Difficulties we faced

We completed a project on ATP electricity billing machine, We faced several difficulties during the project, which are listed below:

1) **Understanding how ATP electricity billing machine works**: We had to learn the basic principles of electricity metering, such as voltage, current, power factor, and tariff. We also had to understand how the machine communicates with the central server and displays the bill on a LCD screen. We had to study the existing models of ATP electricity billing machines and their features and limitations.

2) **Understanding Verilog code language**: We had to learn the syntax and semantics of Verilog, which is different from conventional programming languages. We had to master the concepts of modules, ports, wires, registers, operators, assignments, always blocks, procedural blocks, and behavioral modeling. We also had to learn how to use various data types, such as nets, vectors, integers, reals, and strings.

3) **Learning to program using Verilog is very challenging because it directly involves hardware:** We had to think in terms of hardware components and their interactions rather than software instructions and variables. We had to design our logic circuits carefully and optimize them for speed, area, and power consumption. We had to deal with issues such as timing constraints, clock domains, synchronization, glitches, metastability, and race conditions.

4) **Intel Quartus Prime interface understanding:** We had to use Intel Quartus Prime software to design, compile, simulate, and program our device. We had to familiarize ourselves with the graphical user interface and the various tools and options available in the software. We had to learn how to create a project, add files, set parameters, assign pins, run analysis and synthesis, perform functional simulation, generate programming files, and download them to the device.

5) **Developing and implementing the code using Verilog and debugging the errors is a difficult task:** We had to write our code in a modular and hierarchical way, following good coding practices and conventions. We had to test our code using simulation tools and verify its functionality and correctness. We had to debug our code using various techniques, such as waveform analysis, breakpoints, assertions, print statements, and logic analyzers. We had to fix any errors or warnings that occurred during compilation or programming.

Despite these difficulties, we managed to complete our project successfully and learned a lot from this experience. We thank our instructor for his guidance and support throughout the project.