

***Performance Analysis of a Smart and Portable Multi-Sensor Measuring Instrument for Measuring Hydrogen Gas Concentration and Energy Potential***

Ahmad Fahriannur, S.T., M.T. (*Supervisor*)

Fahrosi Nur Arif

*Renewable Energy Engineering Study Program*

*Majooring of Engineering*

***ABSTRACT***

*This study aims to perform calibration and analyze the error level and performance of a microcontroller-based multi-sensor measurement instrument to determine the concentration and energy potential of hydrogen gas in real-time. The system integrates MQ-8 (H<sub>2</sub>), MQ-135 (CO<sub>2</sub>), DS18B20 (temperature), and HX710B (pressure) sensors controlled by an Arduino Uno. The results show that the system operates at a temperature range of 28–33°C and a stable pressure of 101.32 kPa. After calibration, hydrogen concentration increased from 8–40 ppm to 110–260 ppm. The CO<sub>2</sub> sensor showed 0 ppm, consistent with the gas analyzer results. The temperature sensor error decreased from 6.2% to 0.56%, while the pressure sensor readings approached the reference value. The hydrogen mass ranged from 0.001189–0.00504 g, with an energy potential of 60.51–142.68 J. The variation of 0.2 M with magnet produced the highest hydrogen concentration. Overall, the system is capable of performing real-time measurements with stable and consistent data after calibration.*

*Keywords: Hydrogen gas, sensor calibration, gas purity, multi-sensor.*