

Busitema University

Faculty of Engineering

Department of Computer Engineering

**HAND GEOMETRY RECOGNITION LOGIN
APPLICATION**

by

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A final year project report submitted to the Department of Computer Engineering in partial fulfillment of the requirement for the award of a Bachelor's Degree in Computer Engineering of Busitema University.

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Declaration

This project report is my original work and has not been presented for a degree in any other University or any other award.

Signature:

Date:

Approval

The undersigned certify that he has read and hereby recommend for acceptance of Busitema University, a Project report entitled; ***“HAND GEOMETRY RECOGNITION LOGIN APPLICATION”***

Mr. Gilbert .G. Ocen

Sign:.....

Date:.....

Acknowledgement

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May the Almighty bless all of you abundantly.

Dedication

To my mother, *Mrs. Nantume Rebecca* and dad, *Mr. Kiwanuka Shem*.

I am very grateful for the enduring support and care.

List of Acronyms

2D/3D	2-Deminsion/3-Demision
ANN	Artificial Neural Network
ATM	Automated Teller Machine
EV	Error Value
GA	Genetic Algorithm
GAR	Genuine Acceptance Rate
GB	Gigabyte
GUI	Graphical User Interface
HGR	Hand Gesture/Geometry Recognition.
HSV	Hue-Saturation-Value color model
ICT	Information Communication Technology
KNN	K Nearest Neighbor
LAN	Local Area Network
MATLAB	MATrix LABaratory
NITE	Natural Interaction Technology for End-user
NN	Neural Network
OpenCV	Open Source Computer Vision
OpenNI	Open Natural Interaction
PCA	Principle Component Analysis
PCBR	Principle Curvature Based Region
RGB	Red-Green-Blue color model
RPM	Revolution Per Minute
SVD	Singular Value Decomposition
SVM	Support Vector Machine
TB	Terabyte

Keywords: *hand geometry, Xbox Kinect sensor, OpenCV, Key loggers, Hand Geometry Recognition, Neural Networks, Fingertips and Valleys, hand image;*

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Abstract

One of the goals of biometric systems is to identify a person automatically based on his/her biometric characteristics. These may include iris, fingerprint, face, voice, or hand. Hand geometry recognition is one of the biometric characteristics that can be used to distinguish a number of individuals, because everyone has different hand lines, shapes and sizes. This project study involved use of trained hand images for personal verification and identification to login and access a personal computer system based on windows operating system. This was to add on general system security to reduce vulnerability in password attacks for example remote key loggers. Hand geometry features used in this study consists of the lengths of fingers from the centroid of the palm image, and Euclidean distance between hand finger tips and valleys (25 features). The features were used in the thresholding phase, and Neural Networks classification was used in the training phase of the hand shape. Phases were concatenated and was used to determine the identity of the person. Users can place their hands freely on the glass panel inside the image acquisition device, and hand images were acquired using a Kinect camera infrared rays to generate hand edged image which was used for recognition. Project test datasets included 10 users. These were trained and used for testing system parameters. Accuracy obtained was 70%. False Rejection Rate (FRR) returned 10%, and False Acceptance Rate (FAR) 20% and Genuine Acceptance Rate (GAR) was 80%.

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CHAPTER ONE

INTRODUCTION

1.1. Background

Internet has become part of basic needs for modern society. People are using internet for online banking and confidential information sharing through email and chats on social networking sites. Intruders are using malwares to attack and damage online systems. Malwares reinstall themselves again though they are removed from system, this makes them more harmful and are almost difficult to remove as they hide themselves deep inside operating system [1]. Keylogger is one of the harmful malwares. Keyloggers are installed on a host machine to intentionally monitor the user's activity by logging keystrokes and eventually send them to a third party.

Keyloggers can be implemented as small hardware devices or more conveniently in software. [2]. Software-based keyloggers can be further classified based on the privileges they require to execute. Keyloggers implemented by a kernel module run with full privileges in kernel space (are given full access to the system). In kernel space, the programmer must rely on kernel-level facilities to intercept all the messages dispatched by the keyboard driver, undoubtedly requiring a considerable effort and knowledge for an effective and bug-free implementation. Conversely, a fully unprivileged keylogger can be implemented by a simple user-space process. A user-space keylogger can easily rely on documented sets of un-privileged API commonly available on modern operating systems. [2].

Keyloggers are sometimes used for legitimate purposes for example Child Computer monitoring, employee monitoring, but nevertheless, they can pose a serious threat to users, as they can be used to intercept passwords and other confidential information entered via the keyboard. As a result, cyber criminals can get (Automated Teller Machines' Personal Identification) ATM's PIN codes and account numbers for e-payment systems, passwords to online gaming accounts, email addresses, credit card numbers, user names, email passwords etc. [3]. Once an intruder gets access to private user data, he/she can easily make money transfer from user account to untrusted account.

Unluckily, hold of private data can have many times consequences which can prove to be more hazardous than particular individual's financial loss. [1].

Passwords and banking information have been stolen using keyloggers. Keyloggers are sometimes part of malware packages downloaded onto the computer without the owners' knowledge. [4].

Unknown hackers have used keyloggers to steal money from bank accounts via internet. An example where Mr. Lopez's \$90,000 (Bank of America) was stolen from his account and transferred to Latvia. This all happened when hackers accessed his username and password when Mr. Lopez often used internet banking to access his account.[5].

The major threat of key loggers lies in the fact that they use keyboard input for authenticating the user. One possible solution would be to eliminate the usage of keyboard to enter passwords. This is possible by means of graphical passwords or gestures. [6].

A gesture is a form of non-verbal communication in which visible bodily actions can be used for communication. [7]. A gesture is scientifically categorized into two: dynamic and static[8]. A dynamic gesture is intended to change over a period of time. A waving hand means goodbye is an example of dynamic gesture [8], dynamic (sequence of postures) are more complex but suitable for real time environments [9]. A static gesture is observed at an instant of time. The stop sign is an example of static gesture. [8]. Static (posture or certain pose) require less computational complexity. [9]. The complex process of interpreting all the static and dynamic gestures over a period of time is referred to as gesture recognition. It is also referred to as the process of recognizing and interpreting a stream continuous sequential gesture from the given set of input data. [8].

Gesture recognition is also described as a topic in computer science and language technology with the goal of interpreting human gestures via mathematical algorithms. [10].

Hand gesture is the form of non-verbal communication to convey particular message by using the visible movements and posture of hand. [11]. Hand gesture recognition (HGR) technology invents the use of a different number of hand gestures that can be used to lock the system to prevent unauthorized personnel from system access. The essential aim of building hand gesture recognition system is to create a natural interaction between human and computer [12] where the interpreted and recognized gestures can be used for system security.

In the recent years, gesture recognition system applications have played an important role in our life [12] that is especially for Human computer Interaction (HCI), Robot control, games, sign language recognition, virtual environments, virtual gaming, security, Numbers recognition, television control and surveillance, using different tools and algorithms.[9].

Due to a major technological advance in computing, there raises new security threats that require new security solutions, and thus the need to use more advanced security features to secure and encrypt the system.

1.2. Problem Statement

Key loggers, Brute-Force, Dictionary lists and Packet Sniffing are the most commonly used attacks on passwords by hackers; Key loggers' software once installed of a computer records the keyboard keystrokes without the knowledge of user and create a log file of all these and automatically send it to the hacker's email. Key Loggers can be sent to a victim computer via internal LAN or internet, unknown program installations, or unauthorized access when the owner is absent. This comprises the security of computer systems hence a need to develop a system that overcomes this kind of attack.

1.3. Objectives

The objective of this study is divided in to two, main objective which covers the overall goal of the study and the specific objectives.

1.3.1. Main Objective

To develop a hand geometry recognition login application which uses trained hand geometries to access the windows login system.

1.3.2. Specific Objectives

- i. To identify and analyze the requirements needed for the design and development of the system.
- ii. To design a user interface that captures and processes hand geometries from Xbox 360 Kinect sensor.
- iii. To build a database for storage of captured hand geometries.
- iv. To develop an algorithm for recognition of hand geometries.
- v. To train the system for recognition of database hand geometries.
- vi. To test and validate the hand gesture recognition login application.

1.4. Justification

Some computer users in various organizations in Uganda do not secure systems with updated anti-malware programs. This has brought about exposure of malware from internet sites which perform unknown program installations. One possible solution to protect confidential information from malware attacks like key loggers is to eliminate the usage of keyboard for password authenticity. This is possible by means of hand geometry to replace passwords, thus the need to develop a hand geometry recognition login application.

1.5. Significance

This boasted and added on the general system security unit features thus further preventing the systems from unauthorized access.

Introduction of different hand gesture recognition technology to lock the system and secure various system files is most likely to prevent the system from hackers who use remote logging of key loggers, dictionary lists, brute-force attacks and packet sniffing.

Further, the system was also protected from dumpster divers, since gesture passwords performed won't be written/typed on papers for dumping.

1.6. Scope

A designed user interface that captures and processes hand geometries from Xbox Kinect Sensor.

A built database for storage of trained hand geometries.

A developed algorithm for recognition of database trained hand geometries.

The project design and implementation was scheduled to run from August, 2015 to May, 2016.

1.7. Assumptions

Accuracy of hand geometries trained with the system and stored in the database was not 100%. It's most likely to be range from 85%-95%.

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