

ABSTRAK

Kalibrasi alat kesehatan merupakan salah satu kegiatan penting untuk memastikan keakuratan dan keandalan alat yang digunakan dalam pelayanan medis. Seiring perkembangan teknologi *Internet of Things* (IoT), proses pengukuran dan manajemen data kalibrasi dapat diintegrasikan ke dalam sistem digital yang mampu melakukan pemantauan dan penyimpanan data secara terpusat. Penelitian ini bertujuan merancang dan membangun prototipe *Smart Pressure Calibrator* berbasis *web dashboard* yang mampu mengukur tekanan positif dan negatif pada tensimeter aneroid, *suction pump*, dan kompresor nebulizer, serta memantau suhu dan kelembapan lingkungan.

Sistem dirancang menggunakan mikrokontroler ESP32, sensor MPX5100DP untuk pengukuran tekanan pada tensimeter aneroid, sensor MPX5500DP untuk pengukuran tekanan pada *suction pump* dan kompresor nebulizer, serta sensor DHT22 untuk pengukuran suhu dan kelembapan. Data hasil pengukuran dikirim melalui jaringan internet dan ditampilkan secara *real-time* pada *web dashboard* menggunakan *Firestore Realtime Database*. Selain itu, data pengukuran disimpan ke *Google Sheets* sebagai media dokumentasi dan ditampilkan dalam bentuk grafik menggunakan platform *ThingSpeak*.

Hasil penelitian menunjukkan bahwa prototipe yang dikembangkan mampu melakukan pengukuran tekanan, suhu, dan kelembapan serta menampilkan data secara *real-time* melalui komputer maupun *smartphone*. Sistem juga berhasil melakukan pencatatan dan penyimpanan data hasil pengukuran secara otomatis ke dalam *database* berbasis *cloud* sehingga mendukung proses dokumentasi dan manajemen data kalibrasi alat kesehatan. Berdasarkan hasil pengujian dan perbandingan dengan alat standar DPM-4, prototipe menunjukkan hasil yang baik sehingga dapat digunakan sebagai media pengujian dan *monitoring* tekanan alat kesehatan berbasis digital.

Kata Kunci: *Smart Pressure Calibrator*, Kalibrasi Alat Kesehatan, MPX5100DP, MPX5500DP, DHT22, ESP32, *Internet of Things*, *Web Dashboard*.

ABSTRACT

Medical device calibration is an important activity to ensure the accuracy and reliability of equipment used in medical services. Along with the development of *Internet of Things* (IoT) technology, measurement processes and calibration data management can be integrated into digital systems capable of centralized monitoring and data storage. This study aims to design and develop a *Smart Pressure Calibrator* prototype based on a *web dashboard* that is capable of measuring positive and negative pressure in aneroid sphygmomanometers, suction pumps, and nebulizer compressors, as well as monitoring environmental temperature and humidity.

The system was designed using an ESP32 microcontroller, an MPX5100DP sensor for pressure measurement in aneroid sphygmomanometers, an MPX5500DP sensor for pressure measurement in suction pumps and *nebulizer* compressors, and a DHT22 sensor for temperature and humidity measurement. Measurement data were transmitted through the internet network and displayed in real time on the *web dashboard* using *Firebase Realtime Database*. In addition, the measurement data were stored in *Google Sheets* as a documentation medium and visualized in graphical form using the *ThingSpeak platform*.

The results show that the developed prototype is capable of measuring pressure, temperature, and humidity, as well as displaying data in real time through computers and smartphones. The system also successfully records and stores measurement data automatically in a *cloud*-based database, thereby supporting the documentation process and calibration data management of medical devices. Based on testing results and comparisons with the DPM-4 standard instrument, the prototype demonstrated satisfactory performance and can be utilized as a digital-based testing and monitoring tool for medical device pressure.

Keywords: *Smart Pressure Calibrator*, Medical Device Calibration, MPX5100DP, MPX5500DP, DHT22, ESP32, *Internet of Things (IoT)*, *Web Dashboard*.