SUMMARY

The solution created in this thesis uses an Arduino board with solid-state relays and thermocouple modules that work together with software running on the computer to control and monitor the semiconductor sublimation process.

The chosen approach splits the automation system into two main components. The Arduino board monitors the sensors, calculates the logic, drives the relays, and sends all the important information to the computer. Meanwhile, the computer uses the script to store and visualize the collected data for human monitoring.

One significant advantage of this modular system is its flexibility. Each component can be individually modified, replaced, or tested, simplifying the overall system's management. This modularity allows the system to be adapted to different conditions, such as varying reactor setups, or even repurposed for alternative applications while reusing existing components or software. Another benefit of software control is scalability: adding another line of code and a relay is much easier than adding, setting up, and integrating the new PID controller into the existing system.

Another unique thing in this project, except for the architecture, is the PD control approach: PD controller is not used to output desired output as usual, but rather is outputs the power level that should be used to obtain the desired output.

Now let us analyze how the proposed solution solves the problems stated in the introduction:

Automation: This system is flexible and contains many variable parameters that can be used to alter the system's behavior. This means the system’s performance highly depends on the quality of the parameters provided. As a part of this work, we described the parameters and provided a methodology for their estimation and fine-tuning. Despite the initial time investment in system calibration, this process is a one-time requirement, allowing for numerous subsequent sublimation procedures with minimal human intervention.

Monitoring: Introducing a graphical monitoring feature significantly enhances user-friendliness and utility. Alongside real-time monitoring, the system also offers an experiment recording feature, allowing for future data analysis and improving experiment reproducibility.

In conclusion, automation does not always have to be expensive or complicated. The final hardware solution can be kept simple by moving some logic to the software. Also,

building such a system from multiple simple components can make the whole solution easier to develop and work with.

Another thing to note is the importance of multidisciplinary communication: such an automation task can be completed even by the integrated engineering bachelor student. However, problems like this can only be solved if the people who can solve them are aware of their existence, underscoring the importance of bridging gaps in knowledge and communication to solve everyday engineering problems.