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:	Engr. Md. Shaoran Sayem	**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:	27/02/2024	**Submission Date:**		27/02/2024	
Student Name:	MD. SHOHANUR RAHMAN SHOHAN				
Student ID #:	22-46013-1	**Department:**	CSE	**Section:**	J

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 the answer is correct with all works clearly shown.	Response with no apparent errors and the answer is correct, but the explanation is not adequate/unique.	The response shows an understanding of the problem, but the final answer may not be correct	Partial problem is solved; the 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	STM32F423MH	ATMega2560	PIC24FJ256GA412
Architecture Type	AVR enhanced RISF	ARM Cortex-M4	32-bit ARM Cortex M4	AVR 8-bit	16 bit PIC
Maximum Clock Speed	20 MHz	84 MHz	180 MHz	16MHz	32MHz
Program Flash Memory (kB)	32 kB	512 kB	512kB	256kB	256 kB

Specifications	ATMega328P	STM32F401RE	STM32F423MH	ATMega2560	PIC24FJ256GA412
SRAM (kB)	2 kB	96 kB ~~512 kB~~	128 kB ~~96 kB~~	8 kB	96 kB
ADC Resolution	10-bit	12-bit	12-bit	10-bit	10-bit
Operating Voltage Range (V)	1.8-5.5V	1.7-3.6V	1.7-3.6V	1.8-5.5V	2.2-3.6V
Number of PWM Channels	6	9	17	6	16
Communication Interfaces	SPI, I2C, USART	SPI, I2C, USART	SPI, I2C USART	SPI, I2C, USART	SPI, I2C, USART

The unit prices of the above-mentioned MCUs are as follows: (1 USD = 120 BDT)

	ATMega328P	STM32F401RE	STM32F423MH	ATMega2560	PIC24FJ256GA412
Price	$3.60	$12	$14	$20	$6.7

X Company in Bangladesh is trying to develop an affordable shop security system and they have shortlisted the listed 10 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 kB
Minimum ADC Resolution	10-bit
Minimum Program Memory	64 kB
Minimum Number of PWM Channels	12
Minimum Number of Timers	6
Required Serial Communication Interfaces	4 SPIs, 2 TWIs, 4 USARTs

Being a design engineer at X Company, you have been given the responsibility of selecting 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.

To select the most suitable micro controller (MCU) for x company and based on the provided requirements and unit price the STM32F401RE appears to be the most suitable chosee. Hear's the Reasoning:

Minimum Clock speed: The STM32F401RE has a maximum clock speed of 84 MHz, which comfortably exceeds the required minimum of 32 MHz. This provides room for further expansion and ensure that the MCU can handle the necessary processing speed for sequrity system.

Minimum SRAM: The STM32F401RE comes with 84 KB of SRAM, which greatly exceeds the minimum requirement of 8KB. This ample the SRAM capacity is beneficial for handling data and takes within the sequrity system.

Minimum ADC Resolution: The STM32F401RE offens a 12-bit ADC resolution, which is higher then the required minimum 10-bit. The higher resolution can provide more accurate analog-to-digital conversation, which can be important for sensor reading in a sequrity system.

Minimum Program Memory: The STM32F401RE provides 512KB of Flash memory, which is well above the required minimum of 6 KB. The extensive programm memory can acomalate the further expansion and more complex algorithm.

Minimum Number of PWM channels: The STM32F401RE offers 12 PWM channels, which is exacty same withe requirement. This allows for precise control the device within the sequrity system.

Minimum Number of Timer: The STM32F401RE offers more then 6 timers, which exceeds the provide requirements. It's also help to get more specific results.

Required serial Communication Interfaces: The STM32F401RE supports variety of communication Interfaces including SPIs, TWIs, USARTs. This meets the requirement interfaces for the security system.

Cost: With the STM32F401RE is more expensive than some of the other options. it is still resanably priced at $12,00, especially considering its superior features and capabilities. The extra cost is justified by the enhance and versatility offers.

Given, the STM32F401RE's robust performance, ample memory, and support for required interfaces, it is the most suitable choise for an affordable and efficient shop security system design at x company.