ENERGIZEAIR: INTELLIGENT O2 INFUSION MECHANISM FOR SUPERIOR INDOOR AIR QUALITY

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Keywords:

ESP32, Oxygen Sensor (OOM202), Temperature Sensor, DHT11 Sensor, Gas Sensor (MQ09), Motor Driver, Electrodes, Electrolyte

Introduction:

In contemporary indoor environments, maintaining optimal air quality is critical for the health, productivity, and overall well-being of occupants. However, conventional methods of oxygen supplementation often prove inadequate in consistently providing sufficient oxygen levels. Passive ventilation relies on natural airflow, which can be unreliable and insufficient, especially in tightly sealed mod- ern buildings. Mechanical ventilation systems, while common, consume significant energy and are primarily designed for air circulation rather than targeted oxygen enrichment. Portable oxygen concentrators offer mobility but are not scalable for larger indoor spaces and may not integrate seamlessly with existing building infrastructure. These challenges underscore the pressing need for an innovative solution that can address the shortcomings of traditional oxygen supplementation methods.

The Intelligent Oxygen System project emerges as a response to this critical need, aiming to revolutionize how indoor air quality is managed. By leveraging technology, such as sensors, real-time monitoring, and automated oxygen delivery systems, the project seeks to ensure a continuous and efficient supply of oxygen throughout indoor environments.

The project's objectives include enhancing energy efficiency to reduce operational costs and environmental impact, scalability to accommodate diverse indoor spaces, and integration with existing HVAC systems for seamless deployment. Safety considerations are paramount, with robust measures implemented to manage oxygen distribution safely within enclosed spaces. By optimizing oxy- gen levels in real-time and mitigating disruptions to occupants' daily activities, the Intelligent Oxygen System aims to improve the overall quality of indoor air, thereby promoting better health outcomes and enhancing occupant comfort and productivity.

In conclusion, the Intelligent Oxygen System project represents a pioneering effort to meet the growing demand for reliable and sustainable indoor air quality solutions. By addressing the limitations of current methods and embracing innovative technologies, the project aims to set new standards in oxygen supplementation, benefiting a wide range of indoor environments from offices and homes to educational institutions and healthcare facilities.

Objectives:

- Development of a Medical-Grade Oxygen Supply Device for creating an efficient and reliable oxygen generation system using electrolysis, ensuring a continuous supply of oxygen in enclosed spaces like classrooms and offices.
- Implementation of Real-Time Air Quality Monitoring by integrating CO2 and O2 sensors with a microcontroller (ESP32) to continuously assess air quality, enabling automatic adjustments for maintaining optimal oxygen levels.
- Integration of a Smart Control and Monitoring App, to developed a mobile application that allows users to control the oxygen production rate and monitor system parameters, including temperature, to prevent overheating and ensure safe operation.

Methodology:

The development of the Continuous Medical Grade Oxygen Supply Device follows a structured methodology, starting with conceptualization and requirements gathering through research to define project objectives. Prototyping and iterative development

refine the device with enhancements to sensor integration, control algorithms, and user interfaces. During integration and testing, hardware and software components are unified, and extensive testing ensures the system's accuracy, safety, and medical-grade reliability. Field deployment in real-world settings allows for user feedback and operational evaluation, leading to iterative improvements. Essential tools include CO_2 and O_2 sensors, ESP32 microcontrollers, electrode systems, temperature sensors, and software like Arduino IDE and Platform IO for algorithm development and user interface. This process emphasizes safety, efficiency, and user satisfaction, ensuring a reliable oxygen supply for enclosed spaces

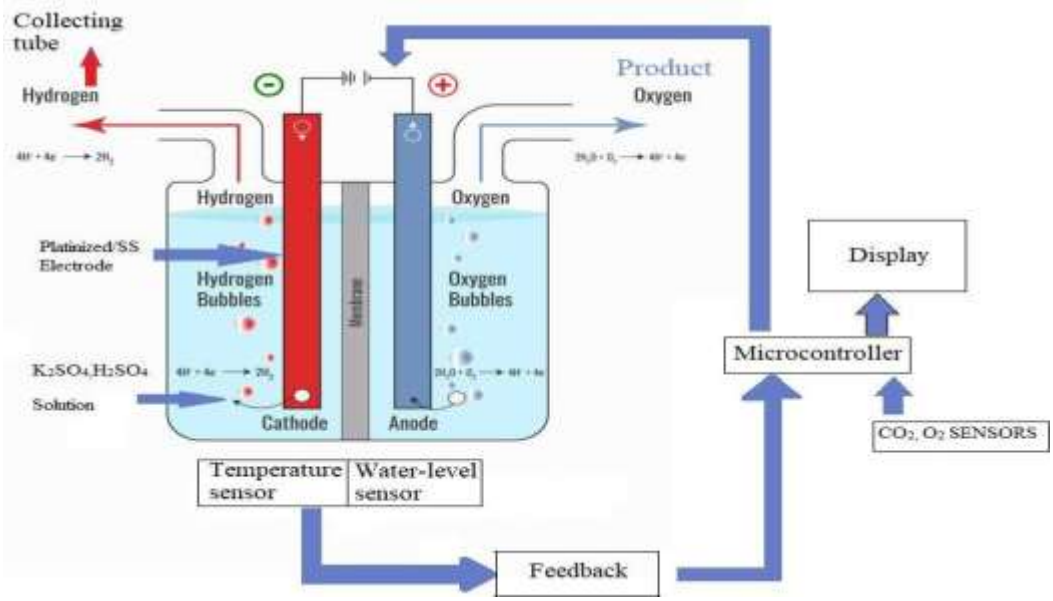

Figure 1: Block Diagram

Result and Conclusion:

The development of the Continuous Medical Grade Oxygen Supply Device has demonstrated promising results in maintaining optimal oxygen levels in enclosed spaces. The system effectively generates and supplies oxygen through an optimized electrolysis process while continuously monitoring air quality using CO_2 and O_2 sensors. Testing confirmed that the device responds dynamically to changing air conditions, ensuring a stable and reliable oxygen supply. The integration of real-time data display and control algorithms further enhances usability and efficiency.

In conclusion, the project successfully delivers a user-friendly, energy-efficient, and modular solution for improving indoor air quality. With its sustainable design and adaptability, the device has the potential for real-world applications in classrooms, offices, and other enclosed environments.

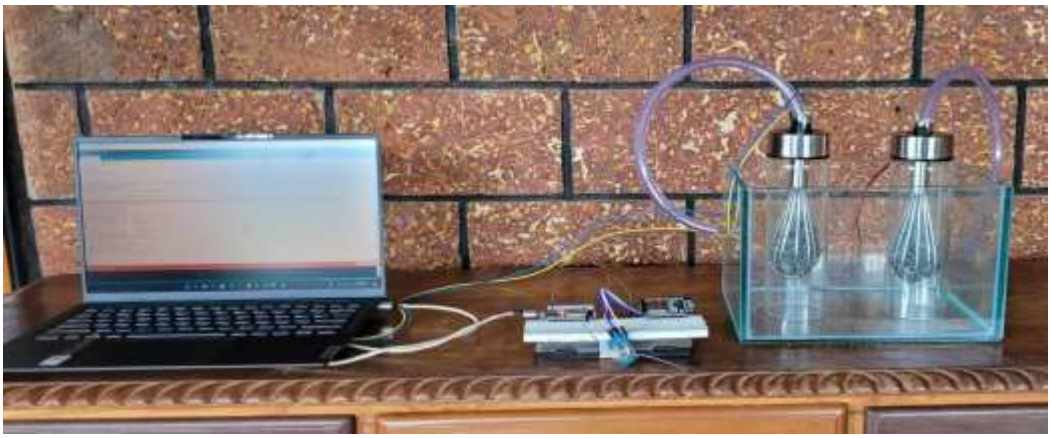

Figure 2: Proposed Prototype

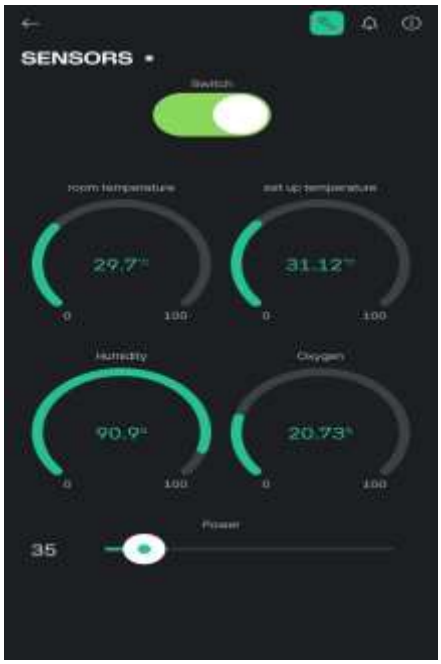

Figure 3: Screenshot of Control Panel View

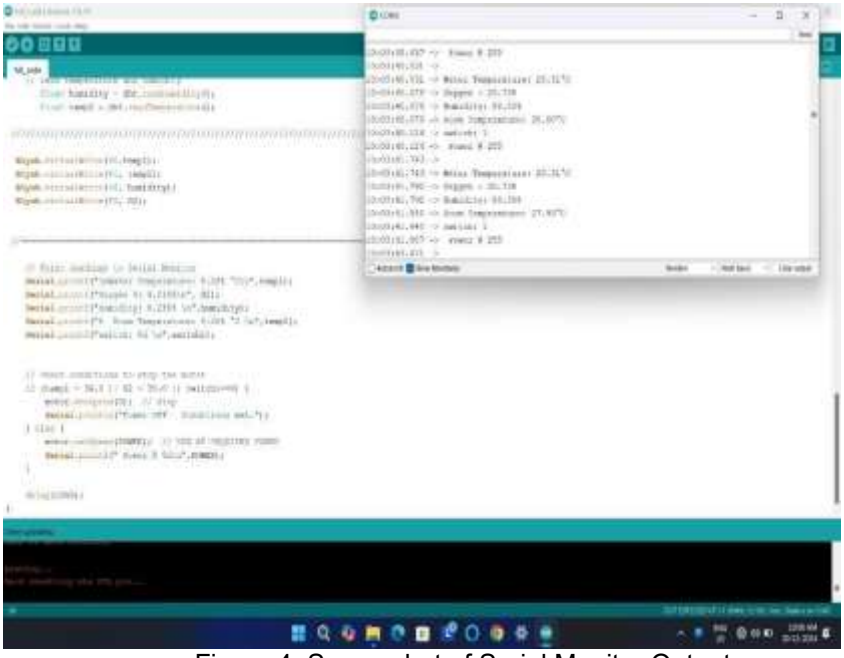

Figure 4: Screenshot of Serial Monitor Output

Future Scope:

- Improve durability for long-term reliability
- Enhanced energy Efficiency
- Improving the storage system for the byproduct released