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Presentation Skills

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Sec: 1

B.N: 9

Task1

a) **Describe all the pins of PIC16f877A. After that, your colleagues would have enough information once they need to interface the PIC16f877A with other hardware…**

- OSC1/CLKI OSC1: Oscillator crystal or external clock input.
- OSC2/CLKO: Oscillator crystal or clock output.
- MCLR/VPP: Master Clear (input) or programming voltage (output).
- RA0/AN0, RA1/AN1, RA2/AN2, RA3/AN3: Digital I/O & Analog Input.
- RA4/T0CKI/C1OUT: Digital I/O & Timer & Comparator.
- RA5/AN4/SS/C2OUT: Digital I/O & Analog Input & Comparator.
- RB0/INT: Digital I/O & External Interrupt.
- RB1, RB2, RB3, RB4, RB5, RB6, RB7: Digital I/O.
- RC0/T1OSO/T1CKI: Digital I/O & Timer.
- RC1/T1OSI/CCP2: Digital I/O & Timer.
- RC2, RC3, RC4, RC5, RC6, RC7: Digital I/O.
- VSS: Ground reference for logic and I/O pins.
- VDD: Positive supply for logic and I/O pins.
- Port D: All Pin are Digital I/O.
- RE0/RD/AN5: Digital I/O & Analog Input.
- RE1/WR/AN6: Digital I/O & Analog Input.
- RE2/CS/AN7: Digital I/O & Analog Input.

Pin Name	PDIP Pin#	PLCC Pin#	TQFP Pin#	QFN Pin#	I/O/P Type	Buffer Type	Description
OSC1/CLKI	13	14	30	32		ST/CMOS(4)	Oscillator crystal or external clock input.
OSC1					I		Oscillator crystal input or external clock source input. ST buffer when configured in RC mode; otherwise CMOS.
CLKI					I		External clock source input. Always associated with pin function OSC1 (see OSC1/CLKI, OSC2/CLKO pins).
OSC2/CLKO	14	15	31	33		—	Oscillator crystal or clock output.
OSC2					O		Oscillator crystal output. Connects to crystal or resonator in Crystal Oscillator mode.
CLKO					O		In RC mode, OSC2 pin outputs CLKO, which has 1/4 the frequency of OSC1 and denotes the instruction cycle rate.
$\overline{MCLR}$/VPP	1	2	18	18		ST	Master Clear (input) or programming voltage (output).
$\overline{MCLR}$					I		Master Clear (Reset) input. This pin is an active low Reset to the device.
VPP					P		Programming voltage input.
							PORTA is a bidirectional I/O port.
RA0/AN0	2	3	19	19		TTL	
RA0					I/O		Digital I/O.
AN0					I		Analog input 0.
RA1/AN1	3	4	20	20		TTL	
RA1					I/O		Digital I/O.
AN1					I		Analog input 1.
RA2/AN2/VREF-/CVREF	4	5	21	21		TTL	
RA2					I/O		Digital I/O.
AN2					I		Analog input 2.
VREF-					I		A/D reference voltage (Low) input.
CVREF					O		Comparator VREF output.
RA3/AN3/VREF+	5	6	22	22		TTL	
RA3					I/O		Digital I/O.
AN3					I		Analog input 3.
VREF+					I		A/D reference voltage (High) input.
RA4/T0CKI/C1OUT	6	7	23	23		ST	
RA4					I/O		Digital I/O – Open-drain when configured as output.
T0CKI					I		Timer0 external clock input.
C1OUT					O		Comparator 1 output.
RA5/AN4/$\overline{SS}$/C2OUT	7	8	24	24		TTL	
RA5					I/O		Digital I/O.
AN4					I		Analog input 4.
$\overline{SS}$					I		SPI slave select input.
C2OUT					O		Comparator 2 output.

Pin Name	PDIP Pin#	PLCC Pin#	TQFP Pin#	QFN Pin#	I/O/P Type	Buffer Type	Description
							PORTB is a bidirectional I/O port. PORTB can be software programmed for internal weak pull-up on all inputs.
RB0/INT	33	36	8	9		TTL/ST(1)	
RB0					I/O		Digital I/O.
INT					I		External interrupt.
RB1	34	37	9	10	I/O	TTL	Digital I/O.
RB2	35	38	10	11	I/O	TTL	Digital I/O.
RB3/PGM	36	39	11	12		TTL	
RB3					I/O		Digital I/O.
PGM					I		Low-voltage ICSP programming enable pin.
RB4	37	41	14	14	I/O	TTL	Digital I/O.
RB5	38	42	15	15	I/O	TTL	Digital I/O.
RB6/PGC	39	43	16	16		TTL/ST(2)	
RB6					I/O		Digital I/O.
PGC					I		In-circuit debugger and ICSP programming clock.
RB7/PGD	40	44	17	17		TTL/ST(2)	
RB7					I/O		Digital I/O.
PGD					I/O		In-circuit debugger and ICSP programming data.

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b) **Explain to your colleagues the functions of the main blocks in PIC16f877A: ALU, Status and Control, Program Counter, Flash Program Memory, Instruction Register, Instruction Decoder.**

1. ***ALU (Arithmetic Logic Unit)***: central arithmetic and logic processing unit of the microcontroller. It performs arithmetic operations (such as addition, subtraction) and logic operations (such as AND, OR and XOR) on binary data.
2. ***Status and Control Registers***: are special registers that store flags and control bits related to the microcontroller's current state. These flags indicate the outcomes of previous operations, such as carry, zero, overflow, and more
3. ***Program Counter (PC)***: is a register that holds the address of the next instruction to be fetched and executed in the program memory.
4. ***Flash Program Memory***: is the non-volatile memory of the microcontroller, where the program code (firmware) is stored.
5. ***Instruction Register***: is a temporary storage unit within the microcontroller that holds the current instruction being executed.

6. ***Instruction Decoder***: is responsible for interpreting the instruction fetched from the program memory and determining the operation that needs to be performed by the ALU or other peripherals.

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c) **Examine the reasons why a led, which is connected to RA4 for flashing purpose not working probably.**

-The reason is RA4 pin is an open drain pin which in the output mode the output buffer selects ground when 0 is sent and the pin is floating when sending 1, so the MCU can not work as source (can't supply current) it only works as sink so we need external configuration such as pull up resistor to toggle the led properly.

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d) **ATMega328P is also an 8-bit but AVR microcontroller. Evaluate the characteristics of ATMega328P versus PIC16f877A, by comparing the memory size, the power consumption, pin count… of those two MCUs. Give 2 examples of embedded systems where ATMega328P is a better choice than PIC16f877A.**

-**Memory Size**:

- ATMega328P: It has 32KB of flash memory for program storage, 2KB of SRAM for data storage, and 1KB of EEPROM for non-volatile data storage.
- PIC16F877A: It has 14KB of flash memory for program storage, 368 bytes of RAM for data storage, and no built-in EEPROM.

The ATMega328P has more flash memory and RAM than the PIC16F877A, making it more suitable for applications that require larger code and data storage.

- **Power Consumption**:

- ATMega328P: It is based on the low-power RISC architecture and has various power-saving modes, which allows it to achieve lower power consumption in many scenarios.
- PIC16F877A: While it can be power-efficient in some applications, it may not offer as many low-power features and modes as the ATMega328P.

The ATMega328P is generally considered more power-efficient, making it a better choice for battery-operated and power-constrained embedded systems.

-**Pin Count**:

- ATMega328P: It comes in various package options, including 28-pin and 32-pin versions.
- PIC16F877A: It has 40 pins.

The ATMega328P is available in smaller package options with fewer pins, making it a suitable choice for applications with space constraints or simpler designs.

Examples of embedded systems where ATMega328P is a better choice than PIC16F877A:

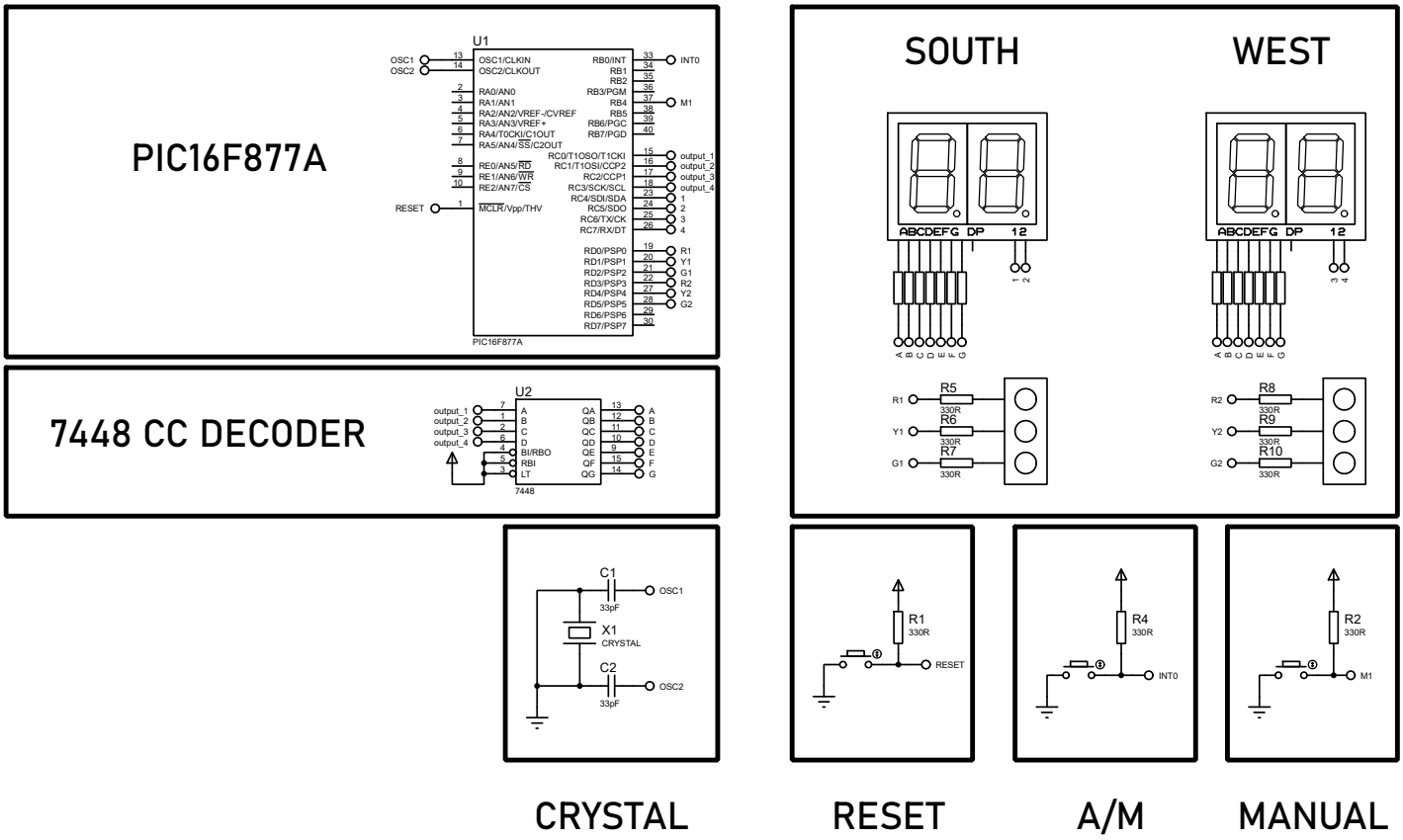
Portable IoT Sensor Node: An IoT sensor node designed to operate on batteries and transmit sensor data to a central server or gateway. The ATMega328P's lower power consumption and ample flash memory would be advantageous for storing sensor data, implementing various communication protocols, and ensuring longer battery life compared to the PIC16F877A.

Data logging and analysis: Applications involving extensive data collection and processing, such as environmental monitoring or industrial automation, often require the ATMega328P's larger memory and computational power to handle data storage and analysis efficiently.

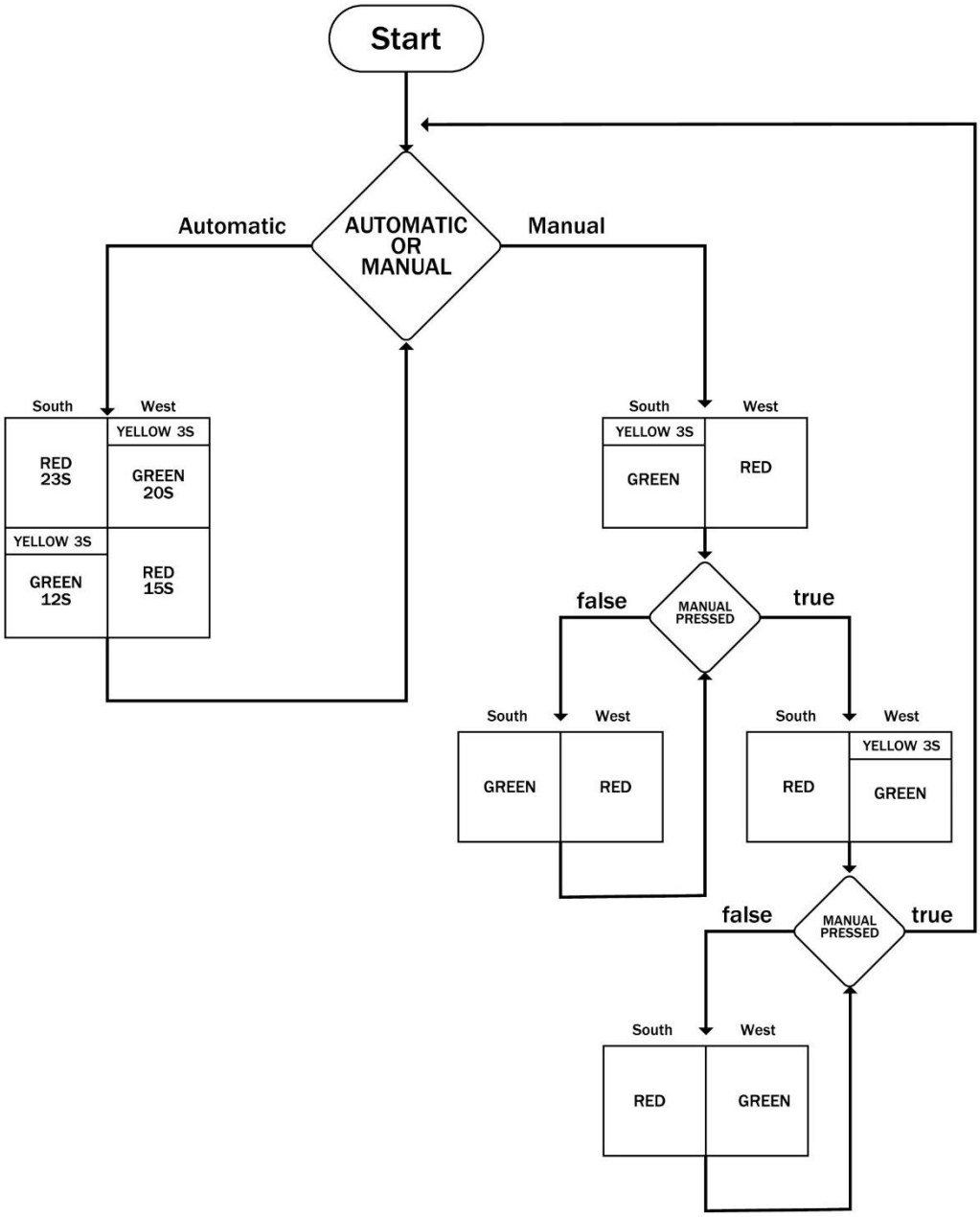
Wireless sensor networks: These systems often require data processing, transmission, and low power consumption. The ATMega328P's larger program and data memory, combined with its higher clock speed, enable more complex algorithms and efficient data handling. Its low-power modes also contribute to extended battery life.

Task 2

a) Circuit Diagram:



b) Flow Chart:


Start
AUTOMATIC OR MANUAL
Automatic
Manual
South
West
YELLOW 3S
RED 23S
GREEN 20S
YELLOW 3S
GREEN 12S
RED 15S
South
West
YELLOW 3S
GREEN
RED
false
MANUAL PRESSED
true
South
West
GREEN
RED
South
West
YELLOW 3S
RED
GREEN
false
MANUAL PRESSED
true
South
West
RED
GREEN