

Research on security protocols for IoT on the ESP8266 chip

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Abstract: This study investigates the implementation and evaluation of security protocols for Internet of Things (IoT) devices, specifically focusing on the ESP8266 microcontroller. Given the widespread deployment of low-cost, resource-constrained devices in IoT networks, ensuring robust data confidentiality, integrity, and authentication remains a critical challenge. The research explores the feasibility of integrating lightweight cryptographic protocols, including TLS 1.2 and MQTT with SSL/TLS encryption, onto the ESP8266 platform. Through a series of empirical experiments, the study measures performance metrics such as memory usage, processing overhead, and network latency under various security configurations. The findings demonstrate that while the ESP8266 can support standard security protocols, significant trade-offs exist between security strength and operational efficiency. The results highlight the necessity of optimizing cryptographic libraries for constrained environments and propose a tailored security framework that balances protection against resource limitations. This work contributes to the development of secure, practical IoT solutions for low-power embedded systems.

Keywords: ESP8266 security, IoT protocol, embedded security, MQTT