

ABSTRAK

Electrosurgical Unit (ESU) merupakan peralatan elektromedik yang memanfaatkan energi listrik frekuensi tinggi untuk menghasilkan efek pemotongan dan koagulasi. Keterbatasan media pembelajaran serta tingginya harga ESU komersial menyebabkan pemahaman mahasiswa mengenai prinsip kerja ESU masih kurang optimal. Penelitian ini bertujuan untuk merancang dan merealisasikan trainer Electrosurgical Unit low power sebagai media pembelajaran yang dapat membantu mahasiswa memahami prinsip kerja ESU secara lebih aman dan ekonomis.

Trainer dirancang menggunakan Arduino Uno sebagai pengendali utama, AD9833 sebagai pembangkit sinyal, LM7171 sebagai penguat sinyal, MOSFET 60S2125 sebagai saklar frekuensi tinggi, LCD 20×4 sebagai media tampilan, serta footswitch sebagai pengendali aktivasi sistem. Sistem dilengkapi dengan dua mode tegangan keluaran, yaitu 50 V dan 90 V.

Hasil pengujian menunjukkan bahwa sistem mampu menghasilkan frekuensi keluaran pada rentang 125–300 kHz dengan amplitudo keluaran AD9833 sebesar 4,3 V. Fungsi selektor daya, indikator tegangan, dan mode cutting dapat bekerja sesuai perancangan. Trainer yang dikembangkan berhasil digunakan sebagai media pembelajaran untuk memahami prinsip kerja Electrosurgical Unit, meskipun masih terdapat gangguan pada sistem display yang memerlukan pengembangan lebih lanjut.

Kata kunci: Electrosurgical Unit, trainer, media pembelajaran, frekuensi tinggi, Arduino Uno.

ABSTRACT

An Electrosurgical Unit (ESU) is an electromedical device that utilizes high-frequency electrical energy to produce cutting and coagulation effects on biological tissue. However, the availability of ESU learning media is still limited, while commercial ESU devices are relatively expensive, making them less accessible for educational and laboratory purposes. In addition, students often have difficulty understanding the operating principles of ESU systems because the generation and delivery of high-frequency energy cannot be directly observed. This study aims to design and develop a low-power Electrosurgical Unit trainer as a learning medium to assist students in understanding the operating principles of ESU systems, demonstrate the relationship between the control circuit, MOSFET driver, high-frequency transformer, and ESU output, and provide a safer and more economical alternative to commercial ESU devices.

The trainer was developed using an Arduino Uno as the main controller, an AD9833 module as the signal generator, an LM7171 operational amplifier as the signal amplifier, a 60S2125 MOSFET as the high-frequency switching device, a 20×4 LCD as the display interface, and a footswitch for signal generator activation. The system was designed with two output voltage levels, namely 50 V and 90 V.

The test results show that the system is capable of generating output frequencies ranging from 125 kHz to 300 kHz, with an AD9833 output amplitude of 4.3 V. The power selector, voltage indicators, and cutting mode operated according to the design specifications. The developed trainer successfully functions as a learning medium for understanding the basic operating principles of an Electrosurgical Unit, although display interference was observed during testing and requires further improvement.

Keywords: *Electrosurgical Unit, Trainer, Learning Media, High Frequency, Arduino Uno.*