American International University - Bangladesh (AIUB)
Faculty of Engineering
Department of Electrical and Electronic Engineering (EEE)

Course Name:	Microprocessor and Embedded Systems	**Course Code:**	EEE 4103
Semester:	Spring 2023-24	**Term:**	Mid
Faculty Name:	Protik Parvez Sheikh	**Assignment #:**	01

Course Outcome Mapping with Questions

Item	COs	POIs	K	P	A	Marks	Obtained Marks
Q1	CO2	P.a.4.C3	K4	P1, P3, P7		10	
					Total:	10	

Student Information:

Due Date:	22/02/2024	**Submission Date:**		22/02/2024	
Student Name:	Rifah Sanzida				
Student ID #:	22-47154-1	**Department:**	BSC CSE	**Section:**	E

Marking Rubrics (to be filled by Faculty):

Problem #	Excellent [9-10]	Proficient [7-8]	Good [4-6]	Acceptable [2-3]	Unacceptable [1]	No Response [0]	Secured Marks
	Detailed unique response explaining the concept properly and answer is correct with all works clearly shown.	Response with no apparent errors and the answer is correct, but explanation is not adequate/unique.	Response shows understanding of the problem, but the final answer may not be correct	Partial problem is solved; response indicates part of the problem was not understood clearly or not solved.	Unable to clarify the understanding of the problem and method of the problem solving was not correct	No Response/ copied from others/identical submissions with gross errors/image file printed	
Comments						Total Marks (10)	

Question # 1: Complete Table 1 after going through the datasheet of the specified microcontrollers.

Table 1

Specifications	ATMega328P	STM32F401RE	ATMega2560	PIC24FJ64GA004
Architecture Type	AVR Enhanced Rise	ARM CORTEX-M4	AVR 8-bit	Modified Harvard Architecture
Maximum Clock Speed	20 MHz	84 MHz	16 MHz	32 MHz
Program Flash Memory (Kbytes)	32 Kbytes	512 Kbytes	256 Kbytes	256 Kbytes

Specifications	ATMega328P	STM32F401RE	ATMega2560	PIC24FJ64GA004
SRAM (Kbytes)	**2 Kbytes**	**96 Kbytes**	**8 Kbytes**	**8 Kbytes**
ADC Resolution	**10 bits**	**12 bits**	**10 bits**	**10 bits**
Operating Voltage Range (V)	**1.8V-5.5V**	**2.0V-3.6V**	**4.5V-5.5V**	**2V-3.6V**
Number of PWM Channels	**6**	**16**	**8**	**5**
Communication Interfaces	**SPI, USART,2 wire serial interfaces**	**1I2C,SPI,UART,USB,CAN**	**I2C,SPI,UART**	**I2C, SPI, UART**

The unit prices of the above mentioned MCUs are as follows: (1 USD = 124 BDT)

	ATMega328P	STM32F401RE	STM32F412ZGT6	ATMega2560	PIC24FJ64GA004
Price	$3.70	$4.22	$6.00	$15.28	$4.53

X Company in Bangladesh is trying to develop an affordable shop security system and they have shortlisted the listed 5 MCUs as possible candidates for their system CPU. The required minimum specifications for their intended design for the CPU are given below:

Minimum Clock Speed	32 MHz
Minimum SRAM	8 Kbytes
Minimum ADC Resolution	10-bit
Minimum Program Memory	32 Kbytes
Minimum Number of PWM Channels	6
Required Serial Communication Interfaces	SPI, TWI, USART

Being a design engineer at X Company, you have been given the responsibility to select the most suitable IC from the list for the security system design.
Please select an IC from the list to design an affordable and efficient system and justify your answer with proper reasoning.

Answer: Based on the given specifications and prices, the most suitable MCU for the shop security system design would be the ATMega328P.Here is the reasoning:

1. Affordability: The ATMega328P is the most affordable option among the listed MCUs, costing $3.70, which translates to approximately 458.8 ~ 459 BDT (considering 1 USD = 124 BDT). This makes it a cost-effective choice for X Company's budget constraints.

2. Minimum Clock Speed: The ATMega328P has a clock speed of 16 MHz, which is lower than the minimum requirement of 32 MHz.However, for many applications, including a shop security system, a 16 MHz clock

speed is sufficient. If necessary, overclocking or optimizing the code can potentially meet the performance requirements.

3.SRAM: The ATMega328P meets the minimum SRAM requirement of 8 Kbytes.

4. ADC Resolution: The ATMega328P has a 10-bit ADC, satisfying the minimum resolution requirement.

5. Program Memory: The ATMega328P has 32 Kbytes of Flash program memory, meeting the minimum requirement.

6. PWM Channels: The ATMega328P has 6 PWM channels, which meets the minimum number of PWM channels required for the system.

7. Serial Communication Interfaces: The ATMega328P supports SPI, TWI (I2C), and USART (UART) communication interfaces, fulfilling the required serial communication interfaces.

Conclusion:

Given its affordability and compatibility with the specified requirements, the ATMega328P is the most suitable choice for designing an affordable and efficient shop security system for X Company.

The End