MICROPROCESSORS, PROGRAMMING AND INTERFACING (CS F241)

Electronic Voting Machine (EVM)

BITS Pilani
K K Birla Goa Campus

Group Number : **43**

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Design Question Number- 6

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Acknowledgement:

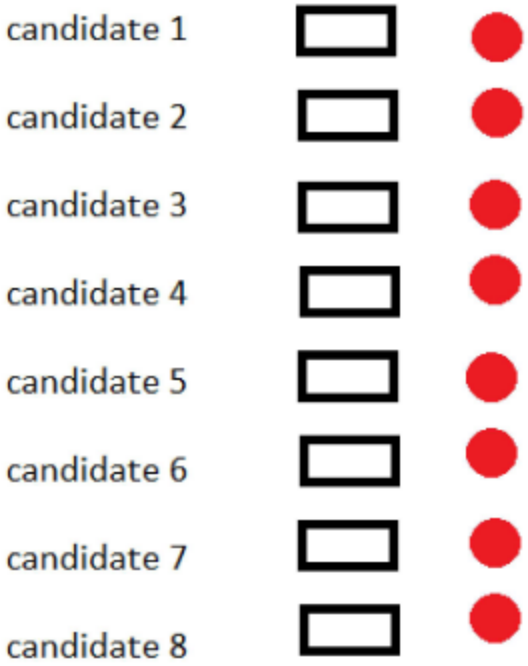
We would like to thank Prof. K. R. Anupama and the entire teaching staff of the course Microprocessors, Programming and Interfacing (CS F241) for giving us this opportunity to broaden our knowledge and get a good understanding of the subject by working on this design assignment.

Problem Statement & User Specifications:

Design Question- 6

Design a microprocessor Voting Machine which has provision for 8 candidates. It should keep the count of total votes polled and the count of votes polled for each candidate. Before being put in use, it should check if all memory locations allotted to candidates, and the total count are empty. If not, it should clear these as well as the display. There are two keypads, one for the polling officials and one for the voter. The Polling Officers Keypad also comes with a 16 character LCD Display. To put the voter keypad in use, it needs to be enabled by 8 polling agents and the Presiding officer. If anyone is missing it should not be enabled. This enabling is done using the polling officers' keypad. The polling officer's keypad has keys 0-9, backspace, enter, Poll count, Lock, Unlock, DisplayCount. Each polling agent and Presiding officer have a unique 5-digit numeric code. The system when turned on displays officer 1 on LCD. The polling officer then enters his numeric code. If correct then the n display is updated to officer 2 and so on and finally the Presiding officer enters his code. Each person is allowed 2 retries — if there is a failure the voting is blocked.

The voting interface for the user will be as follows:



The name of the candidate followed by a button followed by LED. Voter will press the button against the candidate's name — the LED will glow for 2 seconds. After 10 hours (7 a.m. to 5 p.m.) it should stop taking input from voters. There has to be a provision that the Presiding officer by pressing the Lock key followed by a 5-digit code can lock voting in between & then can restart it by pressing the Unlock key followed by a separate 5-digit code. For retrieving the count of each candidate the Presiding Officer presses the Poll Count key followed by a 5- digit code. The Presiding officer then enters the Candidates Number Followed by Display Count Key — The count for the candidate is displayed. This is done for all candidates.

Technical Specifications:

1. The LED next to the candidate's name will glow for 2 seconds after a person votes.
2. The officer's keypad has the following keys: 0-9 numbers, backspace, enter, poll count, lock, unlock, display count.
3. Each password would be a 5-digit code.
4. The number of attempts given for each password is 2, any more failures after that cause the voting to be blocked.
5. The LCD is a 16-character display.
6. The voting is stopped at 5pm, after which the vote count facility becomes available.

Assumptions:

The following assumptions have been made:

1. The vote count is being stored in a word, for each candidate, therefore it is assumed that the total number of votes will not exceed FFFFh (Decimal equivalent 65535).
2. As soon as the presiding officer enters his password, and presses the enter key, the voting starts (time assumed is 7AM) and an interrupt is generated after 10 hours to stop the voting (at 5PM).
3. Once a voter has voted, the next voter has to wait for at least 2 seconds, for the LED to switch off.
4. Passwords are decided before initialising the system, and it cannot be changed later.
5. There is no auto-enter after 5 digits, which means the Enter key in the officer's keypad has to be pressed for the password to be validated.
6. The Voters do not have access to the hex keypad and LCD.

Justifications:

1. The keypad for voting the candidates has been interfaced as a 8x1 keypad instead of a 4x2 matrix keypad. An 8 bit port is being used for the same.
2. 8259 is used because two interrupts are being generated, one is to stop the voting after 10 hours and the other one is to branch to the required ISR when the lock key is pressed.

Components Used & their Description

The following table describes the devices used, their number and a brief description of the role they play in the overall design of the EVM.

Sl. No.	Device Name	Number of Devices	Description
1	8086	1	16-bit Intel Microprocessor
2	8284	1	Used to generate clock for the microprocessor and clock for 8253
3	2716	4	2k programmable ROM chip
4	6116	2	2k programmable RAM chip
7	74LS138	1	3x8 Decoder
8	74LS373	3	Octal Latch
9	74LS245	2	Octal Bus Transceiver
10	74LS244	1	Octal 3-state buffer
12	8255	2	General purpose programmable I/O device
13	8253	1	Programmable Interval Timers
14	LM020L	1	16 x 1 LCD Display
15	LEDS	8	LED lights for each candidate
18	8259	1	To give priority to interrupts

Other components used are Resistors, Switches, Push Buttons, Gates.

Address Mapping:

Memory addressing:

RAM – minimum 2k chip- 4k

ROM - minimum 2k chip – 4k + 4k

ROM1: 00000h to 00FFFh

RAM: 01000h to 01FFFh

ROM2: FF000h to FFFFFh

I/O addressing:

8255 (Officer's): 00h to 06h

8255 (Voter's): 10h to 16h

8254: 20h to 26h

8259: 30h to 32h

Detailed Description of I/O Devices Used:

a) 8255 (Officer's)

This 8255 port is used to interface the LCD data lines and the officer's keypad with 8086 microprocessor. The officer's keypad is a 4x4 matrix of one-hotkeys, which are used to input the passwords, lock and unlock the voter's keypad, and to display the poll count of corresponding candidates after the voting period is over.

Port A: 00h [LCD data lines]

Port B: 02h [LCD control lines]

Port C: 04h [Officer's hex keypad]

Control Register: 06h

b) 8255 (Voter's)

This 8255 port is used to interface the voter's keypad and the corresponding LEDs with the 8086 microprocessor. When the voter presses the key of their preferred candidate, the corresponding LED lights up for 2 seconds, confirming the vote has been counted.

Port A: 10h [One-hot voter buttons]

Port B: 12h [One-hot output LEDs]

Port C: 14h

Control Register: 16h

c) 8253

8253 chip is used to generate an interrupt after 10 hours since the beginning of voting. The interrupt is generated as the output of counter 2. This interrupt is then connected to the IR0 pin of the 8259.

Address and configuration of counters:

Counter Number	Address	Mode of operation	Counter stored	Output
Counter 0	20h	Mode 2	25000d	100Hz
Counter 1	22h	Mode 2	100d	1Hz
Counter 2	24h	Mode 0	36000d	Interrupt after 10 hours
Control Register	26h	-	-	-

d) 8259

8259 is being used to prioritise the interrupts that are generated in the design throughout its working. Interrupt generated by 8253 is connected to the IR0. This interrupt will ensure that the voting is stopped after 10 hours, after which only the poll count facility will be available.

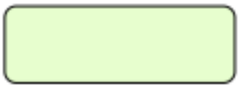
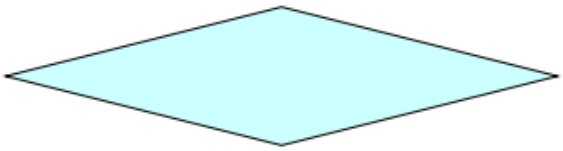
The interrupt generated upon pressing the lock key in the officer's keypad is connected to IR1. This interrupt is implemented in such a way that when the lock key is pressed in the officer's keypad, the corresponding ALP program makes an OR operation between the 8-bit PB port and 00000001b. This ensures that PB0, PB1 and PB2 which are control signals for the LCD remain unaffected, but the PB7 bit becomes 1. This PB7 bit is connected to the IR1 and is used as the interrupt to go to the ISR routine for locking the voting.

Addressing of 8259:

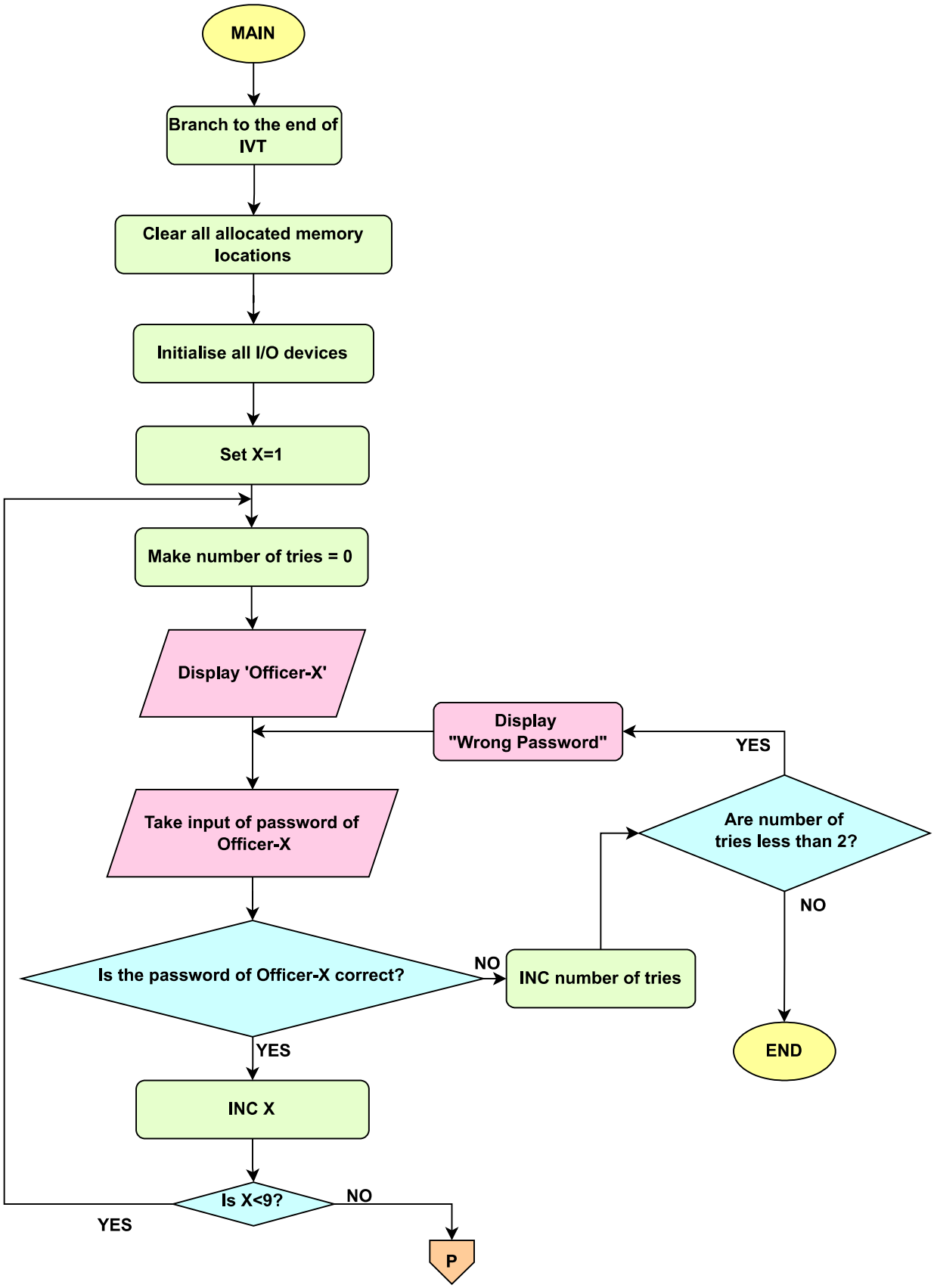
Memory locations 30h and 32h are used as the addresses of 8259.

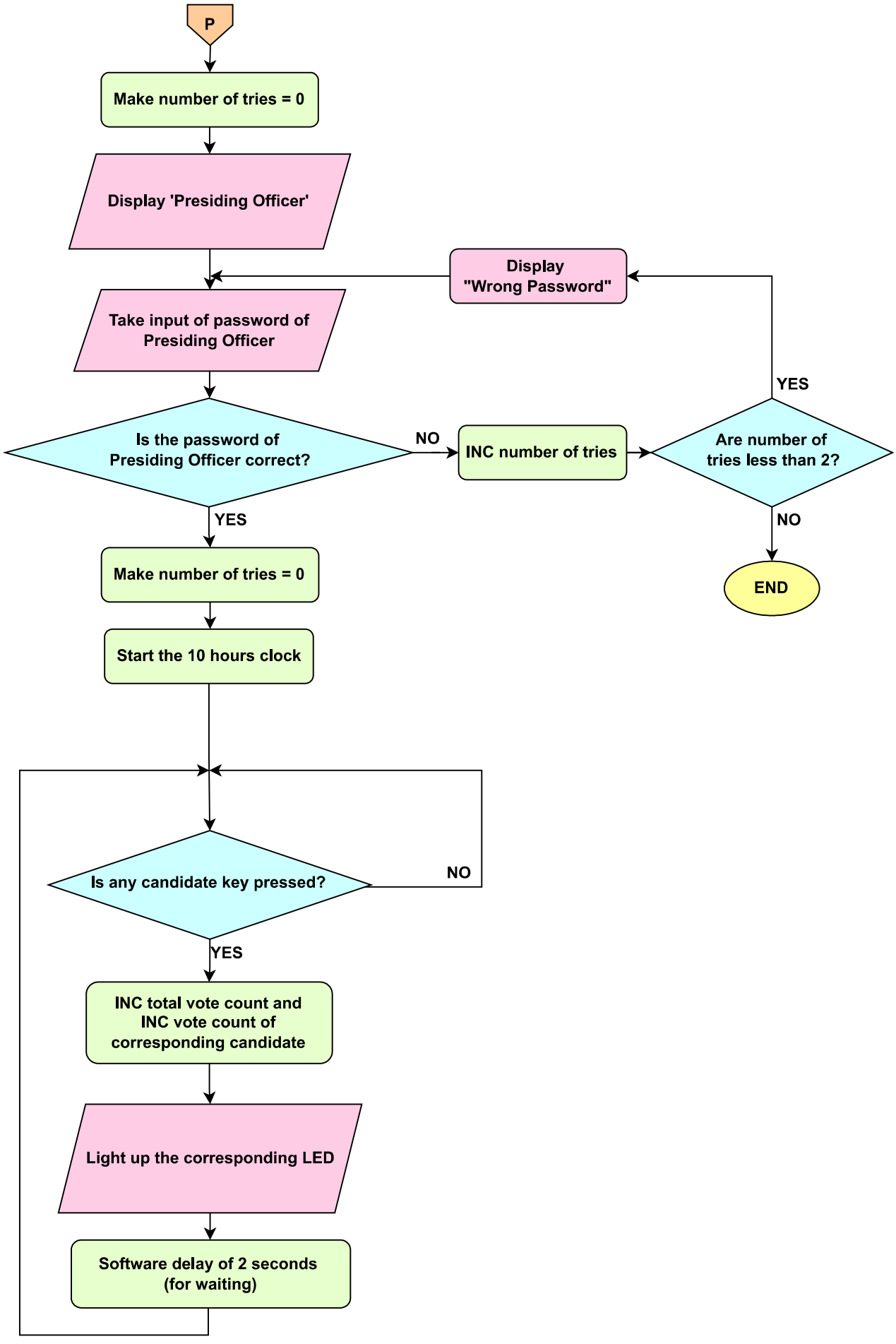
Flowcharts:

Table of symbols used:

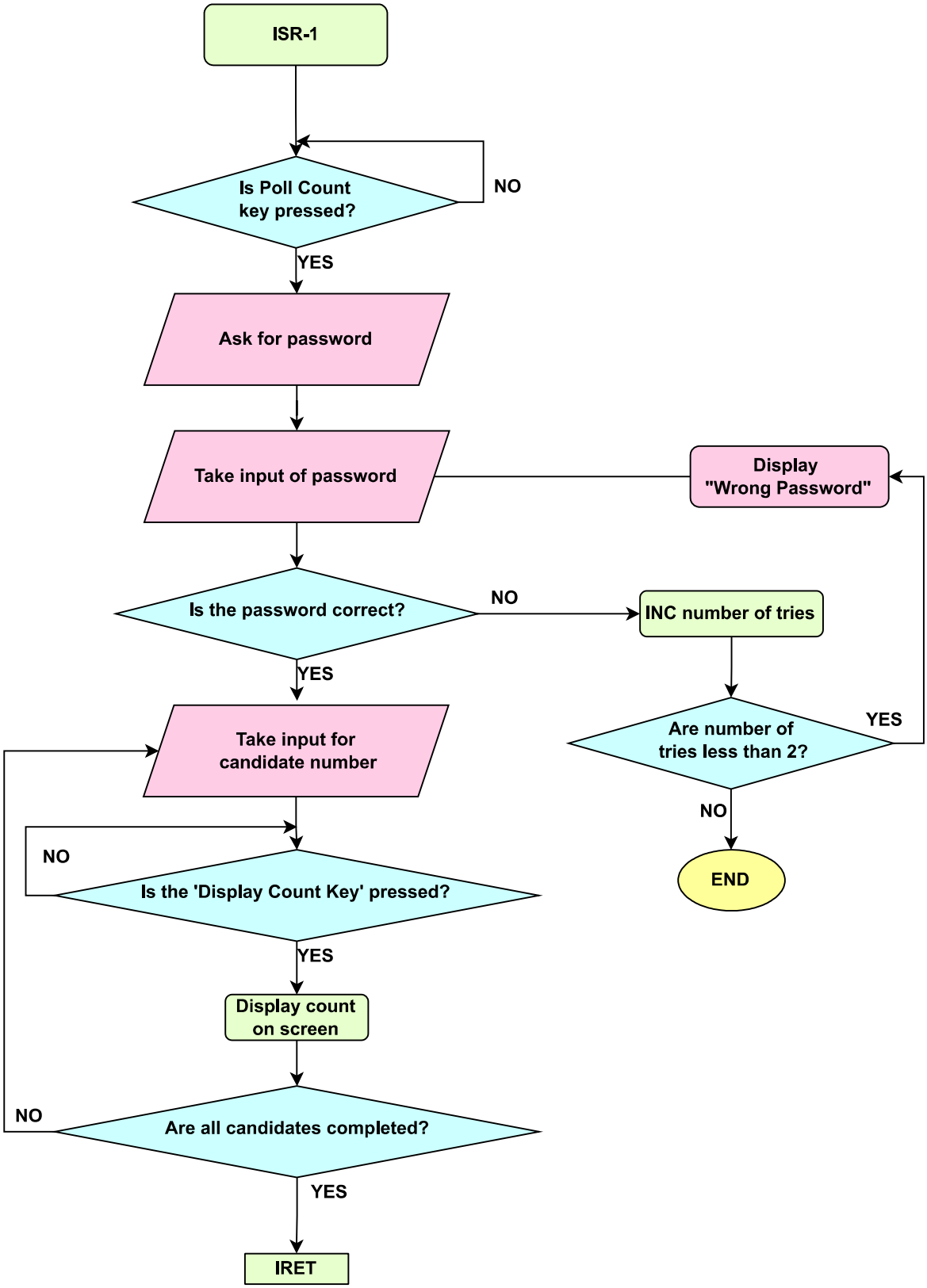
	**Starting or Ending point (Terminator)**
	**Process**
	**Input/Output**
	**Decision**
	**Off-Page Reference (To continue the flow on a new page)**

Main flowchart

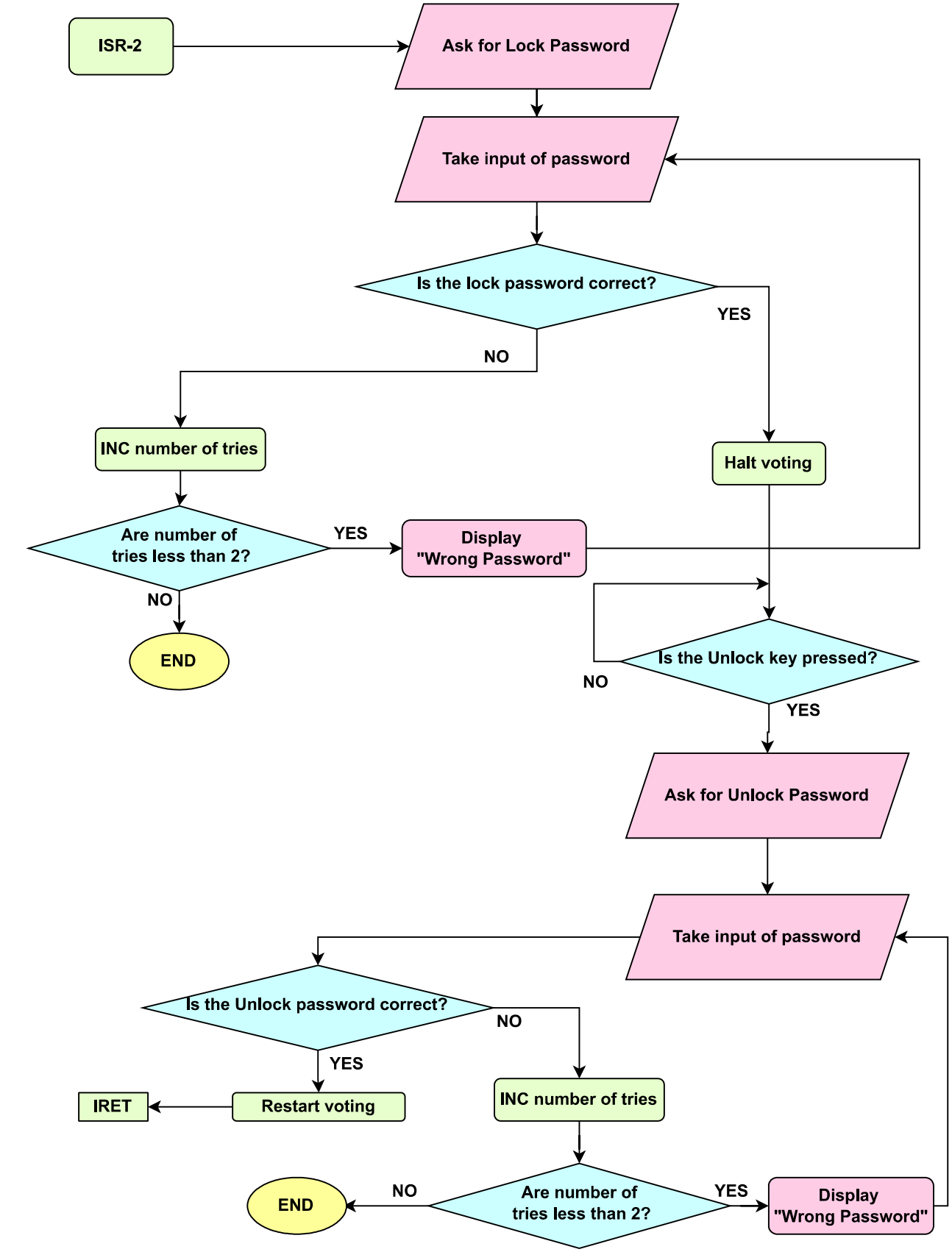



P
Make number of tries = 0
Display 'Presiding Officer'
Display "Wrong Password"
Take input of password of Presiding Officer
YES
Is the password of Presiding Officer correct?
NO
INC number of tries
Are number of tries less than 2?
NO
END
YES
Make number of tries = 0
Start the 10 hours clock
Is any candidate key pressed?
NO
YES
INC total vote count and INC vote count of corresponding candidate
Light up the corresponding LED
Software delay of 2 seconds (for waiting)

ISR-1 flowchart
(10 hour interrupt)



ISR-2 flowchart (lock key pressed)



Datasheets:

- 8086-

  https://www.electro-tech-online.com/datasheets/8086_intel.pdf

- 8255-

  http://aturing.umcs.maine.edu/~meadow/courses/cos335/Intel8255A.pdf

- 8253-

  https://www.cpcwiki.eu/imgs/e/e3/8253.pdf

- 8284-

  https://www.scs.stanford.edu/10wi-cs140/pintos/specs/8254.pdf

- 8259-

  https://www.renesas.com/us/en/document/dst/82c59a-datasheet

- 2716-

  https://amigan.yatho.com/2716EPROM.pdf

- 6116

  http://www.princeton.edu/~mae412/HANDOUTS/Datasheets/6116.pdf

- 74LS373-

  https://www.ti.com/lit/gpn/sn54ls373-sp

- 74LS245-

  https://www.ti.com/lit/gpn/sn54ls245-sp

- 74LS244-

http://www.sycelectronica.com.ar/semiconductores/74LS244.pdf

- LM020L-

  https://datasheetspdf.com/datasheet/LM020L.html

List of Attachments:

1. **Complete on-paper hardware design with proper labelling (attached).**