficiency and accuracy.

The system testing demonstrated that the devices were well integrated across subsystems using internet connectivity, enabling communication to send and receive data from the NodeMCU to the mobile application, such as pump status, LED status, and oil percentage. The system was also capable of transmitting data in real-time, despite an average delay of 0.7 seconds in communication between the NodeMCU, Firebase, and the mobile application. This delay remains within the tolerance limits of IoT implementation and does not significantly impact system performance.

Keywords: waste cooking oil, IoT technology, automatic separation, biodiesel, sustainability