Reg. No.: 21BLC1122

Name :

VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

Continuous Assessment Test II – March/April 2024

Programme	:	B. Tech (ECM)	Semester	:	WS 2023-24
Course	:	EMBEDDED SYSTEM DESIGN	Code	:	BECE403E
			Class Nbr.	:	CH2023240500955 CH2023240500938 CH2023240500927
Faculty	:	PRAKASH V, MUTHULAKSHMI S, MANOJ KUMAR R	Slot	:	B2+TB2
Time	:	90 Minutes	Max. Marks	:	50

Answer ALL the questions

Q.No.	Sub. Sec.	Questions	Marks
1.	(a)	Assume a scenario as follows. • Students are writing their online FAT exams and uploading their answers in VTOP portal. • Faculty members are correcting the answers, and their marks are available in the VTOP portal. • Based on the instructions from Controller of Examination (CoE) office, Software development cell (SDC) compute the grades through Relative/Absolute grading (Based on student strength). • After computation, CoE office will declare the results to the students. For the given application, identify and list out other essential requirements to implement the complete system. Then, represent the entire system behaviour using UML sequence diagram with proper notations.	[5]
	(b)	Consider a textile shop is installed with a Covid-19 prevention and detection system which consists of following modules. • Contactless automatic temperature scanner to detect the fever by scanning forehead temperature of the customer • Camera system is used to scan for customer's mask by performing image processing technique • Digital display unit to displays number of customer's currently inside the shop (Max. limit is 100) • Contactless automatic hand sanitizer dispenser • Upon verification of output from all above modules are within the limit, the entry door will open. Otherwise, the system generates a buzzer sound for a short duration. For the given application, identify and consider out other essential requirement to implement the complete system. Then, represent the entire system behaviour using the Petrinet model diagram with proper notations.	[5]

2. Design a wearable fitness tracker which can be worn on wrist, runs on a battery power. Tracker keeps track on the body temperature of a person who is wearing it and displays the same on the LCD. **[20]**

- Initially the tracker is in sleep mode when it is not in use to save the battery power. IR sensor makes the device ON when you are near the device and wants to use it.
- As soon as it detects the motion it wakes up, glow the on-board LED and displays the message "HELLO DEAR" on first line of the LCD for 2 seconds.
- Once the device wakes up, it asks for the 4-digit password which is entered through the keypad interfaced.
- If the password is correct, the body temperature is measured using LM 35 (analog temperature sensor) and displayed on the first line of the LCD. If the temperature goes above 37°C, the buzzer rings for 3 seconds.

To implement this system using STM32L152RE Nucleo board,

(i). Draw the schematic diagram for the above said design. [5 Marks]

(ii). Write a C++ program for the above using appropriate mbed APIs. [15 Marks]

3. For newly designed automobiles, the testing team intends to test the airbag deployment system using a Bluetooth module. The complete testing unit consists of a transmitter and receiver. **[15]**

- The transmitter section consists of an STM32 Nucleo board interfaced with an I2C protocol-supported ADXL345 accelerometer and HC-05 Bluetooth module to transfer real-time values (X, Y, and Z- axes) to the receiver section.
- The receiver section consists of a Nucleo board interfaced with a Bluetooth module to receive the accelerometer values. The testing team continuously monitors these received values on a PC using a Tera term application via a USB serial interface.

For the testing unit described above,

(i). Draw the schematic for both transmitter and receiver sections [5 Marks]

(ii). Write a C++ mbed program using appropriate APIs for both the transmitter and receiver sections. [10 Marks]

4. Three nodes want to communicate with each other through the CAN communication protocol. The 11-bit message identifier of each node is given as Node-1:0x234, Node-2:0x231, and Node-3:0x243. Find the order in which nodes can send the data on the CAN bus using the arbitration process. Demonstrate the complete arbitration process with a neat timing diagram consisting of Node-1, Node-2, Node-3, and CAN bus signals. Justify your answer. **[5]**

Total [50]

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