

## **Locking It Down: ESP32-Powered 2FA Access Control System for Restricted Storage Units**

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### **Abstract**

In today's digital security landscape, safeguarding restricted access storage units is essential. Many systems still depend on single-factor authentication, which poses security risks. To enhance protection, this study investigates a secure access control system powered by ESP32 that implements two-factor authentication (2FA) alongside user phone number verification. The system's effectiveness in managing access and interfacing with physical locks was rigorously evaluated. The primary goal was to develop an integrated access control system combining digital and physical security measures. Secondary objectives included assessing performance metrics such as one-time password (OTP) latency, system response accuracy, and data logging precision. Testing was conducted using Globe Telecom 4G SIM cards to ensure reliable telecommunications. An experimental design facilitated testing under varying conditions, with descriptive statistics applied to analyze data focusing on key performance indicators. The trials confirmed that the ESP32-based system effectively secured storage units through 2FA, yielding favorable results in OTP latency and response accuracy. The integration of Globe Telecom 4G SIM cards was successfully executed, ensuring consistent telecommunications functionality. Throughout the testing phase, data logging accuracy remained reliable. The study concludes that the ESP32-powered access control system is robust in preventing unauthorized access while effectively managing both digital and physical security measures. Future research should explore compatibility with other telecom providers and additional authentication enhancements, as well as field testing in real-world scenarios to assess performance under diverse conditions.

*Keywords: Access control system, ESP32, Two-factor authentication, Physical lock integration, Telecommunications*