

This thesis discusses the indigenous development of the Selective Laser Sintering Plastic Additive Manufacturing machine prototype. Chapter 1 describes the study and product survey of the SLS 3D printing machine. It also defines the wish specifications of the machine's modules.

Functional concepts and modules are discussed in detail in Chapter 2. The individual blocks in the machine are described in detail with the help of the block diagrams and schematics. The signal interfaces, hardware requirements and software stack are designed in this chapter.

Chapter 3 contains the sub-modular design of the electronics system, where the complete electronic system is partitioned into the mechatronics control system and laser and optics control system. The chapter also discusses hardware design requirements, circuit designs for various sub-modules in each module, software implementation and industrial design aspects like enclosure and PCB. The scan-card system has more significance in this section as its contribution is significant in driving the laser deflection systems while dealing with the inherent nonlinearities. The novel approach to address the distortion is illustrated in depth. The implementation of the algorithms, mathematical equations on the FPGA board and various techniques to improve the performance are described in the section.

The engineering aspects of the products are discussed in Chapter 4. This contains the product structure, PCB design, assembly drawings and software modules. The results are mentioned at the end of the chapter, along with signal waveforms and visual qualitative validations of the outcomes to defend the claims made in the design phase.

The user guides for the custom-designed IPs are listed in the appendix for user reference.