USER REQUIREMENTS SPECIFICATION

For

VENDING MACHINE CONTROL SYSTEM (VMCS)

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1.INTRODUCTION

1.1 Purpose

i) The purpose of this document is to specify the user requirement for the control system for the Vending Machine Control system (VMC) for the Vimto Soft Drink Company.

ii) This document describes the required system facilities and system performance characteristics.

1.2 Objectives

The objectives of this document are to:

i) Establish the User Requirements for the VMCS & Simulator
ii) Determine the scope of the systems needed to meet the user requirements
iii)Identify the system capacity and the requirements for future expansion
iv)Provide the basis for the development of the system

1.3 Scopes

1.3.1 Software System

The function of this system will be the control of operation of the vending machine. In particular it will:

i) Control interactions with customers
ii) Display information to and carry out the instructions of the maintainer

1.3.2 Software Documentation

Complete and easily understood documentation of the system will be provided to aid in future maintenance of the system. In particular for the following deliverables will be produced:

i) The Requirements Model description
ii) The Analysis Model description
iii) The Design Model description
iv) The Acceptance Test plan

1.3.3 User Manual

A user guide for the vending machine maintainer will be produced. It will explain exactly how to use the system.

1.4 Definition of Terms

1.4.1 The Terms

The following terms have special meanings with this document.

i) The word **shall**, implies a mandatory requirement.
ii) The word **should**, implies a desirable requirement.
iii) The word **will**, implies a mandatory requirement outside the scope of this document.
iv) The word **may**, implies a desirable requirement outside the scope of this document.

2. OVERVIEW OF REQUIREMENTS

2.1 Introduction

The Vimto Soft Drink Company operates and maintains a large number of automatic soft drinks dispensers at various sites throughout Singapore. Previously these machines have been controlled by the analog devices, which are now out of production and also difficult to maintain. It has been decided to invest in a computerized control system, which will be installed in a new range of soft drinks vending machines. These machines will sell several different brands of drinks, which can retail at different prices.

Currently the analog controller accepts coins from people wishing to purchase soft drinks cans and activates the dispensing of these drinks cans. It will allow selection of particular brands, or will indicate if a particular brand of soft drink is unavailable. The new system shall duplicate the functionality of the existing system and add new functionality made feasible by the new technology. It will also allow the vending machine maintainer to check and remove cash, and to check the number of drinks cans held.

2.2 System Interfaces

The system shall interface with

i) The mechanical drinks can dispensing mechanism within the vending machine
ii) The coin checking, storage and dispensing mechanism within the vending machine
iii)The door locking/unlocking mechanism within the vending machine

2.3 System Functions

System functions to be implemented are:

i) Acceptance/rejection and cumulative totaling of money input by customer
ii) Dispensation of the selected drinks to the customer
iii) Indication if selected brands are unavailable
iv) Dispensation of change to customers
v) Display of requested information to the vending machine maintainer
vi) Injection of new drink price to the vending machine by the maintainer
vii) Transfer of cash held within machine to the maintainer
viii) Simulation of the customer/maintainer interface and the interface with the vending machine machinery.

2.4 User Characteristics

The users shall either be:

i) acting as customers of the vending machine, who would be members of the general public
ii) acting as the vending machine maintainer who will have a set of simple instructions to use with the system
iii) controllers of the overall simulation of the VMCS

There will only be one user at any one time

2.5 General Constraints

The system is not subject to any general constraints.

3. FUNCTIONAL REQUIREMENTS

In this section, the functional requirements of the VMCS and the Simulator are describes in the text. Figure 1 shows a block diagram, which indicates the roles of the software systems:

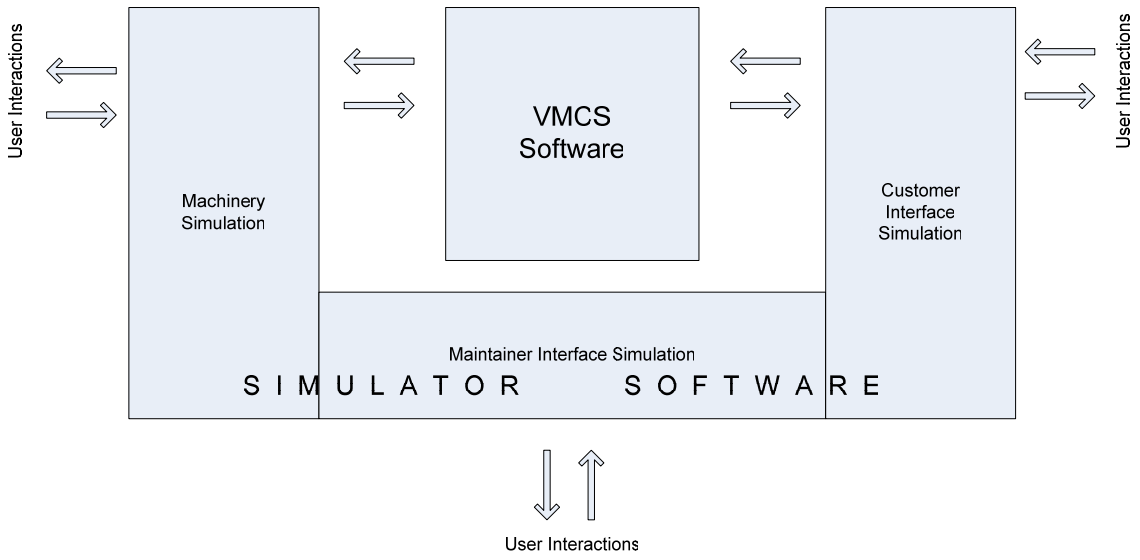

Figure 1: The Overall System

3.1 Processing Requirements:

This section describes the processing requirements for the VMCS software and the simulator software

3.1.1 VMCS Requirements

This section describes the

i) Customer requirements
ii) Maintainer requirements
iii) Other requirements

3.1.1.1 Customer Requirements

The customer will selects a drinks brand before any money can be entered into the vending machine

The VMCS shall monitor the number of drinks cans of each particular brand and will display to the customer if they are available, and what their price is. The price of individual brands will not necessarily be the same.

The VMCS shall check if any coin input to the Vending Machine is valid, and

i. Accept it if it is valid
ii. Reject it if it is invalid and indicate this to customer

The VMCS shall monitor the amount of accepted money that is input to the vending machine during a particular transaction, and

i. Display the cumulated amount of money to the customer
ii. Determine when enough money has been input to purchase a drinks can

The VMCS shall display to the customer the total amount of money he has input to date, at any point during the transaction.

When a customer has selected a particular drinks brand, and finished inputting money, then the VMCS shall determine the total amount of money input by a customer, and determine if enough money has been input to purchase the selected can. If it has not, the VMCS shall not respond to the customer request, and shall wait further from customer.

After the drinks can has been dispensed then VMCS shall determine if any change should be sent to the customer at the end of transaction. It shall also monitor the total cash held within the vending machine and determine if it is possible to pay the customer the appropriate change as follows:

If there is enough change then the appropriate change shall be output
If there are not enough coins of appropriate denominations held within the vending machine then an appropriate message shall be sent to the customer

If the selection is valid and the selected drink is available, and the correct money or more than the correct money has been input then the VMCS shall dispense the appropriate drinks can to the customer.

If a customer selects an unavailable drinks brand, the VMCS shall not respond, and shall wait for the customer to choose a valid drinks brand.

The VMCS shall return the customer his money if the customer chooses to terminate the transaction at any point in the transaction. The transaction is then terminated and no records are kept.

3.1.2.1 Maintainer Requirements

The maintainer shall identify himself to the vending machine using an authorized password. The VMCS will not begin transactions with the maintainer until the appropriate password is received. This password will be fixed. When the password is received the VMCS will unlock the door of the vending machine allowing the maintainer actual access to the drinks stocking mechanism and the money storage.

The VMCS shall not begin any customer transactions whilst the maintainer is operating upon it. If the VMCS is conducting a transaction with a customer when the maintainer attempts to log in, then the customer transaction will be terminated and his money will refunded.

The VMCS shall, on request, supply the maintainer with:

i. The numbers of drinks cans held for any particular brand
ii. The amount of money held in each denomination
iii. The total amount of money held by the vending machine

The VMCS shall on request transfer all cash held within the vending machine to the maintainer

The maintainer will terminate his transaction with the VMCS using a specific exit instruction. Unless this instruction is received, the VMCS will assume the maintainer is still operating on the vending machine. The VMCS will only allow the maintainer to exit if it has received a signal from the vending machine locking mechanism indicating that the door has been relocked.

Once the door has been unlocked, the maintainer has the ability to change the following, independent of VMCS;

i. The number of cans held by the machine
ii. The cash/change held by the machine

Therefore the VMCS shall monitor the status of the cans held by the vending machine, and the change held by the machine, after a maintainer transaction has ceased.

3.1.1.3 Other VMCS Requirements

If the power supply to the vending machine is cut off during a transaction, then the VMCS will cease to function. When power is restored, the VMCS shall not have any knowledge of previous transaction and will start afresh.

3.1.2 Simulator Requirements

The simulator software will simulate the external interfaces of the VMCS with the customer, the maintainer and the mechanical components of the system. It will do this via a single simulation control window, which in turn shall allow the users to access either:

i) windows which directly simulate the external control panel of vending machine
ii) windows which allows the users to change parameters which represent physical characteristics of the vending machine

Each of these windows is described below

3.1.2.1 Overall Simulation Control

This window is shown overleaf in figure 2. It will have the following features.

i) There shall be facility to begin the simulation (corresponding to the main power being turned on for the vending machine). This will be achieved by clicking on a radio button.

ii) There shall be a facility to end the simulation (which will be equivalent to the main power being turned off; i.e. there will be no record kept of the simulated transactions). This will be achieved by clicking on a radio button.

iii) There shall be the facility to activate either the

- The customer interface panel
- The maintainer interface panel
- The machinery simulation panel

This will be achieved by clicking on a radio button

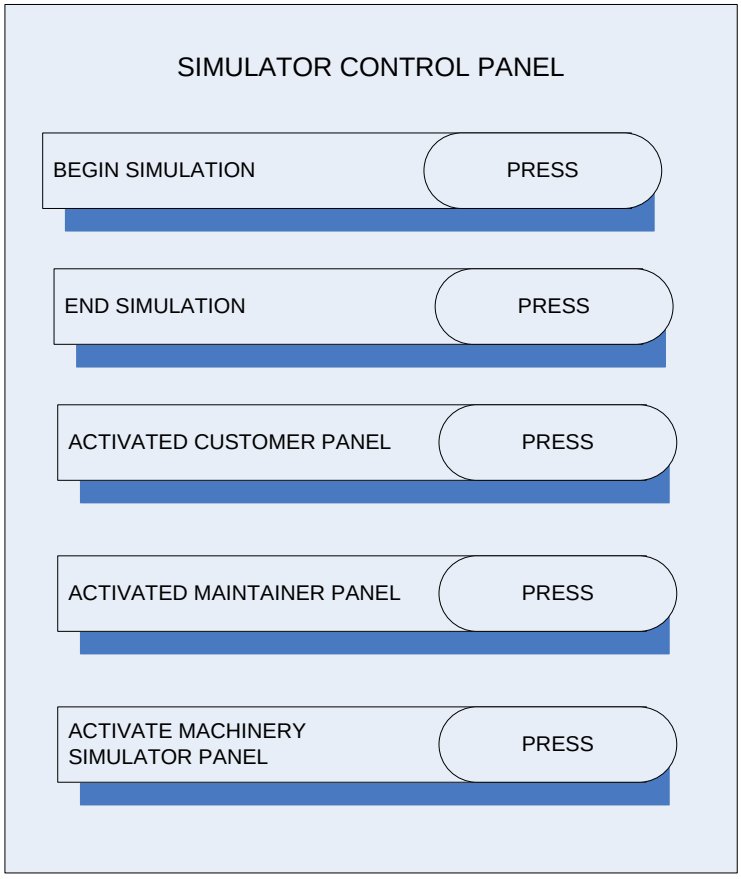

Figure 2 : The Simulator Control Panel

3.1.2.2 Customer Interface

The simulator shall simulate the customer interface panel which is shown below in figure 3.

It will contain the following specific features:

i) There will be a radio button next to "INSERT COINS HERE", which when clicked on, shall activate a dialog box which will allow the simulated input of each coin of any denomination.

ii) If invalid coins are input, then the box "COINS NOT VALID" should flash.

iii) The value or identity of the invalid coin shall appear in a panel next to the caption "COLLECT CHANGE/RETURNED CASH HERE".

iv) The total money inserted to date during a transaction should be displayed next to the "TOTAL MONEY INSERTED" caption.

v) If a brand is unavailable the caption "BRAND UNAVAILABLE" should be activated. Brand selection from available brands should be made by clicking on an appropriate radio button.

vi) If no change is available then the box "no change available" should flash.

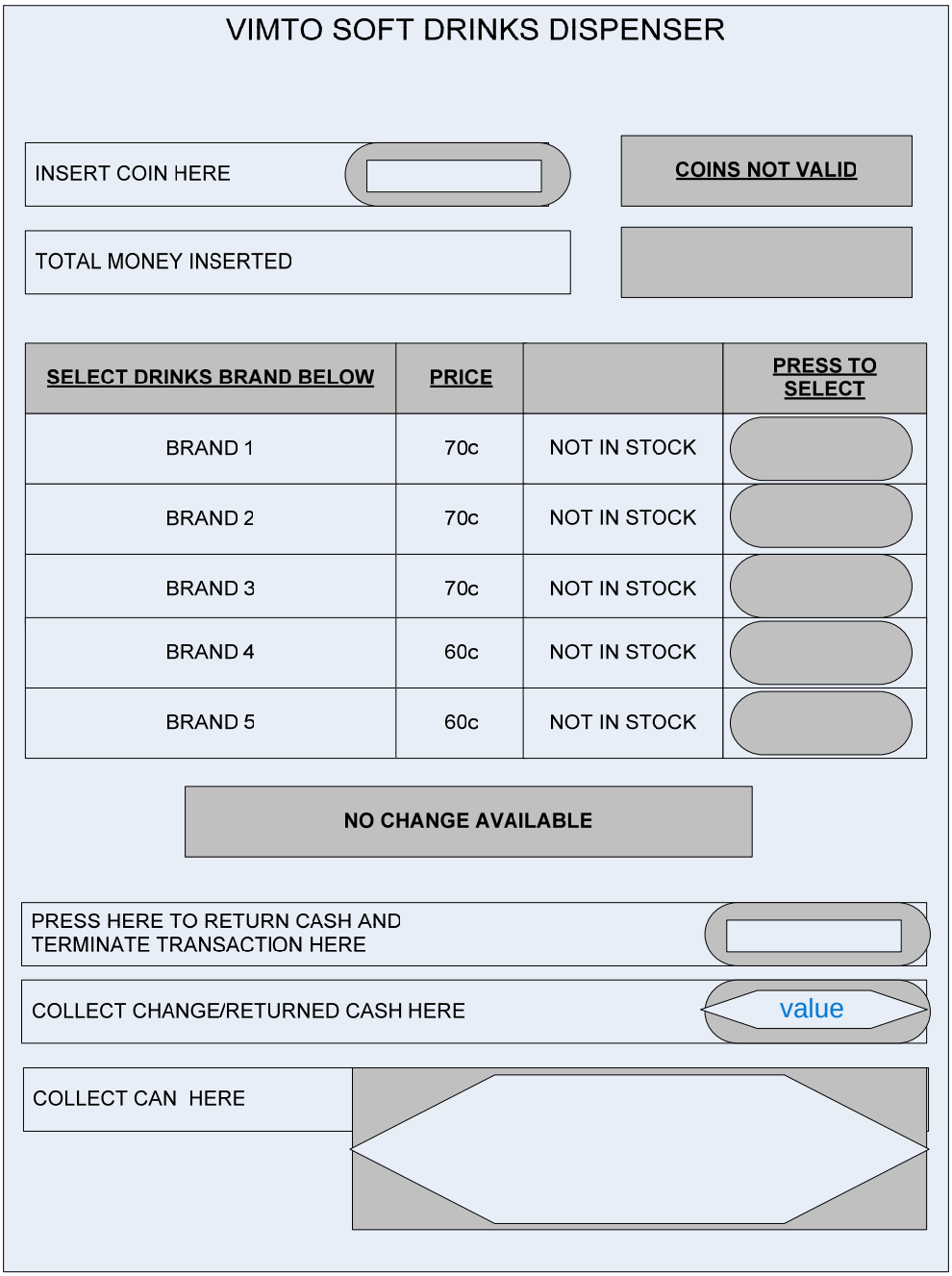

Figure 3: The Customer Panel for VMCS

vii) If change available, then the value shall appear in a panel next to the caption "COLLECT CHANGE/RETURNED CASH HERE".

viii) There will be a radio button next the caption "PRESS HERE TO RETURN CASH", which, if pressed, shall cause the value of the returned money to appear in a panel next to the caption "COLLECT CHANGE/RETURNED CASE HERE".

ix) At the end of a successful transaction a motif representing a can of the selected drinks brand shall appear in a panel next to the caption "COLLECT CAN HERE". This shall effectively remove a can from the store in the machine for that particular brand.

3.1.2.3 The Maintainer Control Panel

This will accurately represent the panel shown in figure 4 below with the following details:

i) There will be a panel next to "TYPE PASSWORD HERE", in which the maintainer can type 6 alphanumeric characters, corresponding to the password

ii) If valid password is input, then the box "PASSWORD VALID" shall flash.

iii) If an invalid password is input, then the box "PASSWORD INVALID" shall flash.

iv) The numbers of coins in a chosen denomination shall be determined by clicking on a radio button corresponding to the chosen denomination; the total number of cans corresponding to that denomination shall then be displayed in a panel below.

v) The number of drinks cans for a chosen brand shall be determined by clicking on a radio button corresponding to the chosen brand; the total number of cans corresponding to that denomination shall then be displayed in a panel below.

vi) If it is desired to change the drinks can price then this shall be done by typing in a new price, in Malaysia cents in a panel next to the caption "TYPE NEW DRINK CAN PRICE HERE". The initial values of the drinks brands are as follows:

- Drinks Brand 1: 70c
- Drinks Brand 2: 70c
- Drinks Brand 3: 70c

- Drinks Brand 4: 60c
- Drinks Brand 5: 60c

vii) The total amount of cash held within the machine shall be collected by pressing the radio button next to caption "PRESS HERE TO COLLECT ALL CASH". The total cash will then be displayed in a panel next to caption "COLLECT ALL CASH HERE". The machine shall then be effectively empty of cash.

viii) The end of the interaction between the maintainer and the vending machine shall be indicated by clicking on the radio button next to caption "PRESS HERE WHEN FINISHED".

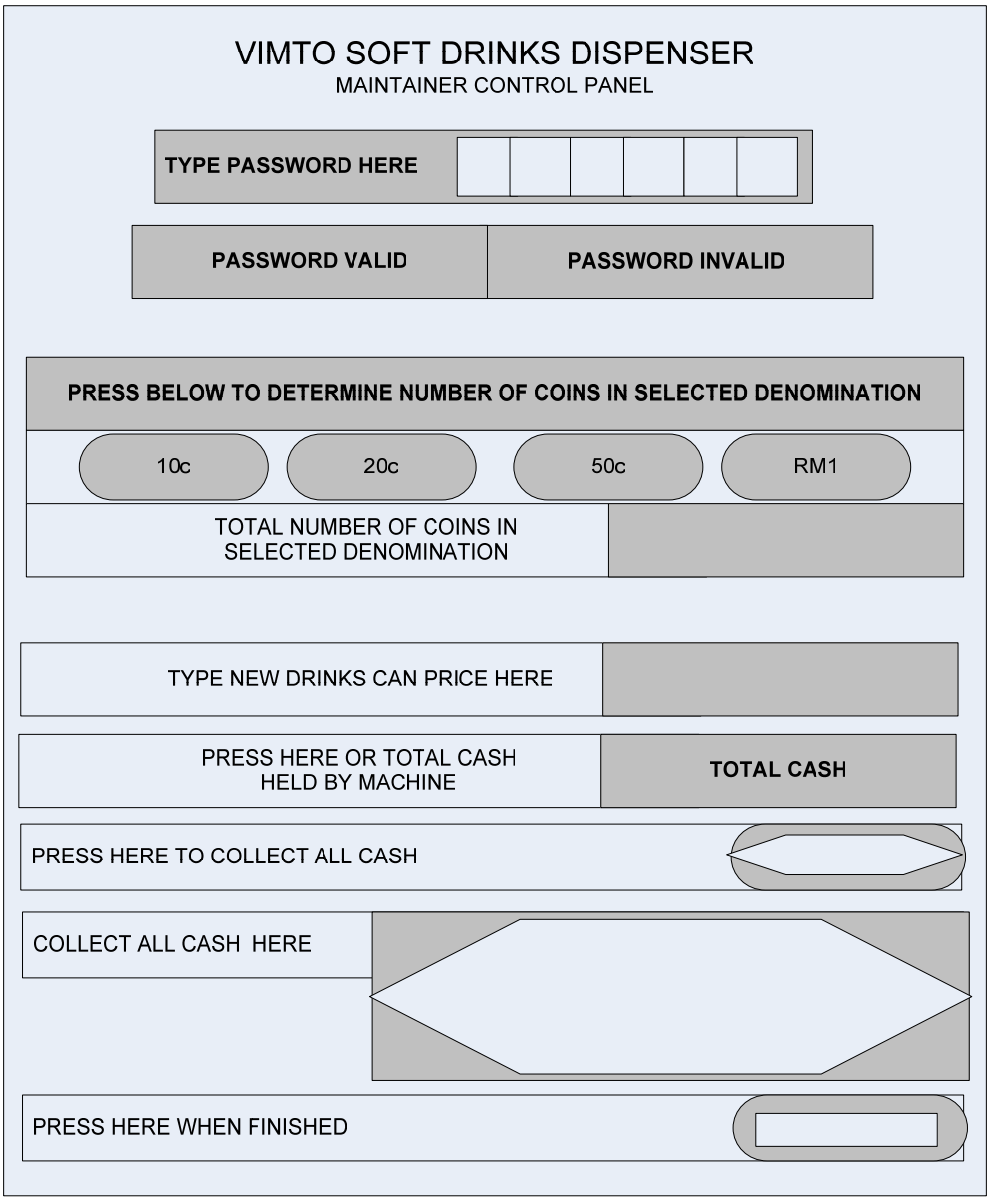

Figure 4: The Maintainer Control Panel

3.1.2.4 The Vending Machinery Simulation

The other vending machine components will be simulated by the software, in particular:

- The cash store
- The drinks can store
- The vending machine door lock

These components shall be simulated using the window illustrated below in figure 5.

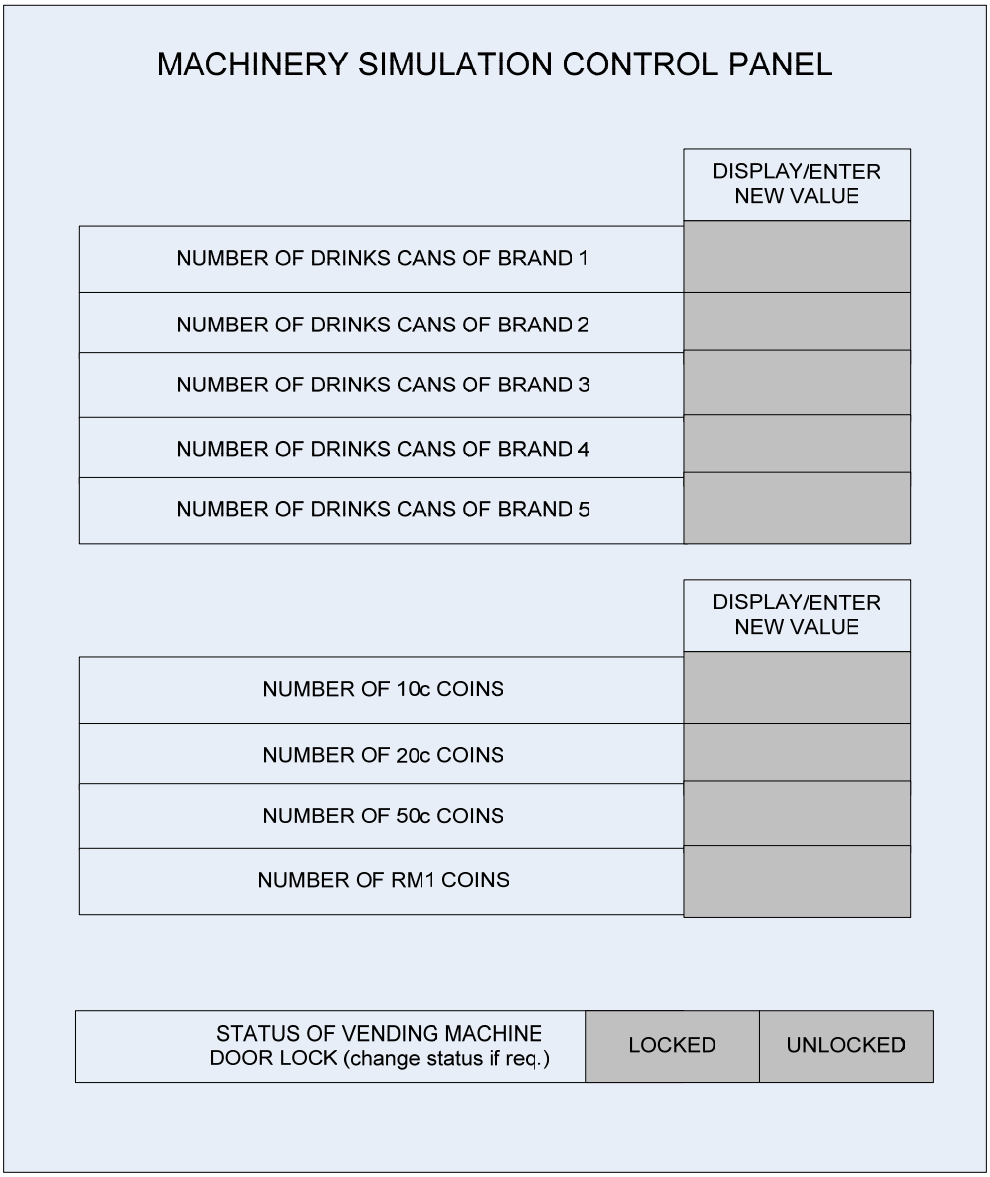

Figure 5: The Vending Machinery Simulation Panel

This panel shall have the following features.

i) It shall display the number of drinks cans of each brand held by the vending machine, and allow the user to overwrite this value with a new value. (that must be integer, ≥ 0 & ≤ 20).

ii) It shall display the number of coins in each denomination held by the vending machine, and allow the user to overwrite this value with a new value. (that must be integer, ≥ 0 & ≤ 20).

iii) It shall display the status of the vending machine door lock (locked/unlocked), and allow the user to change status from unlocked to locked, but not vice-versa.

The initial values for the number of drinks cans of each brand will be 0, and the initial values of the number of coins in each denomination will be 0. The initial setting for the vending machine door lock will be locked.

3.2 Inputs

For the purpose of the initial implementation, the simulator shall only accept inputs from the outside environment. These will be processed and passed to the VMCS. The inputs to each system are described below:

3.2.1 Inputs to the Simulator

The following inputs shall be processed by the Simulator:

i) Simulated coins input to the Vending Machine, which will be either 10c, 20c, 50c or RM1.

ii) Choice of drinks brand by the customer

iii) Termination of the transaction by the customer

iv) Changes to values of the number of drinks cans available within the machine

v) Changes to values of the different coin denomination held within the machine

vi) The maintainer password

vii) Changes to values of the different brands drink can price

viii) The request to dispense all cash to the maintainer

ix) The "Exit Maintainer" transaction command from the maintainer

x) Selection of windows to proceed with different features of the simulation

xi) Begin/Terminate simulation

xii) Request to display the number of cans of a particular brand

xiii) Request to display the number of coins of a selected denomination

xiv) Changes to the door lock status, from both the user and the VMCS

3.2.2 Inputs to the VMCS

The following inputs shall be processed by the VMCS:

i) Signals representing coins input to the vending machine, which will be either 5c, 10c, 20c, 50c, or RM1

ii) Choice of drinks brand by the customer

iii) Termination of the transaction by the customer

iv) Current values of the number of drinks cans available within the machine

v) Current values of the different coin denomination held within the machine

vi) The maintainer password

vii) Current values of the different brands drink can price

viii) The request to dispense all cash to the maintainer

ix) The "Exit Maintainer" command from the maintainer

x) Request to display the number of cans of a particular brand

xi) Request to display the number of coins of a selected denomination

xii) Changes to the door lock status, from "unlocked" to "locked"

3.3 Outputs

For the purpose of the initial implementation, outputs to the outside environment shall only be produced by the simulator. Outputs from the VMCS will be fed to the simulator. The outputs from each system are described below:

3.3.1 Outputs from the Simulator

The following outputs shall be produced by the simulator:

i) A simulated selected drinks can to the customer

ii) A display of the total cash fed into the vending machine to date in the current transaction to the customer

iii) The simulated correct change to the customer

iv) "Drinks brand not available" display on the customer panel for each particular brand.

v) "No change available" message for the customer

vi) A display of the total cash fed in by a single customer during a transaction

vii) Simulated rejected coins to the customer and an "Invalid Coin" message to the customer

viii) Simulated returned cash returned to the customer

ix) Display "Correct/Incorrect Password" to the maintainer

x) Display the number of drinks cans for a selected brand held by the vending machine to the maintainer

xi) Display the number of coins for a selected denomination held by the vending machine to the maintainer

xii) Display the number of drinks cans for a selected brand held by the vending machine at the machinery simulation panel

xiii) Display the number of coins for a selected denomination held by the vending machine at the machinery simulation panel

xiv) Display the total amount of money held by the vending machine to the maintainer

xv) Simulate the total amount of money held by the vending machine dispensed to the maintainer

xvi) Display the status of the door locking mechanism to the user

3.3.2 Outputs from the VMCS to Simulator

The following outputs shall be produced by the VMCS

i) A signal to release a selected drinks can to the customer

ii) A display of the total cash fed into the vending machine to date in the current transaction to the customer

iii) A signal to release correct change to the customer

iv) "Drinks brand not available" for each particular brand.

v) "No change available" message for the customer

vi) A display of the total cash fed in by a single customer during a transaction

vii) A signal to return rejected coins to the customer and an "Invalid Coin" message to the customer

viii) A signal to return cash to the customer on request to the customer

ix) Display "Correct/Incorrect Password" to the maintainer

x) Display the number of drinks cans for a selected brand held by the vending machine to the maintainer

xi) Display the number of coins for a selected denomination held by the vending machine to the maintainer

xii) Display the total amount of money held by the vending machine to the maintainer

xiii) A signal to release the total amount of money held by the vending machine dispensed to the maintainer

xiv) Changes to the door lock status, from "unlocked" to "locked"

4. EXTERNAL INTERFACES

4.1 User Interfaces

i) The VMCS will communicate with the customers via the customer panel which is displayed in figure 3. This will be simulated by the Simulator Software package. The functionality available at this interface is described in 3.1.2.2.

ii) The VMCS will communicate with the maintainer via the maintainer control panel which is displayed in figure 4. This will be simulated by the Simulator Software package. The functionality available at this interface is described in 3.1.2.1

iii) The VMCS simulation will be controlled by the simulator control panel which is displayed in figure 2. The functionality available at this interface is described in 3.1.2.1

iv) Data for the VMCS simulation will be input via the vending machine simulation panel which is displayed in figure 5. The functionality available at this interface is described in 3.1.2.4

4.2 Hardware Interfaces

i) The VMCS shall interface to the coin storage mechanisms by a simple interface where commands and data will be exchanged in simple 16-bit words.

ii) The VMCS shall interface to the drinks can storage and dispenser mechanisms by a simple interface where commands and data will be exchanged in simple 16-bit words

iii) The VMCS shall interface to the customer control panel by a simple interface where commands and messages will be exchanged in simple 16-bit words.

4.3 Software Interfaces

Neither the VMCS software nor the simulator software shall interface with other software packages.

5. QUALITY REQUIREMENTS

5.1 Reliability

The VMCS system shall have a mean time between failure of 1000 hours.5.2.

5.2 Maintainability

The VMCS mean down time shall be 5 hours. The down time shall not exceed 24 hours

5.3 Availability

The VMCS shall operate from when the main power is switched on for the vending machine, and will close down if the main power is cut off. If the VMCS is in the process of a transaction with the customer then it will not continue this transaction when power is restored, nor will it keep a record of it.

5.4 Performance

Since only one customer will be dealt with at any one time, and the processing loads are minimal, there is no requirement on the performance of the system.

5.5 Security

Access to operate the functions available to the maintainer will be restricted by use of the correct password

5.6 Expandability

The number of drink brands may increase to 10 over a period of time

5.7 Integrity

Once installed in the vending machine hardware, the VMCS software shall not be capable of being changed

6. ENVIRONMENT

6.1 Hardware

For the purpose of initial development the system will be designed and implemented on a DELL workstation. The target hardware will be an Intel 404 processor, installed within a Mitsubishi Drinks Vendor. It is intended that the VMCS software and the simulator software be developed as independent packages, so that the VMCS can be separately installed in the target hardware.

6.2 Software

The system shall operate in a DELL-WINDOWS-32 environment. The software will be written in JAVA JINI™.

7. DESIGN CONSTRAINTS

7.1 Methods

Object-oriented development (OOD) techniques with UML notation shall be applied to the project

8. CAPACITY

Initially the system shall cater for: 5 Drink Brands