Boss-Spy Requirements Document

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1 Introduction

For the modern day corporate employee, the work place is a suspicious and intimidating environment. With bosses of varying importance constantly “checking in”, an employee must be in a constant state of alertness. Boss-Spy is a product designed to relax the work environment of employees. By making use of recent advances in facial detection and recognition, Boss-Spy provides early warning of a bosses’ presence by delivering software warnings.

1.1 Purpose
The purpose of this document is to define and explain, in detail, all of functional and non-functional requirements of the Boss-Spy system.

1.2 About the System
Boss-Spy will use multiple algorithms to exam the area that the camera is searching to find the faces of people in the area and to determine if any of these faces belong to the person the user has selected as your target. Photos of the user’s targets will be saved in a database. The camera will retrieve images from the environment and process them to determine whether any of the individuals in the database are in the image.

1.3 Applications
Although marketed as a workplace product, Boss-Spy is appropriate for many consumer applications. For the consumer the system may be adapted to any scenario which requires a facial recognition system. Possible examples include

1. Detection of individuals at a home owner’s door
2. Various security scenarios including the identifying of marked individuals at airport security

Additionally Boss-Spy will be an invaluable tool to computer vision researchers. The system may serve as a framework, which new face detection and recognition algorithms may be added and tested in a real world environment.

2 Functional Requirements

2.1 Graphical User Interface
The GUI is the way in which the user interacts with the system. It has an interaction with the camera, in that the user may see what images are currently being processed. Additionally, the user may add or remove photos from the database and configure what action(s) are associated with each image. The GUI is a Java Swing application.
2.1.1 The Logon Screen

Logging in to the system is required for any user who wishes to use Boss-Spy. See Figure 1 for a view of the Boss-Spy logon screen.

- **User Name** The login box accepts AlphaNumeric input. The login box is limited to 20 input characters. This device will return an error if an unknown username is entered.

- **Password Box** The password box accepts AlphaNumeric input. The password box size is limited to the range of x-xx characters. The password box is not publicly viewable, instead the characters are covered with the ‘*’ character. The login screen will return an error if the password is invalid. The login screen will return an error if the username and password do not match.

- **The Sign Up Button** The button is used to send users to the create a new account (see section 2.1.2). The login button is used to start a Boss-Spy session.

2.1.2 Sign Up Screen

Figure 1: Graphical User Interface: The logon screen

Figure 2: Graphical User Interface: New user sign up screen
The sign up screen allows new users to create an account, and thus, to be able to use Boss-Spy. This screen is intended to be a simple interface for creating an account and password.

- **The Username Box** The user name box is limited to Alphanumeric character input. The user name box is limited to xx characters of input. The user name box is a publicly viewable text area. The user name box will return an error if the username is already in the system. The user name box will return an error if the entry includes unacceptable characters.

- **The Enter Password Box** The password box accepts Alphanumeric input. The password box size is limited to the range of x-xx characters. The password box is not publicly viewable, the characters are covered with the ‘*’ character. The password box will return an error if the password is invalid.

- **The Re-Enter Password Box** This box is exactly equivalent to the enter password box with the following addition: The re-enter password box returns an error if the input does not match the enter password box.

**2.1.3 The Main Screen**

The main screen (Figure 3) is where the user interacts with the camera, sets up actions to be performed, details what faces he or she wishes to look for and sets preferences for the application. This section is set up with tabular selection across the top of the screen for easy switching between sections.

![Figure 3: Graphical User Interface: The main interface screen](image)

- **The Home Tab** The home tab is where every session of Boss-Spy starts. The majority of the screen is the Boss-Spy logo. The current user is shown in the lower left corner of the screen. The current status of the application is displayed on the lower right corner of the screen. There are two buttons on this screen; They are Logout and Quit. These buttons do the following: Kills any active processes, Terminates any running algorithms. **The Logout Button** Returns the user to the login screen. **The Quit Button** Terminates the program without returning to the login screen.

**2.1.4 The Monitor Tab**

The camera monitoring screen (Figure 4) displays a near real-time feed of the camera. The majority of this tab is used to display the current image sent from the camera. Directly below the image is the name of the face currently being detected by the application, or “none” if the image does not match any faces in the database.
Figure 4: Graphical User Interface: Camera monitoring screen

Figure 5: Graphical User Interface: Faces configuration screen
2.1.5 The Faces Tab

The faces screen (Figure 5) is where the user configures the faces he or she wishes Boss-Spy to search for. In addition, the action(s) to be taken upon detecting a given face are configured here.

- **The Name Box** Here the user specifies the name of the face. This box allows Alphanumeric input only. The user will be prompted with an error message when an illegal name has been entered.

- **The Image Box** This field specifies the location of the face image image file. There is a “Browse” button attached to this box. Only pictures of the type .jpg or .png will be allowed as files.

- **The Image Browse Button**
  This button opens the standard “Browse” dialog, and thus allows the user to easily locate a face image.search for a face image. Upon selecting a file and clicking “Open” the full path to the selected file will be placed in the Image Box.

- **Associated Actions** This section of the faces tab is used to associate actions the user wishes to occur when a face has been recognized by Boss-Spy. Currently each action may only be associated to the current select face from the face list. Associated actions is a selectable list of actions. Each time a different face image is selected (from the “Faces” list on the left), the associated actions list displays the actions associated with the currently selected face image. Similarly, the Configure Action Section is updated to reflect the currently selected action in the “Associated Action” list. There are three buttons associated with the associated actions list: Remove, Duplicate and New.

- **Remove Button** This button removes the currently selected action from the associated actions list. This button will prompt the user with an “Are you sure?” question box. This button will be unavailable (grayed out) if no action is selected from the associated actions list.

- **Duplicate Button** This button duplicates the currently selected action. This is a shortcut for users who wish to add a new action similar to an existing one in the list. This button will be unavailable (grayed out) if no action is selected from the associated actions list

- **New Button** This button allows the user to create a new action for the currently selected face.

- **Configure Action Section** This section allows the user to configure the action currently selected in the “ Associated Actions” list.

- **Name Box** This box is where the user specifies the name for the action. The name box is limited to alphanumeric characters.

- **Action Combo Box** This is a Combo Box (i.e. Drop Down Box) which contains the various actions Boss-Spy is capable of performing when a given face is detected. The following actions are available to the user: Run a program/script, Open an Open Office document, and Play a sound file. The field under this box depends on the action selected. For example, when “Run Program/Script” is selected, the next field is labeled “Program/Script”. But when “Play a sound” is selected, the next field is labeled “Sound File”. Likewise, when “Open Open Office document” is selected the next field is labeled “Document”.

- **Program/Script Location Box** This box is used to set the path to the program which the user wishes to run. If desired, command line arguments may also be specified here. This box has a browse button associated with it.

- **Program/Script Browse button** Just link to the description of the other browse button.

- **The Save/Apply Changes Button** This button saves all information on the Faces tab to the hard-drive and applies the changes to data structures of the application.
- **Discard Changes Button** This button discards any changes the user has made to the Faces configuration since last saving them. The discard button will prompt the user with an “Are you sure you want to discard changes” box.

- **The Faces List** This is a selectable list of faces the user has set as targets for BOSS-SPY. Each item is a thumbnail image of a face with the name of that face as a caption underneath. Below the faces list are three buttons which interact with the faces list. These buttons are: Remove, Duplicate and Add.

- **The Remove Button** This button is used to remove the currently selected face and all actions associated with it. If a user chooses the remove button, they will be asked “Are you sure you want to delete (face name) from your list of faces?” If the user selects “OK” then the face and all of its associations are removed from the current user’s BOSS-SPY directory.

- **The Duplicate Button** This button makes a copy of the currently selected face and any associated actions. This is a shortcut in the case that the user wishes to add several faces with similar associated actions.

- **The Add Button** This button creates a new face entry. The user is given to specify the details after this button is pushed.

2.1.6 **The Console Tab**

![Figure 6: Graphical User Interface: Console screen](image)

The console tab (Figure 6) is where the more technically savvy BOSS-SPY user (and, more importantly, developers) can examine the actions and communications of the BOSS-SPY program. It has a command prompt area and an open buffer which shows the current and last few commands which have been executed by the program. To re-iterate, this tab is only useful to expert users. Normal users will not have to concern themselves with this tab.

- **Backend Debug Level** This selectable option list allows the user to choose what level of debugging is available for the back end unit. The values in this list are from 0 to 5. The higher the value, the more messages will be sent to the console screen for viewing by the user. This list is associated with the messages being sent to the console about the functions of the algorithms and other internal functionality of the system.

- **GUI Debug Level** This selectable options list allows the user to choose what level of debugging is available for the front end GUI. The values in this list are from 0 to 5. The higher the value, the more messages will be sent to the console screen for viewing by the user. This list is associated with messages being sent to the console about the functions of the GUI.
• **Restart Back end Button** This button will flush out all of the algorithms information. This button will prompt the user with an “Are you sure you want to restart the Back-End” option box.

• **Console Buffer Screen.** Seen in the screen shot as a white area in the middle of the tab, this section will display the current and past commands run by BOSS-SPY.

• **Command Box** This box allows the user to input commands directly to the BOSS-SPY buffer. This box is mainly used to help debug BOSS-SPY and set special values. This box is directly associated with the “send” button.

• **The Send Button** This button will send commands input by the user to the BOSS-SPY console buffer for execution. Touching the enter key will be the same as clicking on the send button with the mouse.

2.1.7 **The Preferences Tab**

![Image of Preferences Tab]

The preference tab (Figure 7) is used to set the preferences various options of the application such as how sensitive they want the algorithm to be when matching faces and the refresh rate of the monitor tab.

• **The Sensitivity Bar** This is a way for the user to calibrate the algorithm. It is on a scale from 0 to 10, with 10 being most sensitive and 0 being least sensitive. This calibration effects the way the algorithm will consider matches in the following manner: 0: more false negatives from the algorithm, it will be harder for the algorithm to consider a match to be true. 5: average, the algorithm will run smoothly, but there is some potential for false negatives. 10: extremely sensitive, if low quality face images are used, there is great potential for false positives.

• **Monitor Refresh Interval** This scrollable preset list will allow the user to calibrate how often the monitor tab gets refreshed. This list has nothing to do with the way the algorithm works.

• **Path to Open Office Box** This allows the user to set the path to Open Office This path will be used by the face images and their actions in order to run programs. This path is directly associated with a browse button.

• **Browse Path Button** This path allows the user to browse for the path to open office.

• **Path to Sound Player** This allows the user to specify a path to their sound player of choice. This path will be used by the face images and their action associations in order to create sounds. This path is directly associated with a browse button.
2.1.8 The About Tab

![Figure 8: Graphical User Interface: The about screen](image)

The about tab (Figure 8) shows the version and contact information for Boss-Spy.

2.2 Algorithm Requirements

2.2.1 Facial Detection

The facial detection has two uses within the Boss-Spy system. First and foremost, the algorithm will be used to detect the position of the face of the on-camera target. The facial detection algorithm requires that the target be non-moving and with optimal lighting conditions. This means that the target be directly in front of the camera and facing directly at the camera. No part of the target’s face should be at a sideways tilt. Lighting requirements include fully lit face and body similar to that of a passport photograph. The second aspect of the facial detection algorithm will be used when the user introduces a new target face image into the GUI. The facial detection algorithm requires a photograph with optimal lighting conditions and a size of 640x480. The facial detection algorithm will then be able to crop the face image before it is introduced to the user’s directory.

2.2.2 Facial Recognition

The face recognition algorithm will determine whether any of the faces detected in an image taken with the camera match a person in the database. The algorithm is required to run in some sort of real time (on the order of a minute).

3 Non-Functional Requirements

This section is used to explain all necessary requirements the user must abide by in order to have Boss-Spy run optimally on their system. These requirements do not explain what is needed within Boss-Spy for proper functionality, rather elements such as RAM and processor speed for the computer, requirements of the camera and additional requirements.
3.1 System Requirements

Boss-Spy requires Linux, or some equivalent Unix variant.

3.1.1 Hardware Requirements

Processor: a minimum 1.0 ghz Pentium processor or equivalent minimum, a 2.0 ghz Pentium processor or equivalent recommended. Memory: a minimum 1028 mb of RAM minimum, 1540 mb of RAM recommended. Hard Drive: Boss-Spy requires a minimum of 200 mb of free hard drive space. Operating System: Linux version xx or later required.

3.1.2 Library Requirements

3.2 Camera Requirements

The camera must be able to send at least 15 frames/second to the system at a resolution of a least 640 x 480.

4 System Evolution

- **First system evolution expectations** The first evolution expectations for the system are; the system should be able to locate a face, which is not moving and directly in front of the camera, facing the camera. The lighting should be optimal, and similar to that of a passport photograph. The will be able to make a proper match with a face image from the users directory within one (1) minute of the image first appearing on screen. The system will be able to hold 10 face images and there will be up to three (3) actions able to be performed for each face image within the user’s directory. **Second system evolution expectations** The second version of the system will be able to greatly increase the speed at which the algorithms are able to both detect the face on the image and match it to one of the images in the user’s directory. The new expected time from the image appearing on camera to matching to an image in the user’s directory will be twenty (20) seconds. All other expectations remain the same.

- **Third system evolution expectations** The third version will use additional changes and advancements within the algorithms to correctly detect and match a system within one (1) second of the image appearing on the screen under the previously described optimal conditions. The system will be able to handle faces which are partially visible, facing to the side and/or not lighted properly within one (1) minute. The system will be able to see an image of a target in motion and be able to detect the face within one (1) minute.

5 Glossary

- **Face detection**: Localizing a face in an image

- **Face recognition**: Recognizing whether a localized face belongs to any of the individuals in a database