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| **Assignment** | **:** | **Systems Programming and Computer Control** |
| **Subject Code** | **:** | **CE00352-5-SPCC** |
| **Date Assigned** | **:** | **Week 4** |
| **Date Due** | **:** | **Week 10** |

A company has received a contract to design a controller for an Automated Teller Machine (ATM). An ATM interfaces with a Bank to provide financial services to customers. The specifications and rules of functions are listed below. Your job is to design a controller using LabVIEW, that satisfies all specifications.

**Instructions:**

* Document your assumptions either in your Document or on the LabVIEW block diagram.
* The assignment requires you to develop a LabVIEW application based on a set of specifications.
* A computer with a standard installation of LabVIEW is the only reference allowed for the assignment. Externally developed code and third party tools are not allowed in the assignment.
* You are to submit your finished application online via the appropriate channel.
* Total time allocated for the assignment is 7weeks

**Grading:**

The application development assignment consists of a total of 50 points (100%) which are allocated as follows:

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| --- | --- | --- |
| **Criteria** | **Points** | **Percentage %** |
| Programming style | 15 | 30 |
| Functionality | 15 | 30 |
| User InterfaceDesign | 5 | 10 |
| Conformity to design standards | 5 | 10 |
| Documentation | 10 | 20 |

A presentation will follow to allow students to showcase the full functionality of their application. The goal of this presentation is to ascertain that the application submitted is the intellectual product of the student. Failure to perform/submit a presentation will result in a **ZERO (0).**

**IMPORTANT:**

* **When you have completed the Assignment, submit the assignment document as a MS Word Document, and the S/W (along with any other resource) as a Zip file.**
* **The Video presentation is to be no longer than 10mins and have a compact file size of no more than 50MB.**
* **Submit the files on the appropriate online channels.**

**Application Development**

**Section I: General Requirements**

The application should:

* Function as specified in **Section II** of this document.
* Conform to LabVIEW coding style and documentation standards (found in

LabVIEW documentation – LabVIEW Development Guidelines).

* Be created using VIs and functions available in LabVIEW (templates, examples, or code developed outside the core functions of LabVIEW are not acceptable).
* Be hierarchical in nature. All major functions should be performed in sub VIs.
* Use a state machine that either uses a type defined enumerated control, queue, or

Event structure for state management.

* Be easily scalable to add more states / features without having to manually update

the hierarchy.

* Minimize the use of excessive structures, variables (local / global) and Property

Nodes.

* Respond to front panel controls (within 100ms) and not utilize 100% of CPU

time.

* Close all opened references and handles where used.
* Be well documented and include the following:
* Labels on appropriate wires within the main VI and sub VIs.
* Descriptions for each algorithm.
* Documentation in VI Properties » Documentation for both main VI and sub VIs.
* Tip strip (tool tip) and Description for front panel controls and indicators.
* Labels for constants.

**Section II: Application Requirements Security System**

**Instructions:**

Design an Automated Teller Machine (ATM) controller using LabVIEW. The front panel of the controller should look similar to the following front panel.

Diagram

Description automatically generated

General Operation:

The ATM controller simulates the control system of an Automated Teller Machine. The user interacts with controls and indicators on the front panel to perform common ATM functions such as deposit funds, withdraw funds, and inquire about the balance of funds from the user account.

The ATM controller has access to user account information stored in the Accounts.txt file on a **remote server**. You, the developer, are responsible for creating the Accounts.txt file on the remote server, which the ATM controller reads from or writes to, depending on user-initiated transactions. Refer to the ATM Accounts File specification section for more information about the initial content and data format of the Accounts.txt file.

The controller should perform the following general operations:

* Obtain user input through the User Input, “**Left Buttons**”, and “**Right Buttons**”.
* Manage the “**Left Menu**” and “**Right Menu**” strings and take appropriate action by responding to the corresponding “**Left Buttons**” and “**Right Buttons**”.  
  Prompt user actions and confirm transactions by displaying appropriate messages in the ATM Messages indicator.
* Monitor user inactivity and terminate the user session after the specified time expires. If no move自动关机

Sequence of Operation:

**Start (Application Run):** When the application starts, the User Input, “**Enter (E)**”, “**Left Menu**”, “**Right Menu**”, “**Left Buttons**”, and “**Right Buttons**” should be disabled.  
The “**Card Simulator button**” should be enabled and the ATM Messages indicator should display the Welcome Message.

*Refer to the ATM Message Types section of the specification for message types and font specifications for the messages.*

**Insert ATM card:** Click the Card Simulator button. The button should remain pressed and the Boolean text should display Card Inserted. This action enables the “**Enter (E)”** button and the User Input string control, focuses the cursor to the User Input control and waits for the user to enter the account number in the control. The “**Card Simulator**”button should remain pressed until the user completes the session or a timeout (10 seconds) occurs.

After the user completes keying in the account number and presses the “**Enter (E)”** button, the ATM controller should access the ATM Accounts file from the remote server using a TCP/IP connection and verify that the account exists.  
If the account does not exist, the ATM Messages indicator should display the Account Verification Failed Message and prompt the user to re-enter the account number. If the account exists, the ATM controller should enable the “**Left Menu**”, “**Right Menu**”, “**Left Buttons**” and “**Right Buttons**”, and display the Main Menu Message on the ATM Messages indicator. The ATM controller should also populate the “**Left Menu**” and “**Right Menu**” with the “**Main Menu**” and wait for user action.

Refer to the **ATM Menus section** of the specification for more information about the strings that appear in the menus.  
**Note:** If, at any time after the insertion of the ATM card, the ATM controller does not detect use of front panel controls for 10 seconds, the “**Card Simulator**”button should be released and the user session should be terminated by stopping the application. The ATM Messages indicator should display the Session Terminate Message.

**Deposit:** Click the button next to the corresponding “**Right Menu item**”. This action should display the Deposit Message, focus the cursor to the User Input, and allow the user to enter the amount to be deposited. After the user enters an amount in the User Input and presses the “**Enter (E)”** button, the Deposit Complete Message should display on the ATM Messages indicator and the ATM Accounts file should update with the new balance.

**Withdraw:** Click the button next to the corresponding “**Right Menu”** item. This action should display the Withdrawal Message, focus the cursor to the User Input control, and allow the user to enter the amount to withdraw from the account. After the user enters an amount in the User Input control and presses the “**Enter (E)”** button, the ATM controller should check if the account has sufficient funds to complete the transaction.   
If the account has sufficient funds, the controller should deduct the keyed in amount from the current balance, update the ATM Accounts file with the new balance, and display the Withdrawal Complete Message on the ATM Messages indicator.

If the account has insufficient funds, the Withdrawal Failed Message should display on the ATM Messages indicator.

**Fast Cash $50:** Click the button next to the corresponding “**Right Menu**”item. The ATM controller should check if the account has sufficient funds to complete the transaction. If the account has at least $50, the ATM controller should deduct $50 from the current balance, update the ATM Accounts file with the new balance, and display the Withdrawal Complete Message on the ATM Messages indicator.

If the account has insufficient funds, the Withdrawal Failed Message should display on the ATM Messages indicator.

**None:** This button is reserved for future use. Clicking the button next to the corresponding “**Left Menu**” item should not produce any results. The ATM Messages indicator should continue to display the current message.

**Balance Inquiry:** Click the button next to the corresponding “**Left Menu**”item to get the current balance from the ATM Accounts file. The ATM Messages indicator should display the Balance Inquiry Message.

**Return Card and Terminate:** Click the button next to the corresponding “**Left Menu**”item to terminate the user session. The ATM Messages indicator should display the Session Terminate Message. The ATM controller should release the “**Card Simulator**” button to indicate the return of the ATM card, disable the User Input control, and terminate the application.

Description of Controls/Indicators:

|  |  |
| --- | --- |
| **Control Name** | **Control Description - Function** |
| **Card Simulator** | Button – Simulates insertion of an ATM card OFF text: Press to inset card ON text: Card inserted |
| **Left Buttons** | Cluster of Buttons – Allows user to select ATM transaction |
| **Right Buttons** | Cluster of Buttons – Allows user to select ATM transaction |
| **User Input** | String – Allows user to enter Account number, Deposit, and Withdrawal amounts. |
| **Enter Button** | Button – Commits the entry in the **User Input** |

|  |  |
| --- | --- |
| **Indicator Name** | **Indicator Description - Function** |
| **ATM Messages** | String – Displays messages to guide and provide feedback to user. Refer to the *ATM Message Types* section for the list of messages |
| **Left Menu** | Cluster of strings – Used to display menu. Refer to the *ATM Menus* section for the list of menus. |
| **Right Menu** | Cluster of strings – Used to display menu. Refer to the *ATM Menus* section for the list of menus. |

**ATM Message Types:**

|  |  |
| --- | --- |
|  |  |
| Welcome Message | Welcome to Acme Bank. Please insert your card and enter your account number in the User Input.  Press Enter (E) when done. |
| Main Menu Message | Welcome to Acme Bank First Name, Last Name (from file)  Please select transaction by using the buttons. |
| Account Verification Failed Message | Account Information Incorrect Please Re-Enter Account Number. Press Enter (E) when done |
| Session Terminate Message | Your session has been terminated due to inactivity or menu selection. Please take your card  Goodbye! |
| Welcome Message | Welcome to Acme Bank. Please insert your card and enter your account number in the User Input.  Press Enter (E) when done. |
| Main Menu Message | Welcome to Acme Bank First Name, Last Name (from file)  Please select transaction by using the buttons. |
| Account Verification Failed Message | Account Information Incorrect Please Re-Enter Account Number. Press Enter (E) when done |
| Session Terminate Message | Your session has been terminated due to inactivity or menu selection. Please take your card  Goodbye! |
| Deposit Message | Please enter amount to deposit and press Enter (E) when done |
| Deposit Complete Message | $ (Amount) Deposited |
| Withdrawal Message | Please enter amount to withdraw and press Enter (E) when done |
| Withdrawal Complete Message | $ (Amount) Withdrawn |
| Withdrawal Failed Message | Insufficient funds in account Please check your balance and try again |
| Balance Inquiry Message | Your Balance Is: $ (Balance Amount from file) |

The font for the **ATM Message** indicator should be 14 point and bold. The message should be centred in the display, as shown in the following figure.

**Sample screen shot for ATM messages:**

Graphical user interface, text, application

Description automatically generated

**ATM Menus:**

Main Menu:

|  |  |
| --- | --- |
| **Left Menu (Strings)** | **Right Menu (Strings)** |
| None | Deposit |
| Balance Inquiry | Withdraw |
| Return Card and Terminate | Fast Cash $50 |

**Note:** The application should be scalable to add other menus without major modifications to the application.

**Sample screen shot with Main Menu displayed:**

Graphical user interface, text, application

Description automatically generated

**ATM Accounts File specification:**

The file should be a text file containing ATM account information in a Delimited Spreadsheet format. The file should be located in the same folder as the main server VI. The ATM controller should **not** prompt the user for a filename or prompt the user to update the file.

The account information should be in the following format: Account Number (5 digits), First Name, Last Name, Balance

Each account should be identified by a unique account number only.

The following four records should exist to test the operation of the ATM:

Table

Description automatically generated

**Marking Criteria**

The assignment will contribute **50%** towards the entire grade of the Module, as mentioned in the Module Descriptor.

**Distinction**

Demonstrated comprehensive research with detailed evidence. High level of analysis performed, exceptional and thorough knowledge and understanding displayed with regard to application. This includes analysis and evaluation of facts followed by results of evaluation. Documentation presented in a professional manner, following proper sequencing and flow. Displayed evidence of critical appraisal. High level of listing citation and references.

**Credit**

Adequate research conducted with fair detail of evidence presented. Moderate level of understanding, analysis and knowledge displayed. Some level of relevance included in terms of application. Moderate level of analysis and evaluation of facts followed by results comparison. Good level of documentation presented. Some level of reflection was evident in the documentation. Moderate level of listing citation and references.

**Pass**

Low level research conducted. Some evidence of research displayed. Basic level of understanding and knowledge analysis displayed. Satisfactory level of documentation. No evaluation and analysis of facts, no results comparison performed Satisfactory or low level of reflection displayed. Low level of listing citation and referencing.