CHAPTER FIVE

5.1 SUMMARY

This project focused on the design and construction of a 5KVA Automatic Voltage Regulator (AVR) capable of stabilizing voltage supply to electrical appliances. The AVR was designed to monitor and regulate input voltage variations using a microcontroller-based control system. The system automatically detects under-voltage or over-voltage conditions and adjusts the output by switching between transformer taps via relays to maintain a steady output voltage.

The components used include a microcontroller (ATmega328), voltage sensors, relays, auto transformer, rectifier, comparator, voltage divider, and display units. These were assembled on a PCB board with proper soldering and housed in a protective casing. The testing phase confirmed that the AVR consistently regulated voltage within safe operating limits.

5.2 CONCLUSION

From the successful design and implementation of the 5KVA Automatic Voltage Regulator, it is evident that the system effectively meets the desired objective of maintaining a stable voltage supply. The AVR automatically compensates for fluctuations in input voltage and protects electrical appliances from damage caused by over-voltage or under-voltage conditions. The use of a microcontroller enhanced the accuracy, response time, and decision-making ability of the system.

The analog or digital display also provides real-time monitoring for users, increasing the system’s usability. The success of this project has proven that incorporating embedded systems into power regulation can enhance performance and reliability in both domestic and industrial environments.

5.3 RECOMMENDATIONS

Based on the design and testing outcomes, the following recommendations are made:

1. Use of High-Quality Components: For long-term use and durability, future versions should incorporate higher-grade components to withstand power surges and extreme environmental conditions.

2. Enclosure and Cooling: Proper casing and improved ventilation should be prioritized to prevent overheating of sensitive components, especially the transformer and relays.

3. Circuit Protection: Adding fuses, surge protectors, and overload protection circuits can further enhance safety.

4. Microcontroller Programming: Continuous updates and optimization of the microcontroller code can improve switching speed and voltage sensing accuracy.

5.4 LIMITATIONS

Despite its effectiveness, the project has a few limitations:

The system currently handles only single-phase voltage regulation.

It lacks wireless remote control or data logging features.

Real-time monitoring is limited to local display only.

5.5 SUGGESTIONS FOR FUTURE IMPROVEMENTS

To improve the system's performance and broaden its application, the following upgrades are suggested:

1. Wireless Monitoring and Control: Integrating Wi-Fi or GSM modules for remote voltage monitoring and control using a mobile app or SMS.

2. Data Logging and Alerts: Incorporating SD card storage or cloud logging to keep records of voltage conditions over time. Alerts via SMS or app in case of voltage abnormalities.

3. Three-Phase Extension: Modify the design to regulate three-phase power supply systems commonly used in industrial applications.

4. Auto Bypass Feature: A feature that allows the system to bypass regulation manually or automatically in emergency cases.

5. Touchscreen Display: Replacing the analog or basic digital display with a touch-screen interface for better user interaction.

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