

1. Functional Requirements

1.1 User Interface (UI) Requirements

1. The GUI shall have a text editor for entering BasicML instructions either from a file or manually.
2. The GUI shall have buttons to load the instructions to memory after validating them.
3. The GUI shall display the memory contents of 100 memory locations, CPU state, PC, and Accumulator dynamically.
4. The GUI shall provide buttons to Run, Step, Halt or Reset the program.

1.2 Memory Management Requirements

1. The program shall allocate a 100 word memory space for instructions.
2. Memory instructions shall be represented as four-digit words (e.g. +1234, -1234)
3. Instructions shall be validated before they are stored in the memory.
4. Memory shall support I/O instruction operations with prior validation.
5. The memory shall be color coded to show any changes from the last memory state.

1.3 CPU Functionality Requirements

1. The CPU shall support I/O operations: READ (10), WRITE (11) and also support LOAD (20), and STORE (21) operations.
2. The CPU shall support arithmetic operations: ADD (30), SUBTRACT (31), DIVIDE (32), MULTIPLY (33).
3. The CPU shall support Control Operations: BRANCH (40), BRANCHNEG (41), BRANCHZERO (42), and HALT (43).

1.4 Error Handling Requirements

1. The program shall handle errors including invalid file paths, invalid instructions, or invalid I/O operations by displaying an error message in the GUI.
2. The program shall check for memory overflows before executing the next instruction.
3. Invalid instructions shall not affect the CPU state, or memory contents.

2. Non-Functional Requirements

2.1 Usability

1. The UI shall be user friendly with a clear and organized layout and provide descriptions on how to use instructions.

2.2 Performance

1. The program shall finish executing at most 100 instructions per execution cycle in less than 1 second with real-time updates through the UI.

2.3 Maintainability

1. The project shall have documentation for all functions and classes and ensure that each module is loosely coupled.