

	<b>American International University - Bangladesh (AIUB)</b> <b>Faculty of Engineering</b> <b>Department of Electrical and Electronic Engineering (EEE)</b>		
<b>Course Name:</b>	Microprocessor and Embedded Systems	<b>Course Code:</b>	EEE 4103
<b>Semester:</b>	Spring 2022-23	<b>Term:</b>	Mid
<b>Faculty Name:</b>	Tahseen Asma Meem	<b>Assignment #:</b>	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:

<b>Student Name:</b>	MD. ABDUL MUNEEM ADNAN	<b>Section:</b>	E
<b>Student ID #:</b>	20-44213-3	<b>Department:</b>	CSE

### Submission Information:

<b>Submission Date:</b>	22/02/2023	<b>Due Date:</b>	23/02/2023
-------------------------	------------	------------------	------------

### Marking Rubrics (to be filled by Faculty):

	Excellent [5]	Proficient [4]	Good [3]	Acceptable [2]	Unacceptable [1]	No Response [0]	
Problem #	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.	Unable to clarify the understanding of the problem and method of the problem solving was not correct	No Response/ (Copied/identical submissions will be graded as 0 for all parties concerned)	Secured Marks
Student ID							
Comments						Total marks (10)	

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

**Table 1**

<b>Specifications</b>	<b>ATMega328P</b>	<b>STM32F401RE</b>	<b>ATMega2560</b>	<b>PIC24FJ64GA004</b>
<b>Architecture Type</b>	8-bit RISC processor core	ARM®32-bit Cortex®-M4 CPU with FPU	AVR enhanced RISC	Modified Harvard Architecture
<b>Maximum Clock Speed</b>	20 MHz	84 MHz	16 MHz	16 MHz
<b>Program Flash Memory (Kbytes)</b>	32Kbytes [10000 write/erase cycles]	up to 512 Kbytes	256Kbytes	64 Kbytes
<b>SRAM (Kbytes)</b>	2Kbytes	96Kbytes	8Kbytes	8Kbytes
<b>ADC Resolution</b>	10 bits	12 bits	10 bits	10 bits
<b>Operating Voltage Range (V)</b>	1.8-5.5(V)	1.7-3.6(V)	5(V)	2-3.6(V)
<b>Number of PWM Channels</b>	6	Up to 16	12	5
<b>Communication Interfaces</b>	SPI, USART, Two-wire Serial Interface	Up to 3 x I2C interfaces, 3 USARTs, 4 SPIs, SDIO and Advanced connectivity	Communicate with I2C / TWI devices	Two 3-Wire/4-Wire SPI, Two I2C™, Two UART modules

The unit prices of the above mentioned MCUs are as follows: (1 USD = 106.40 BDT)

	<b>ATMega328P</b>	<b>STM32F401RE</b>	<b>ATMega2560</b>	<b>PIC24FJ64GA004</b>
<b>Price</b>	\$2.70	\$4.10	\$18.86	\$4.02

X Company in Bangladesh is trying to develop an affordable shop security system and they have shortlisted the listed 4 MCUs as possible candidates for their system CPU. The required minimum specifications for their intended design for the CPU are given below:

<b>Minimum Clock Speed</b>	16 MHz
<b>Minimum SRAM</b>	8 Kbytes
<b>Minimum ADC Resolution</b>	10-bit
<b>Minimum Program Memory</b>	32 Kbytes
<b>Minimum Number of PWM Channels</b>	5

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:**

The PIC24FJ64GA004 would be the ideal MCU for the shop security system design based on the minimal requirements specified:

- ✚ **Clock Speed:** A security system that needs to react rapidly would benefit from the PIC24FJ64GA004's minimum clock speed of 16MHz.
- ✚ **SRAM:** The PIC24FJ64GA004 has eight kilobytes (KB) of SRAM, which is more than the minimal requirement of eight kilobytes. This indicates that the memory will have enough room to accommodate data storage and processing for the device.
- ✚ **ADC Resolution:** The PIC24FJ64GA004 has an ADC resolution of 10 bits, which satisfies the minimal requirement of 10 bits. For a shop security system that needs to record images and analyze video signals, this resolution is appropriate.
- ✚ **Program Memory:** 64 KB of program memory on the PIC24FJ64GA004 is sufficient to satisfy the minimum requirement of 32 Kbytes. This is adequate for storing the system's operating commands and program code.
- ✚ **PWM Channels:** The PIC24FJ64GA004 has 5 PWM channels, which is the minimal quantity needed. This will enable the system to regulate and manage other output devices, such as the speed of motors and the brightness of lights.

The PIC24FJ64GA004 is also the second most affordable Microcontroller on the list, making it an intelligent investment for X Company.

The PIC24FJ64GA004 was found to be the most suitable and reasonably priced MCU for the design of the shop security system for X Company based on the aforementioned study.