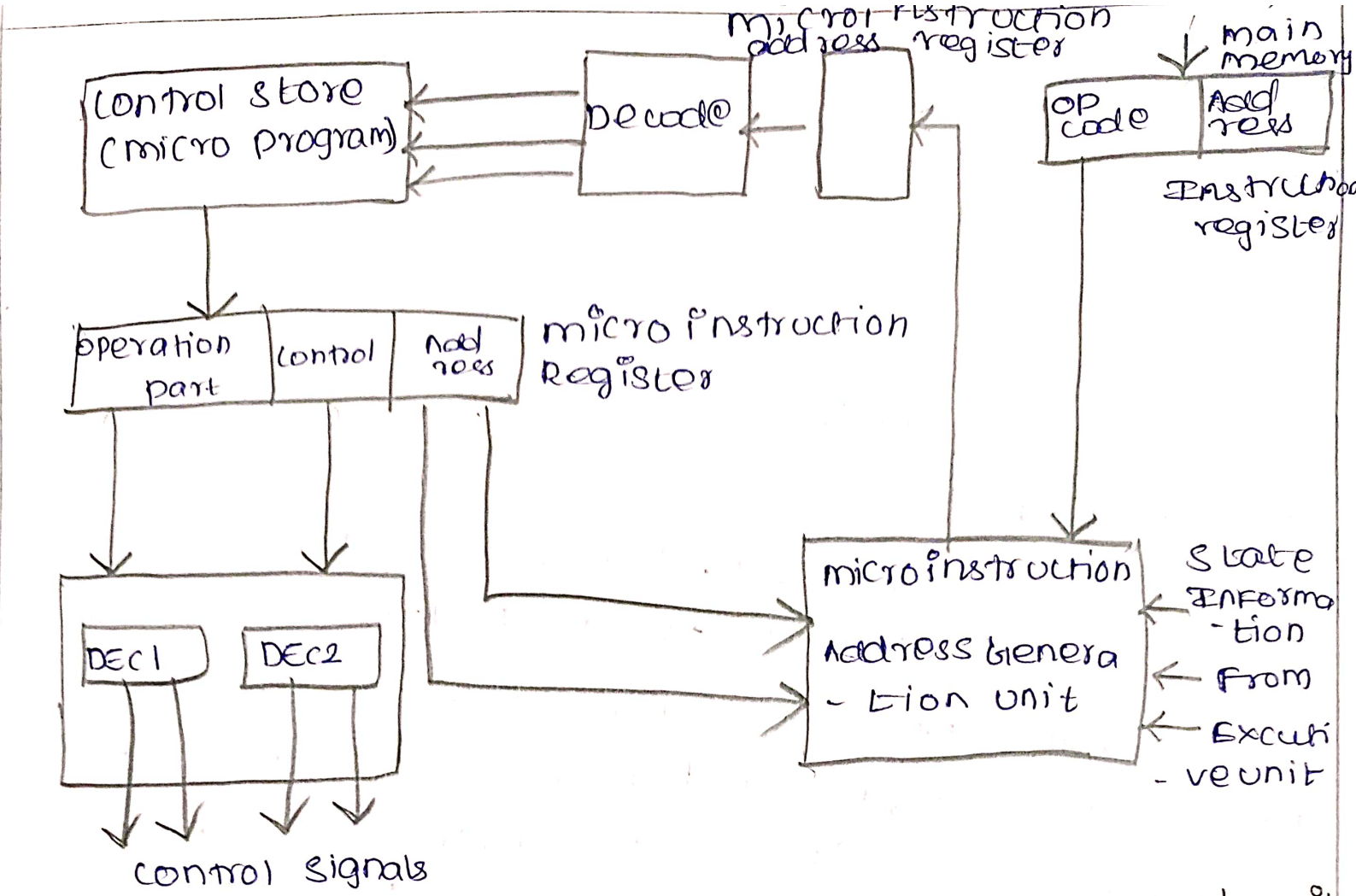
Hardwired control

The hard wired control unit is a unique From of control signal generation that utilizes ~~rami~~ Finite state machines (FSM) This control unit is constructed as a sequential logical circuit, made by physically interconnect components like flip-flops gates and drums to produce the final circuit. Due to its physical construction it is commonly referred to as a hard wired controller.

Understanding the Hardwaired control unit: The Hardware control unit is a techni - que used to generate control signals using Finite state Machines (FSM). The control signals necessary for executing instructions in the Hardward control unit are produced by special hardware logic circuits. It is important to note that altering the mechanism of signal production



Key Features of the Hardwired control unit:

- A Hardwired control unit is composed of two decoders, a sequence counter, and logic gates.
- The instruction register (IR) stores instruction fetched from the memory unit.
- The instruction register comprises the operation code, the I bit, and bit 0 through 11.
- A 3 x 8 decoder is used to encode the operation code in bits 12 through 14.
- The output of the decoder are represented by the letter D0 through D7.

- The operation code of bit 15 is transferred to a Flip-Flop denoted by the symbol I.
- The control logic gates are programmed with operation codes from bits 0 to 11.
- The sequence counter (or SC) has the ability to count from 0 to 15 in binary.

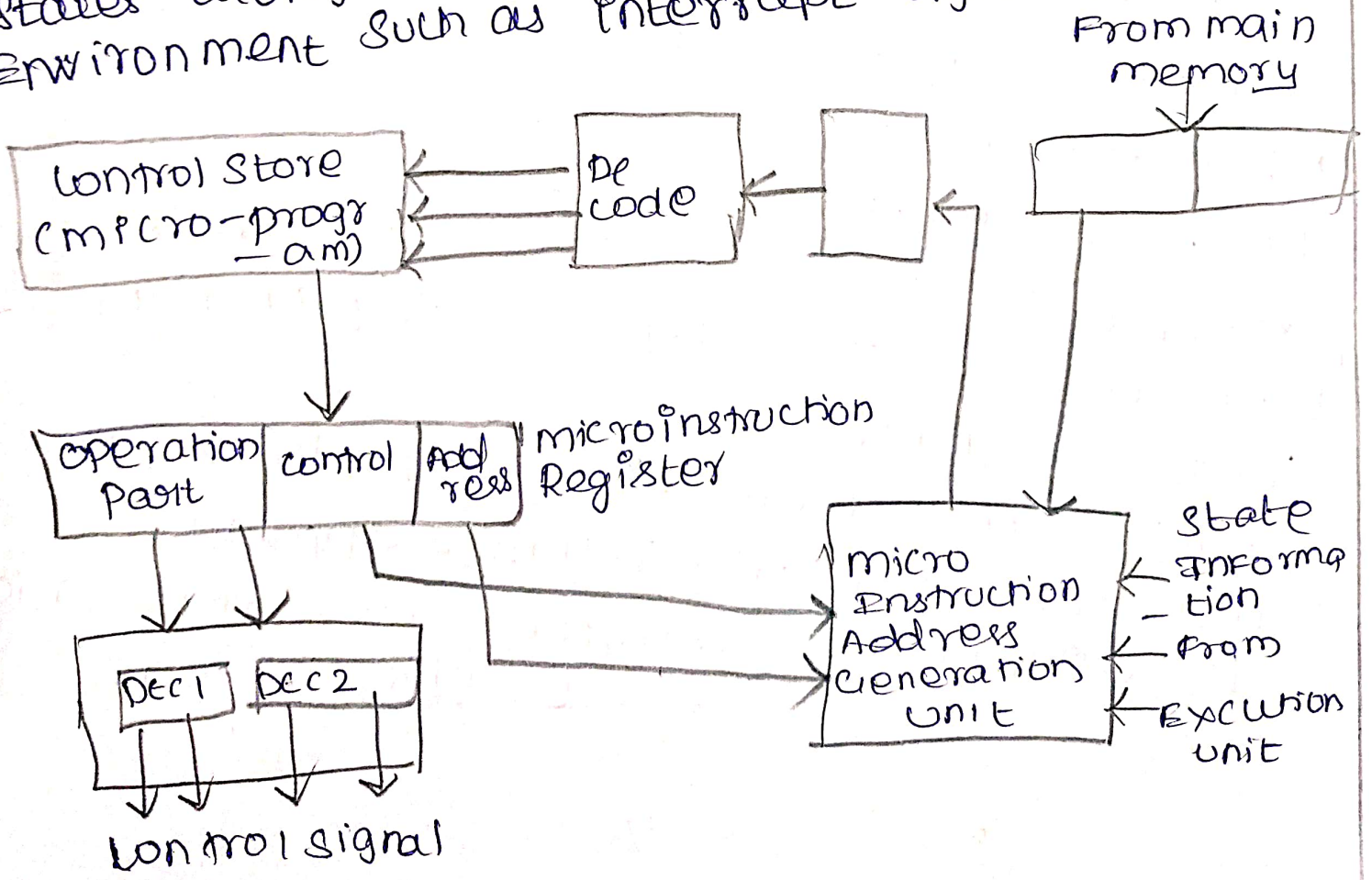
The Design process of a Hardwired control unit:

Sequence control method: This is a practical approach to design a some what complex controller.

Delay Element method: This method depends on the use of timed delay elements of creating the sequence of control signals.

State table method: This method uses the standard algorithmic approach to design the controller using the clasical State table method.

How does a hardwired control unit work? The operation code of an instruction holds the basic data for generating control signals. This operation code is decoded in the instruction decoder, which is a set of decode various fields of the instruction opcode. Consequently only a few of the instruction decoder's output lines have active signal value. These output lines are connected to the inputs of the matrix, which provides control signals for the computer's executive units. This matrix combines the decoded signals from the instruction opcode with the output from the matix that generates signals indicating consecutive control unit states along with signals from the external environment such as interrupt signals.



The process of signal Generation: control signals for instruction execution must be generated during the entire time range, corresponding to the cycle of instruction not just at a single moment in the time. The control unit organizes the appropriate sequen -ce of internal states based on the structure of this cycle.

Benefits of using a Hardwired control unit:

- The Hardwired control unit is fast Because it uses combinational circuits to generate signals.
- The delay that can occur in the creat -ion of control signals is depent on the number of gates.
- It can be optimized to achieve the Fastest mode of operation
- It is faster than a micro-programmed control unit.

Limitations of a Hardwired control unit:

- The design becomes more complex as more control signals need to be generated (requiring more encoders or decoders).
- changes to control signals are challenging as they require reconfiguring the wires in the hardware circuit.
- Adding a new feature can be difficult and time-consuming.
- Evaluating and fixing flaws in the initial design can be challenging.
- It can be somewhat expensive.