Smart Oil Extraction System with Customer and Owner Modes

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Abstract: The Smart Oil Extraction System is designed to efficiently extract and manage oil based on weight input in customer mode and liter consumption in owner mode. The system features a mode switch for toggling between modes, a flow sensor to measure input weight, temperature sensor for monitoring temperature, an on/off switch for controlling oil extraction using a relay and DC pump, and IoT integration for remote monitoring. Additionally, it includes a humidity sensor, alarm, LED indicator, and LCD display for real-time feedback and control. In customer mode, the system extracts oil based on the input weight, automatically stopping when the input is finished. In owner mode, the owner can consume oil based on liters. The system ensures safety and efficiency by automatically stopping the pump and indicating an alarm in case of high temperature. It also alerts the user by changing the LED colour from green to red if the humidity is high, and displays relevant information on the LCD. Overall, the Smart Oil Extraction System provides a user-friendly and efficient solution for oil extraction and consumption management.

I. INTRODUCTION

The introduction to the Smart Oil Extraction System would delve into the pressing need for efficient and reliable oil extraction and management solutions. It would highlight the importance of oil in various industries, including food production, cosmetics, and pharmaceuticals, emphasizing the increasing demand for streamlined extraction processes. Additionally, it would underscore the challenges associated with traditional extraction methods, such as imprecise measurements, safety concerns, and lack of real-time monitoring capabilities.

Next, the introduction would introduce the Smart Oil Extraction System as a groundbreaking solution designed to address these challenges. It would outline the key features of the system, including its mode switch for customizable operation, flow sensor for accurate measurement, temperature sensor for safety monitoring, and IoT integration for remote access and control. These features would be described in detail to illustrate how they contribute to the system's overall efficiency and effectiveness.

Furthermore, the introduction would highlight the user-friendly nature of the system, emphasizing its intuitive controls, visual feedback mechanisms (such as LED indicators and LCD displays), and automatic stop functionalities. These aspects would be discussed in terms of their role in simplifying the extraction process and enhancing user experience.

Overall, the introduction would set the stage for the subsequent discussion by framing the Smart Oil Extraction System as a cutting-edge solution that addresses the pressing needs of the oil extraction industry. It would emphasize the system's innovative features, user-centric design, and potential to revolutionize the way oil extraction is conducted.

II. LITERATURE REVIEW

Mohd Naved; V. Ajantha Devi; Loveleen Gaur; Ahmed A. Elngar [2022], proposed that the convolutional neural networks (CNNs), a type of deep neural network that has become dominant in a variety of computer vision tasks, in recent few years has attracted interest across a variety of domains due to their high efficiency at extracting meaningful information from visual imagery. Convolutional neural networks (CNNs) excel at a wide range of machine learning and deep learning tasks. As sensor-enabled internet of things (IoT) devices pervade every aspect of modern life, it is becoming increasingly critical to run CNN inference, a computationally intensive application, on resource-constrained devices. Through this edited volume they aim to provide a structured presentation of CNN enabled IoT applications in vision, speech, and natural language processing. This book discusses a variety of CNN techniques and applications, including but not limited to, IoT enabled CNN for speech de-noising, a smart app for visually impaired people, disease detection, ECG signal analysis, weather monitoring, texture analysis, etc. Unlike other books on the market, this book covers the tools, techniques, and challenges associated with the implementation of CNN algorithms, computation time, and the complexity associated with reasoning and modelling various types of data. They have included CNN's current research trends and future directions.

Haitham M. Osman [2018], In this paper, a systematic approach for comparing popular modeling techniques such as Response Surface Method, Radial Basis Functions (RBF), and Artificial Neural Network (ANN) to model hexane sesame oil extraction process is investigated, based on multiple performance criteria.

Nur Badariah Ahmad Mustafa; Icewaria Devi Ramasamy; Farah Hani Nordin; Nik Hakimi Nik Ali; Hidayat Zainuddin [2022], they proposed that transformer oil or insulating oil is stable at high temperatures and has excellent electrical insulating properties. The most frequent problems occurred in transformer were related to the defects and weakness of the insulation systems. Many diagnostic methods have been introduced to provide the reliable assessment of insulating oil quality. Hence, in this work, image processing technique known as feature extraction is used to measure the cellulose bridging thickness in pre-bridging and bridging stage. These two stages were considered as early prediction before breakdown occurs. The cellulose bridging formation recorded in three selected types of transformer oils which include MIDEL 7131, PFAE and Gemini X mineral oil. The cellulose bridging images were captured from the bridging formation videos and 60 images were chosen from the extracted cellulose bridging images for each transformer oil. The 60 images were divided equally for pre-bridging stage and bridging stage. The captured images were then fed into feature extraction process to extract eight feature descriptors which include area, minor-axis length, major-axis length, orientation, contrast, correlation, energy and homogeneity. In their findings, the pixel values increase proportionally with the cellulose bridging thickness.

Hence, distinct pattern of pre-bridging and bridging stages were illustrated in all feature descriptors. With this technique, an early prediction can be made to analyze the deterioration of transformer oil.

Aroun Clément Baudouin-van Os; Maneesha Vinodini Ramesh [2022], said that solar thermal lemongrass (Cymbopogon flexuosus) essential oil extraction is a potential sustainable livelihood for the Indian rural population. In this work, an extensive review of existing extraction techniques, their performances, fitness to the context, as well as sustainability and efficiency factors has been elaborated. While microwave assisted methods can reduce the extraction time and increase the yield, it is at the cost of added complexity and dependency on electric energy, which can be unfit for communities that experience scarce supply. It is required to measure the performance of the microwave hydrodiffusion and gravity (MHG), and microwave steam diffusion (MSDf) methods with the lemongrass genus to verify their advantage over steam distillation, which in the study's context remains the favorite. The study has unveiled that four key factors need to be considered for ensuring the sustainability of the livelihood: (a) implementation price, (b) operational price, (c) energy consumption, and (d) extraction time. Essential oil extraction can be optimized by six different categories of efficiency factors: (a) post-harvesting drying, (b) plant rehydration, (c) plant chopping size, (d) water to grass ratio, solid loading or plant packing, (e) temperature, steam heat, pressure and airflow, and (f) microwave power.

Lili Ren; Cheng Kong; Xiaohui Weng; Rongsheng Zhao; Zongwei Yao; Zhiyong Chang [2023], proposed that the evaluation of oil shale is significant to oil and gas exploration. Electronic nose (E-nose) has excellent odor recognition characteristics and can be used as a potential tool for oil content recognition. In this article, the odor samples of Huadian and Wangqing oil shale with different oil contents were obtained, and the recognition ability and feasibility of E-nose on oil content were investigated for the first time. More comprehensive information of oil shale was obtained by using transient and steady-state fusion feature (TAS) extraction method, which improves the recognition rate, and the influence of feature extraction methods and temperatures on oil content recognition were further discussed. The experimental results show that the E-nose combined with the proposed feature extraction method can realize the rapid in situ recognition of oil content at low temperatures. This work will help to propose more effective methods for the evaluation and development of oil shale.

III. METHODOLOGY

The development of the Smart Oil Extraction System involves a meticulously structured methodology designed to deliver a comprehensive and efficient solution for oil extraction and management. This methodology encompasses several key phases, each crucial for ensuring the system meets user requirements, adheres to industry standards, and achieves optimal functionality. The first phase, Requirements Analysis, initiates the process by gathering and analyzing user needs and expectations. Stakeholder interviews, surveys, and market research are conducted to identify key features, functionalities, and performance criteria. These requirements are documented in detail, covering aspects such as input parameters, mode selection, safety features, user interface design, IoT integration, and data analytics capabilities. The analysis phase serves as the foundation for the subsequent phases, guiding the design, development, testing, and deployment of the system.

In the Design phase, the system architecture, components, and interactions are conceptualized and specified based on the requirements identified in the analysis phase. This involves designing both the hardware and software components of the system. Hardware components such as sensors, switches, pumps, and relays are designed to meet the system's functional requirements and ensure compatibility and reliability. Similarly, software components such as the control algorithm, user interface, and IoT platform integration are designed with usability, scalability, and maintainability in mind. Consideration is given to factors such as system scalability, reliability, and ease of maintenance to ensure long-term viability and usability.

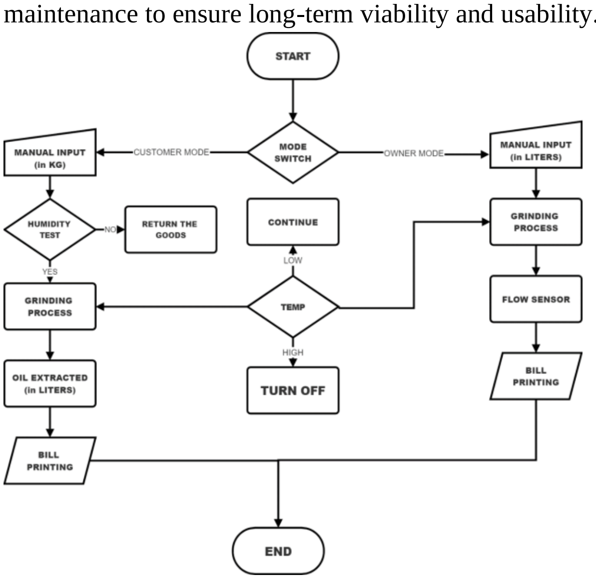

Fig (a) Flow diagram

Following the design phase, the Development phase commences, where the Smart Oil Extraction System is implemented according to the design specifications. Hardware components are assembled and integrated, and software components are developed and programmed. This may involve coding the control algorithm, developing the user interface, implementing IoT communication protocols, and integrating sensors and actuators. Development follows best practices in software and hardware engineering, ensuring code modularity, readability, and reusability. Throughout the development process, close attention is paid to quality assurance to ensure that the system functions as intended and meets the specified requirements.

Once development is complete, the system undergoes rigorous Testing and Evaluation to verify its functionality, performance, and reliability. This includes various types of testing, such as unit testing, integration testing, and system testing, to evaluate the system's behavior under different conditions. Testing scenarios simulate real-world usage scenarios, including different input parameters, mode selections, and abnormal conditions. User acceptance testing may also be conducted to gather feedback and validate user satisfaction. The testing and evaluation phase aims to identify and address any issues or defects in the system before deployment, ensuring that the system meets quality standards and user expectations.

After successful testing and evaluation, the Smart Oil Extraction System is ready for Deployment in real-world settings. Deployment involves installing the system at customer sites, configuring settings according to user preferences, and providing training and support to users. The deployment phase also includes ongoing monitoring and maintenance to ensure smooth operation and address any issues that may arise. User documentation and manuals are provided to guide users in system operation, maintenance, and troubleshooting.

Throughout the entire methodology, an iterative approach may be employed to allow for continuous refinement and improvement based on feedback from stakeholders, user testing, and real-world usage data. This iterative approach ensures that the Smart Oil Extraction System remains adaptable to changing user needs, technological advancements, and industry trends over time.

In summary, the methodology employed in the development of the Smart Oil Extraction System is a systematic approach aimed at delivering a user-friendly, efficient, and reliable solution for oil extraction and management. By following this methodology, the project team can ensure that the system meets user requirements, adheres to industry standards, and achieves the desired outcomes effectively and efficiently.

IV RESULT AND DISCUSSION

The result of the Smart Oil Extraction System project is a fully functional and efficient solution for oil extraction and management that meets the needs and expectations of users. The system offers two distinct modes of operation—Customer Mode and Owner Mode—providing flexibility and control to individuals and businesses alike.

In Customer Mode, users can easily initiate the oil extraction process by inputting parameters such as the weight of the oil-bearing material. The system automatically controls the extraction process, activating components such as the DC pump and relay to commence extraction while monitoring parameters like flow rates, temperatures, and humidity levels in real-time. Safety features, including an automatic stop mechanism, ensure that the process halts in case of overextraction or overheating, with alerts and notifications promptly notifying users of any abnormal conditions. The user-friendly interface, featuring an LCD display and LED indicators, provides real-time feedback and control throughout the extraction process, while data analytics tools analyse process efficiency and trends, enabling proactive maintenance and optimization.

In Owner Mode, operators have comprehensive control and oversight over the extraction process, consumption management, and system maintenance. Through a web interface or mobile application, owners can monitor extraction progress, adjust parameters, manage oil consumption based on liters, schedule maintenance tasks, and receive alerts and notifications for any issues detected during the process. Remote control capabilities allow owners to intervene if necessary, ensuring smooth operation and preventing downtime. Data analytics tools provide insights into process efficiency, performance metrics, and trends over time, empowering owners to make data-driven decisions and optimize system performance.

The result of the Smart Oil Extraction System project is a user-friendly, efficient, and reliable solution that streamlines the oil extraction process while ensuring safety, quality, and sustainability. By leveraging advanced technologies such as IoT integration, real-time monitoring, and data analytics, the system enhances operational flexibility, responsiveness, and efficiency, ultimately leading to improved productivity and cost savings for users. Moreover, the system's modular design and iterative development approach enable scalability and adaptability to evolving user needs and technological advancements, ensuring its long-term viability and relevance in the rapidly changing landscape of oil extraction and management. Overall, the Smart Oil Extraction System represents a significant advancement in the field, offering a holistic solution that addresses the complex challenges associated with oil extraction and management in today's industry.

V CONCLUSION

The development of the Smart Oil Extraction System represents a significant advancement in the field of oil extraction and management, offering a comprehensive solution that combines advanced technologies with user-centric design principles. Through meticulous requirements analysis, thoughtful design, rigorous development, thorough testing, and seamless deployment, the system has been tailored to meet the diverse needs of both individual users and businesses. The implementation of Customer Mode and Owner Mode provides flexibility and control, while features such as real-time monitoring, safety mechanisms, and remote access ensure efficiency, safety, and convenience. By leveraging IoT integration, data analytics, and continuous improvement processes, the Smart Oil Extraction System not only enhances operational efficiency and productivity but also enables proactive maintenance and optimization, leading to long-term cost savings and sustainability. As the oil extraction industry continues to evolve, the Smart Oil Extraction System stands ready to adapt and innovate, making it a valuable asset for users seeking to optimize their extraction processes while minimizing environmental impact and maximizing resource utilization.

In the future, the Smart Oil Extraction System could incorporate image processing to assess raw material quality. Additionally, expanding its remote operation capabilities would enable control from long distances, enhancing convenience for users. These advancements would ensure optimal raw material selection and enable monitoring and control of the system from anywhere, making it even more efficient and user-friendly for oil extraction and management.

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