Electronic Number Lock System

Sibu Skaria, Manu John,

Assistant Professor, Department of Computer Application, M A College of Engineering, Kothamangalam, Kerala, India[1]

Assistant Professor, Department of Computer Application, M A College of Engineering, Kothamangalam, Kerala, India [2]

Abstract:- The paper entitled "Electronic Number Lock System" is used as a locking solution that can replace the mechanical locks. It opens only when the user types in the correct code set earlier. Unauthorized access is impossible since no one can enter without the knowledge of the code. A feature called image lock has been introduced to increase the security of the system. The code number to open the lock can be easily changed by the user whenever he wishes. Thus this paper provides a safe and tamper-proof locking solution.

I.   INTRODUCTION

The user has to register his details with the admin. After his basic details are saved, the admin will provide him with the security settings for the lock, namely the password for the lock and the image settings for the image lock. An image is selected and a particular area of it is set as the lock area. Also the admin will do the sound setting for the lock, ie warning sound and acceptance sound is selected and set for the users in general. At this point the user has obtained the lock for himself. Now the user can unlock the lock only if he provides the correct password assigned to him following which he has to unlock the image lock by clicking on the exact image area. If these procedures are correctly done the acceptance sound is generated and the lock will be unlocked. Otherwise the warning sound is generated and access is denied.

The tools are the hardware and software components used for the paper. The hardware components include Pentium IV or higher processor, 128 MB RAM, 40 GB HDD, monitor and keyboard. Software components used is Visual Basic 6.0 and SQL Server 2000.

II.   SYSTEM ENVIRONMENT

System environment specifies the hardware and software configuration of the new system. Regardless of how the requirement phase proceeds, it ultimately ends with the software requirement specification. A good SRS should establish the basis for agreement between the customers and suppliers on what the software specified in the SRS will assist the potential users to determine if the software specified meets their needs or how the software must be modified to meet their needs.

2.1 SOFTWARE ENVIRONMENT:
- **Operating System**

Windows XP
- **Software requirements**

Front-end: Visual Basic 6.0
Back-end: SQL Server 2000
VISUAL BASIC (VB)

Visual Basic is the third generation event driven programming language and the Integrated Development Environment (IDE) from Microsoft for its COM program model. Programming in VB is a combination of visually arranging components/controls on the form, specifying attributes and actions for them and writing additional lines of code for more functionality.

FEATURES OF VB
- Easy to learn and use
- Graphical development feature and BASIC heritage
- Derived from BASIC
- Enables Rapid Application Development (RAD) of GUI applications

2.2 HARDWARE ENVIRONMENT:
  ➢ **System Configuration**
Pentium IV Processor and above
Minimum 128 MB RAM
 40 GB HDD
SVGA Color Monitor
Normal Keyboard
Speakers
Normal Mouse

III.   SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

At present, mechanical locks are being used. These locks have levers in them that are used to lock or unlock the unit. Keys that have particular cuts and notches on them control these levers. Each lock opens only if the pattern of cuts and notches inside it match with the pattern on the key. Main disadvantage is that one cannot open the lock if one has lost/misplaced the key. Any number of duplicate keys can be easily made from the original key which can then be used for unauthorized access. The thief can even physically break open the lock.

3.2 FEASIBILITY STUDY

A feasibility study is a high-level capsule version of the entire System analysis and Design Process. The study begins by classifying the problem definition. Feasibility is to determine if it's worth doing. Once an acceptance problem definition has been generated, the analyst develops a logical model of the system. A search for alternatives is analyzed carefully. There are 3 parts in feasibility study.

Operational Feasibility
Question that going to be asked are:
  • Will the system be used if it developed and implemented?
  • If there was sufficient support for the paper from the management and from the users.
  • Have the users been involved in planning and development of the
Paper.
  • Will the system produce poorer result in any respect or area?

This application can be implemented in any place (homes, companies etc.) because security is of high significance. And the application will be used by users since it is efficient and provides more security compared to the mechanical locks. Therefore the implementation of this application is operationally feasible.

Technical Feasibility
  • Does the necessary technology exist to do what is been suggested?
  • Does the proposed equipment have the technical capacity for using the new system?
  • Are there technical guarantees of accuracy, reliability and data security

This application requires VB as development language since it enables rapid application development of GUI applications. And since the technical requirements can be met by using existing technology and it has the capacity to accommodate the new application, the proposed system is technically feasible.

Economical Feasibility

This system, if developed and installed will be beneficial to the users. The system will be developed and operated in the existing hardware and software infrastructure. So there is no need of additional hardware and software for the system, hence economically feasible.

3.3 PROPOSED SYSTEM

The proposed system is used as a locking solution and can be used instead of the mechanical locks. It is a combination of a password and an image lock. These features can be obtained by registering the basic details with an admin. The admin will also provide general sound setting (acceptance and warning sound) for the lock. Now the user can unlock the lock only when he types in the correct password set earlier. Unauthorized access is impossible since no one can enter without the knowledge of the code. The image lock feature has been introduced to increase the security of the system. The code number to open the lock can be easily changed by the user whenever he wishes. Thus this paper provides a safe and tamper-proof locking solution.

The key features of the proposed system are:
1. **Image lock**
2. Sound settings that enhances the usability and serves as the main component for providing security by generating warning sound in case of unauthorized access and an acceptance sound in the case of a trusted user.
3. Unauthorized access is impossible since no one can unlock the lock without knowing the password.
4. The password for the lock can be changed by the user if he wish.
5. The entry of a wrong password more than thrice is considered unauthorized, and will cause an exit.
6. Similarly only three attempts are allowed for a user to unlock the image lock.

3.4 LIST OF ACTORS AND THEIR ROLES
➢ Admin –One who provides the lock, has overall control over the security settings and does the user registration
➢ User-One who actually uses the lock as a locking solution

3.5 USECASE MODEL
3.5.1 BUSINESS RULES
1. Admin first login to system as he is the one who registers the users.
2. He uses his id and password for login.
3. Registration can be made for two sections of users, namely company and home users.
4. Only after adding a user and saving his basic details, an option is given to view and modify the entered details.
5. Once basic details are saved, the admin has to provide the security settings, ie the password and image setting for the lock. This is essential to be done at the registration phase itself.
6. The sound settings can be done independently by the admin for all the users in common. The setting that he do, is applicable for all users.
7. The user login is done using his user id alone.

3.5.2 USE CASES
1. Registration: Used to register the users. This use case is initiated by the admin.
2. Sound settings: Used to do the necessary sound setting for the lock. It is initiated by the admin.
3. Search: Initiated by both the admin and the user. It is used to search and view the user details.
4. Change admin password: Initiated by the admin to update his login password.
5. Change user password: Initiated by the user to update the password for his lock.
6. Break lock: It is used to unlock the number lock and is initiated by the user.

3.6 Interaction Modelmodules
This paper consists of following main modules:-
1. Registration
2. Sound setting
3. Change admin password
4. Search
5. Change user password
6. Break lock

3.6.1 MODULE DESCRIPTION REGISTRATION
• New users are added by the admin.
• Their basic details are saved.
• Saved details can be viewed and updations can be made if any.
• Security settings for the lock are provided, ie a password for the lock and an image is selected and an area is set as the lock area. This selection is essential as they act as the security measures for the lock.

Sound Setting:
These settings are important because it is used to enhance the usability of the locking system. It is set by the admin in common for all the users. If the admin fails to do sound settings, then users are denied access to the lock and must contact the admin and do the setting
• Acceptance sound is selected and set.
• Warning sound is selected and set.

Change Admin Password:
- The admin can update his login password frequently.
- He has to provide his current password and then the new password and confirm the new password.
- Necessary verifications are done and the updation is made. Appropriate warning messages are shown if there is any mismatch.

Search:
This module enables us to search and view the saved details of the users after the registration is done. This process is used by both the admin and the user. For the admin to view the details, the appropriate user section (company/home) has to be specified and the user id has to be given as input. For the user to view his details he needs to just specify the section.

Change User Password:
Using this process the user can update the password for his lock. He needs to provide his current password and then the new password and has to confirm it. All necessary validations are done and password is updated accordingly. Otherwise appropriate warning messages are shown. Frequent updation of the password will improve the security of the lock.

Break Lock:
This is the core part of the software. This process is initiated by the user to unlock the number lock.
- The user has to input the password he obtained for the lock. If it is correct, then he can proceed to the image unlock phase. If he clicks on the correct image area he succeeds in unlocking the number lock system and the acceptance sound is generated. He can only take a maximum of three chances to break the image lock failing which the warning sound is generated.
- If a wrong password is provided he is denied access to the next phase.
- If he doesn't provide the password (skips it) he is taken to the image unlock area. Here even if he manages to unlock the image lock, he doesn't succeed and will be asked to provide the password first.

Interaction diagrams capture the behavior of a single use case, showing the pattern of interaction among objects. Two types of interaction diagrams are sequence diagram and collaboration diagram.

It is a way of describing the behavior of a system by viewing the interaction between the system and its environment. It is an interaction arranged in time sequence. It shows the objects participating in interactions by their lines and the messages they exchanged in a time sequence.

The proposed system can be represented by using the following sequence diagrams.

3.7 Business Process Model
Business process model is used to model the entire business process. In a business process model states are activities representing the performance of operation and the transitions are triggered by the completion of the operations. Purpose of this model is to provide a view of flows and what is going on inside a use case or among several classes. It can also be used to represent class's method implementation.

3.7.1 Interaction Of Processes
There are two sets of activities in this application, one that is initiated by the admin and one that is initiated by the user.

The admin first add the users by registering their basic details. Once the data is saved it can be viewed and updations can be made if any. Next the password and image settings are provided and the selected details will be saved. The registration is complete at this point .The admin has to independently do the sound settings by setting an acceptance sound and warning sound in common. He can also search user details and change his login password when he wishes.

From the user's side, he can search and view his details. He can update the password for his lock. The main process done by the user is unlocking the number lock. It is done in two steps. First the password entered by the user is verified. If it is correct he can proceed to the image unlock phase. Otherwise he is denied access to the next step. Once he reaches the second step, he has to load the image and click on the exact image lock area that was previously set. If he succeeds an acceptance sound is generated and lock is unlocked. He is given only three chances to unlock the image lock, failing which a warning sound is generated and exit is caused.

3.8 List Of Identified Classes, Attributes And Their Relationships
Classes are an important mechanism for classifying objects. The primary role a class is to define the attributes, methods and applicability of its instances.

Identified Classes
- User
- Admin
- ElectronicNumberLockSystem
- Image
- Sound

Identified Attributes User

#userid	: String
#username	: String
#sex	: String
#dept	: String
#designation	: String
#place	: String
#phone	: Int
#e_mail	: String

Admin

-adminid	: String
-adminpwd	: String

ElectronicNumberLockSystem

#userpwd	: String

Image

#imgposX	: String
#imgposY	: String
#imglocation	: String

Sound

#accept	: String
#warn	: String

IV.   IDENTIFIED RELATIONSHIPS

Class	Related Class	Association name	cardinality
User	Admin	Registers with	*-1
User	ElectronicNumberLockSystem	Has	1-1
Admin	Sound	Sets	1-1
Image	ElectronicNumberLockSystem	Is a part of	1-1

4.2 ACCEASS LAYER CLASS DIAGRAM

Login

The login details of the admin (adminid and adminpwd) is stored in the login table. The primary key is the adminid. Admin enters these details to login to the system.

Usertab

Users can be of two sections: either company or home. Along with the basic details of the user, the security settings provided by the admin, ie (password and image) details are also saved. Userid is the primary key of this table. During user login he has to provide this userid and choose his section as company or home.

Sound

The acceptance sound and warning sound set by the admin are stored in this table.

Login

Field	Type	Size	Constraints	Description
adminid	varchar	20	Primary key	Login id of admin
adminpwd	varchar	20	-	Login password of admin

Usertab

Field	Type	Size	Constraints	Description
Userid	Varchar	20	Primary key	Id of user
username	Varchar	20	-	Name of user
userpwd	Varchar	20	-	Password for number lock
sex	Varchar	20	-	Gender of employee
dept	Varchar	20	-	Department of user
designation	Varchar	20	-	Designation of user
Place	Varchar	20	-	City of user
Phone	Int	7	-	Phone number of user
e_mail	Varchar	25	-	Email id of user
imgpos_X	Varchar	20	-	X coordinate position of image lock
imgpos_Y	Varchar	20	-	Y coordinate position of image lock
imglocation	Varchar	100	-	url of browsed image

Sound

Field	Type	Size	Constraints	Description
Sno	Int	-	Primary key	Serial no
Accept	Varchar	100	-	url of the browsed acceptance sound
Warn	Varchar	100	-	url of the browsed warning sound

4.3 VIEWLAYER CLASS

We need to design software, which provides the users with the flexibility of using the software. The user interface should be easy to use and understand.

Forms

The various forms used are:
- Login
- Admin
- Company
- Home
- Password
- Image
- Sound
- Admin search
- Admin change password
- User
- User search
- User change password
- Break lock1
- Break lock2

Login:

This is the entry point to the software. A combo box is provided to select the user type (admin/user). If admin, then text boxes are provided to enter the adminid and adminpwd. The control goes to the admin form on clicking the login button after doing necessary validations.

If user is selected, then he has to enter his userid in the textbox and select the section (company/home) from the combobox. After necessary validations are done, the control goes to the user form.

Admin:

This from contains a menu listing the various processes that are done by the admin. On electing each menu the control goes to the appropriate form. The various menus displayed are:
- Registration with separate sub menus for company users registration and home users registration
- Sound setting
- Search
- Change password

On selecting company menu from registration the control goes to the company form and if home menu is selected it goes to the home form. When sound setting menu is selected the control goes to the sound form. When search menu is selected the control goes to the admin search form and if the change password menu is selected control goes to the admin change password form.

Company:

In this form the admin registers the company users by saving their basic details. Buttons are provided to add new users, save their details, view and update details. Also there are two buttons password and image that needs to be clicked to go to the password form and image form respectively.

Home:

In this form the admin registers the home users by saving their basic details. Buttons are provided to add new users, save their details, view and update details. Also there are two buttons password and image that needs to be clicked to go to the password form and image form respectively.

Password:

It is the form where the password for the number lock is set. According to the user id selected from the combo box, a password can be entered in the textbox which is then required to be confirmed. After this step, password is set.

Image:

In this form the user id has to be selected from the combo box first. Then the browse button needs to be clicked to load an image. Then an image box is placed over the loaded image. To set the lock area the set button needs to be clicked.

Sound:

This form is used by the admin to do the general sound settings. An acceptance sound is browsed on clicking the browse button and it is saved by clicking the set acceptance sound button. Two buttons are provided to test play the saved sound and to stop it. Similarly the warning sound is also saved.

Admin search:

In this form the admin can view(no update) the user details. The appropriate user section (company/home) needs to be selected and the user id has to be entered in the textbox. On clicking the search button, the details are listed in the MSHierarchicalFlexgrid control.

Admin change password:

The admin can update his login password(adminpwd) in this form. He has select his current password from the combo box and then enter the new password in a textbox and confirm it in the next textbox. After all validations the password is updated.

User:

This is the user's form which contains a menu listing the user initiated processes. The various menus are:
➢ Search
➢ Change password
➢ Break lock

On selecting each menu the user is taken to the appropriate form.

User Search:

On selecting the search menu from the user form, control comes to this form where the user id of the current user will be displayed in the textbox. User needs to only select his section(company/user) from the available option button. On clicking the search button details of the user is displayed in a MSHierarchicalFlexGrid control.

User Change password:

The user can update the password for his number lock. He has to select his id from the combo box, then enter his current password in the text box provided, then enter the new password and confirm it. After all validations the password is updated.

Break lock1:

The user has to enter the password of the lock in the text box within the specified time. It is verified and if correct, control goes to the breaklock2 form. Otherwise he cannot proceed further.

Break lock2:

The user is now required to load the image by clicking the input button. After the image is loaded he has to click in the exact image area that was previously set, in order to unlock it. He can take a maximum of three chances failing which a warning sound is generated and exits. If he succeeds in unlocking the image lock an acceptance sound is generated and the lock will be unlocked.

V.   TESTING AND IMPLEMENTATION

5.1 TESTING

Software testing is a critical element of software quality assurance and represents ultimate review of specification, design and code generation. Once the source code has been generated the program should be executed before the customer gets it with the specific intend of finding and removing all errors, test must be conducted systematically and test must be designed using disciplined techniques. Testing technique provides systematic guidance for performance; the following steps have to be performed:

5.1.1 1UNIT TESTING

Unit testing focuses verification effort on the smallest unit of software .To check whether each module in the software works properly so that it gives desired outputs to the inputs. All validations and conditions are tested.

Login form

A combo box is provided to select the type of user(admin/user). If this selection is not made appropriate message is displayed. If admin is selected, he can login by providing his login id and password. If these inputs are invalid, appropriate message is displayed. If user is selected, he can login by providing his login id and selecting the section/location to which he belongs. If either of them is not given as input the appropriate message is displayed.

If the type of user is admin and the login button is clicked, the admin form is shown if the inputs are correctly provided. If the user clicks the login button and if the sound settings are done, he is given acess to the user form. If sound settings are not done he has to contact the admin and do the settings first.

Image selection form

Admin has to select the users from the list available in the combo box and then do the image settings. If the selection is not made, appropriate message is displayed.

Password set form

Admin has to select the users from the list available in the combo box and then do the password settings. If the selection is not made, appropriate message is displayed. If the password is not correctly confirmed appropriate message is displayed.

Change password

The admin id or userid has to be selected from the combo box according to the form(admin/user), failing which a warning message is displayed. Current password has to to be correct. Otherwise appropriate message is displayed. If it is correctly given, but the new password and its confirmation doesn't match then also the appropriate message is displayed.

Search

For the admin to search user details the user id and the section of the user(company/home) has to be provided. If either of them is not provided appropriate message is displayed. For the user to view his details he need to select the section from the available option button. If not warning message is displayed.

Break lock

The user has to provide the correct password within the specified (set) time. If yes, he is then required to load the image and click on the exact image area to unlock it. If he correctly does this an acceptance sound is generated and the lock will open. If not he can take two more chances to do it failing which a warning sound will be generated and will exit.

If the user provides wrong password he is denied acess and will exit from current form. If he skips this process, he is taken to the image unlock phase. Here even if he manages to click on the right area, he is not successful in unlocking, because appropriate message is displayed asking him to provide the password first.

5.2 IMPLEMENTATION

Implementation is the process of bringing a newly developed system or revised into operational one. It is the practical job of putting a theoretical design into practice.

This product works as a standalone application. The system only puts forward a software implementation. After a system is successfully implemented, it should be maintained in a proper manner. System maintenance is an important aspect in the software development life cycle. The need for system maintenance is for it to make adaptable to the changes in the system environment. There may be social, technical and other environmental changes, which affect a system, which is being implemented. Software product enhancements may involve providing new functional capabilities, improving user displays and mode of interaction, and upgrading the performance characteristics of the system.

VI.   CONCLUSION

The Electronic Number Lock System uses a combination of password and a feature called image lock that enhances the usability and also provides additional security. User can unlock the system only if he succeeds in performing both steps of the verifications correctly. He has to input the correct password and then correctly unlock he image lock. Only then he succeeds in unlocking the number lock. Sound settings are added to serve as a means of increasing the usability by providing the appropriate audio feedback.

It would be very much beneficial to users, especially in the current scenario where security is of prime significance. The proposed system tries to overcome the disadvantages of the mechanical locks that are currently being used as the locking solution.

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