Sylhet Engineering College

Department of Computer Science & Engineering



**Title: Car Driving Experience in Virtual Reality**

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Date: 20th February, 2021

**Recommendation Letter from Project Supervisor**

The project entitled “**Car Driving Experience in Virtual Reality**” submitted by the student(s)

1. MD. Amanullah
2. Md Shariful Islam

is a record of research work carried out under my supervision and I, hereby, approve that the report be submitted in partial fulfillment of the requirements for the award of his/her/their Bachelor Degree(s).

Signature of the Supervisor: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Date: 20/02/2021

**Certificate of Acceptance of the Project**

The project entitled “**Car Driving Experience in Virtual Reality**” submitted by the student(s)

1. MD. Amanullah
2. Md Shariful Islam

On 20/02/2021 is, hereby, accepted as the partial fulfillment of the requirements for the award of their Bachelor Degree(s).

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**Abstract**

We have tried to build such a system which makes our computer protected from unauthorized access. That means if anyone starts the other’s computer then the system will detect either this person is the original user of the computer or not. This detection will be performed by analyzing the person’s mousemovements. This detection is known as anomaly detection also. The mousemovements of every user are differenti.e. the pattern, speed of mouse cursor, the mouse cursor stays a lot in which portion of computer for a specific person are totally different from one another. So if the system is set to a person’s computer then the system will collect these types of mouse informations from the user. The system will be predefined about the mousemovement data of original user i.e. the system will be learned about original user’s mouse movements. Firstly, the system will take the user’s mouse co-ordinates. Secondly, the system will calculate the necessary informations for detection.Thirdly, the system will be learned about these necessary informations. This learning process is called supervised learning. Then if the data doesn’t match with the current user’s data, the computer will be locked automatically.

**Keywords**: Anomaly detection, Machine learning, Portion of Mouse Cursor, Direction of Mouse Cursor, Total Distance, Pausing Coordinates, Average Speed.

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Then we would like to thank all our friends and family, especially our parents because all our achievements are the outcome of their sacrifice.

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**Table of Contents**

[List of Figures 2](#_Toc490588886)

1.[Introduction 3](#_Toc490588887)

2.[Background Study 7](#_Toc490588888)

3.[Problem Definition 9](#_Toc490588889)

[3.1 Virtual reality 9](#_Toc490588890)

[3.2 Importance of Virtual reality 9](#_Toc490588891)

[3.3 Application of Virtual reality 9](#_Toc490588892)

[3.4 Importance of Virtual reality 9](#_Toc490588893)

[3.5 Types of anomaly detection 9](#_Toc490588894)

[3.6 Anomaly detection techniques 10](#_Toc490588895)

[3.7 Selected work 10](#_Toc490588896)

4.[Methodology 11](#_Toc490588897)

[4.1 Data collection 11](#_Toc490588898)

[4.2 Apparatus 11](#_Toc490588899)

[4.3 Mouse movements’ data 12](#_Toc490588900)

5.[Features Analysis 14](#_Toc490588901)

[5.1 Movement direction 14](#_Toc490588902)

[5.2 Total and average distance 15](#_Toc490588903)

[5.3 Mouse cursor’s speed 16](#_Toc490588904)

[5.4 No movement 17](#_Toc490588905)

[5.5 Mouse cursor’s portion 18](#_Toc490588906)

6.[Future Work 20](#_Toc490588907)

7.[Conclusion 21](#_Toc490588908)

[References 22](#_Toc490588909)

# List of Figures

1.[Set path of bin location of JDK 11](#_Toc490432077)

2. [Divided portions for 1366x768 pixels display 13](#_Toc490432078)

3. [Eight directions in 10 minutes for 10 data 14](#_Toc490432079)

4. [Difference between right down direction 15](#_Toc490432080)

5.[Total traveled distance in 10 minutes 15](#_Toc490432081)

6. [Difference between average distances 16](#_Toc490432082)

7. [Cursor's speed in 10 minutes 16](#_Toc490432083)

8. [Differences between average speeds 17](#_Toc490432084)

9. [Pausing coordinates in all portion 17](#_Toc490432085)

10.[Average pausing coordinates at portion 1 18](#_Toc490432086)

11. [Movement coordinates in different portion 18](#_Toc490432087)

12.[Average coordinates at portion 4 19](#_Toc490432088)

**Chapter 1**

# Introduction

Anomaly detection is an important tool for detecting fraud, network intrusion, and other rare events that may have great significance but are hard to find. The goal of anomaly detection is to identify cases that are unusual within data that is seemingly homogeneous.

Machine Learning is a type of Artificial Intelligence that allows software applications to become more accurate in predicting outcomes without being explicitly programmed. The basic premise of machine learning is to build algorithms that can receive input data and use statistical analysis to predict an output value within an acceptable range. Two of the most widely machine learning methods are supervised learning and unsupervised learning.

Supervised learning algorithms are trained using labeled examples such as an input where the desired output is known. The learning algorithm receives a set of inputs along with the corresponding correct outputs. The algorithm learns by comparing its actual output with correct outputs to find errors. It then modifies the model accordingly. Through methods like classification, regression, prediction and gradient boosting, supervised learning uses patterns to predict the values of the label on additional unlabeled data. Supervised learning is commonly used in applications where historical data predicts likely future events.

A secure system accomplishes its task with no unintended side effects. Using the analogy of a house to represent the system, you decide to carve out a piece of your front door to give your pets' easy access to the outdoors. However, the hole is too large, giving access to burglars. You have created an unintended implication and therefore, an insecure system.

In the software industry, security has two different perspectives. In the software development community, it describes the security features of a system. Common security features are ensuring passwords that are at least six characters long and encryption of sensitive data. For software consumers, it is protection against attacks rather than specific features of the system. Your house may have the latest alarm system and windows with bars, but if you leave your doors unlocked, despite the number of security features your system has, it is still insecure. Hence, security is not a number of features, but a system process. The weakest link in the chain determines the security of the system. In this article, we focus on possible attack scenarios in an e-Commerce system and provide preventive strategies, including security features that you can implement.

Security has three main concepts: confidentiality, integrity, and availability. Confidentiality allows only authorized parties to read protected information. For example, if the postman reads your mail, this is a breach of your privacy. Integrity ensures data remains as is from the sender to the receiver. If someone added an extra bill to the envelope, which contained your credit card bill, he has violated the integrity of the mail. Availability ensures you have access and are authorized to resources. If the post office destroys your mail or the postman takes one year to deliver your mail, he has impacted the availability of your mail.

In the computer industry, the term security or the phrase computer security refers to techniques for ensuring that data stored in a computer cannot be read or compromised by any individuals without authorization. Most computer security measures involve data encryption and passwords. Data encryption is the translation of data into a form that is unintelligible without a deciphering mechanism. A password is a secret word or phrase that gives a user access to a particular program or system. So computer Security is the protection of computing systems and the data that they store or access.This means that everyone who uses a computer or mobile device needs to understand how to keep their computer, device and data secure.e.g. in a university computer security allows the university to carry out its mission by:

* Enabling people to carry out their jobs, education, and research
* Supporting critical business process
* Protecting personal and sensitive information

While security features do not guarantee a secure system, they are necessary to build a secure system. Security features have four categories:

* **Authentication:** Verifies who you are. It enforces that you are the only one allowed to your Internet banking account.
* **Manipulation:**Allows only you to manipulate your resources in specific ways. This prevents you from increasing the balance of your account or deleting a bill.
* **Encryption:** Deals with information hiding. It ensures you cannot spy on others during Internet banking transactions.
* **Auditing:** Keeps a record of operations. Merchants use auditing to prove that you bought a specific merchandise.

Attacks against e-Commerce Web sites are so alarming, they follow right after violent crimes in the news. Practically every month, there is an announcement of an attack on a major Web site where sensitive information is obtained. Why is e-Commerce vulnerable? Is e-Commerce software more insecure compared to other software? Did the number of criminals in the world increase? The developers producing e-Commerce software are pulled from the same pool of developers as those who work on other software. In fact, this relatively new field is an attraction for top talent. Therefore, the quality of software being produced is relatively the same compared to other products. The criminal population did not undergo a sudden explosion, but the incentives of an e-Commerce exploit are a bargain compared to other illegal opportunities.

An e-Commerce system with several points that the attacker can target:

* Shopper
* Shopper' computer
* Network connection between shopper and Web site's server
* Web site's server
* Software vendor

This section describes potential security attack methods from an attacker or hacker.

**Tricking the shopper:** Some of the easiest and most profitable attacks are based on the shopper, also known as social engineering techniques. These attacks involve surveillance of the shopper's behavior, gathering information to use against the shopper. For example, a mother's maiden name is a common challenge question used by numerous sites. If one of these sites is tricked into giving away a password once the challenge question is provided, then not only has this site been compromised, but it is also likely that the shopper used the same ID and password on other sites.

A common scenario is that the attacker calls the, pretending to be a representative from a site visited, and extracts information. The attacker then calls a customer service representative at the site, posing as the shopper and providing personal information. The attacker then asks for the password to be reset to a specific value.

Another common form of social engineering attacks phishing schemes. Typo pirates play on the names of famous sites to collect authentication and registration information. For example, http://www.ibm.com/shop is registered by the attacker as www.ibn.com/shop. A shopper mistypes and enters the illegitimate site and provides confidential information. Alternatively, the attacker sends emails spoofed to look like they came from legitimate sites. The link inside the email maps to a rogue site that collects the information.

**Snooping the shopper's computer:** Millions of computers are added to the Internet every month. Most users' knowledge of security vulnerabilities of their systems is vague at best. Additionally, software and hardware vendors, in their quest to ensure that their products are easy to install, will ship products with security features disabled. In most cases, enabling security features requires a non-technical user to read manuals written for the technologist. The confused user does not attempt to enable the security features. This creates a treasure trove for attackers.

A popular technique for gaining entry into the shopper's system is to use a tool, such as SATAN, to perform port scans on a computer that detect entry points into the machine. Based on the opened ports found, the attacker can use various techniques to gain entry into the user's system. Upon entry, they scan your file system for personal information, such as passwords.

While software and hardware security solutions available protect the public's systems, they are not silver bullets. A user that purchases firewall software to protect his computer may find there are conflicts with other software on his system. To resolve the conflict, the user disables enough capabilities to render the firewall software useless.

**Sniffing the network:** In this scheme, the attacker monitors the data between the shopper's computer and the server. He collects data about the shopper or steals personal information, such as credit card numbers.

There are points in the network where this attack is more practical than others. If the attacker sits in the middle of the network, then within the scope of the Internet, this attack becomes impractical. A request from the client to the server computer is broken up into small pieces known as packets as it leaves the client's computer and is reconstructed at the server. The packets of a request sent through different routes. The attacker cannot access all the packets of a request and cannot decipher what message was sent.

**There are some consequences for security violations. These are:**

* Risk to security and integrity of personal or confidential information.
* e.g. identity theft, data corruption or destruction, unavailability of critical information in an emergency, etc.
* Loss of valuable business information.
* Loss of employee and public trust, embarrassment, bad publicity, media coverage, news reports.
* Costly reporting requirements in the case of a compromise of certain types of personal, financial and health information.
* Internal disciplinary action(s) up to and including termination of employment, as well as possible penalties, prosecution and the potential for sanctions / lawsuits.

Today the detection of attacks and intrusion is an important role in the security of our networks. Also we have many personal information in our computer. So there should be a security system in our computer which will ensure about the unauthorized access from other users. To address this issue, we have several systems that follow a number of different strategies to solve this matter, among them are the Intrusion Detection System (IDS) signature-based and anomaly-based detection systems. Throughout this paper the importance of these systems on security will be shown. A small comparison will also be made with the misuse detection techniques that will serve the reader as an introduction to the understanding of them. Before making a comparison, we must define what are FPR and FNR. These acronyms refer, respectively, to the concepts False Positive Rate and False Negative Rate. The false positive occurs when normal behavior is detected as illegal, and false negative occurs when attacker behavior is considered as normal.

Our work is to improve a system based on supervised learning and anomaly detection that will inform us whether the current user of computer is the original or not and lock the computer by analyzing user’s mouse movements.

**Chapter 2**

# Background Study

In order to find a specific approach, we have studied quite a number of research papers related to our task. In this section these will be briefly discussed here.

**Chapter 3**

# Problem Definition

## 3.1 Virtual Reality

**Virtual reality** (**VR**) is a simulated experience that can be similar to or completely different from the real world. Applications of virtual reality include entertainment (e.g. video games) and education (e.g. medical or military training). Other distinct types of VR-style technology include augmented reality and mixed reality, sometimes referred to as extended reality or XR.

## 3.2 Importance of virtual reality

Experiencing things that have no existence through the computers is now possible with VR technology! Virtual Reality is a trending technology that gives excellent scope to diverse businesses to take a leap and simulate physical presence in the real world as well as the imaginary world. This immersive technology creates a computer-simulated environment, and the advancements offer cutting-edge solutions. The cutting-edge technology crossed the barriers and diverse industrial verticals embrace the technology to create new marketing and communicating strategy. Virtual Reality technology, of course, lifted the gaming experience to an advanced level but, not limited within the gaming industry! The importance of Virtual Reality spreads across the world involving businesses from diverse fields. VR technology offers a new path to success in the modern world.

## 3.3 Application of virtual reality

Virtual reality is most commonly utilized in amusement applications such as video recreations and 3D cinema. Shopper virtual reality headsets were to begin with discharged by video amusement companies within the early-mid 1990s. Starting within the 2010s, next-generation commercial fastened headsets were discharged by Oculus (Fracture), HTC (Vive) and Sony (PlayStation VR), setting off a unused wave of application development. 3D cinema has been utilized for wearing occasions, erotica, fine craftsmanship, music recordings and brief movies. Since 2015, roller coasters and topic parks have joined virtual reality to coordinate visual impacts with haptic feedback.

In social sciences and brain research, virtual reality offers a cost-effective device to ponder and reproduce intuitive in a controlled environment. It can be utilized as a frame of restorative intercession. For occurrence, there's the case of the virtual reality presentation treatment (VRET), a shape of presentation treatment for treating uneasiness clutters such as post traumatic stretch clutter (PTSD) and fearsIn social sciences and brain research, virtual reality offers a cost-effective device to ponder and reproduce intuitive in a controlled environment. It can be utilized as a frame of restorative intercession. For occurrence, there's the case of the virtual reality presentation treatment (VRET), a shape of presentation treatment for treating uneasiness clutters such as post traumatic stretch clutter (PTSD) and fears

Virtual reality programs are being utilized within the restoration forms with elderly people that have been analyzed with Alzheimer's illness. This gives these elderly patients the opportunity to recreate genuine encounters that they would not something else be able to encounter due to their current state. 17 later ponders with randomized controlled trials have appeared that virtual reality applications are successful in treating cognitive shortfalls with neurological diagnoses. Misfortune of versatility in elderly patients can lead to a sense of depression and sadness. Virtual reality is able to help in making maturing in put a life saver to an exterior world that they cannot easily explore. Virtual reality permits presentation treatment to require put in a secure environment.

In pharmaceutical, recreated VR surgical situations were to begin with created within the 1990s.Beneath the supervision of specialists, VR can give viable and repeatable preparing at a moo taken a toll, permitting learners to recognize and correct blunders as they occur. Virtual reality has been utilized in physical recovery since the 2000s. In spite of various thinks about conducted, great quality prove of its viability compared to other restoration strategies without advanced and costly gear is missing for the treatment of Parkinson's disease. A 2018 survey on the viability of reflect treatment by virtual reality and mechanical technology for any sort of pathology concluded in a comparative way. Another think about was conducted that appeared the potential for VR to advance mimicry and uncovered the contrast between neurotypical and extreme introvertedness range clutter people in their reaction to a two-dimensional avatar.

Immersive virtual reality innovation with myoelectric and movement following control may speak to a conceivable treatment choice for treatment-resistant apparition appendage torment. Torment scale estimations were taken into consideration and an intuitively 3-D kitchen environment was created bases on the standards of reflect treatment to permit for control of virtual hands whereas wearing a motion-tracked VR headset. A orderly look in Pubmed and Embase was performed to decide comes about that were pooled in two meta-analysis. Meta-analysis appeared a critical result in favor of VRT for balance.

VR can recreate genuine workspaces for work environment word related security and wellbeing purposes, instructive purposes, and preparing purposes. It can be utilized to supply learners with a virtual environment where they can create their abilities without the real-world results of falling flat. It has been utilized and considered in essential education, life structures teaching, military, space traveler training, flight simulators, digger training, building design,[citation required] driver training and bridge inspection. Immersive VR building frameworks empower engineers to see virtual models earlier to the accessibility of any physical prototypes. Supplementing preparing with virtual preparing situations has been claimed to offer roads of authenticity in military and healthcare preparing whereas minimizing cost. It moreover has been claimed to diminish military preparing costs by minimizing the sums of ammo used amid preparing periods

Within the designing field, VR has demonstrated exceptionally valuable for both building teachers and the understudies. A previously costly taken a toll within the instructive office presently being much more available due to lowered by and large costs, has demonstrated to be an awfully valuable instrument in teaching future engineers. The foremost noteworthy component lies within the capacity for the understudies to be able to connected with 3-D models that precisely react based on genuine world conceivable outcomes. This added tool of instruction gives numerous the drenching required to grasp complex subjects and be able to apply them. As famous, long run planners and engineers advantage incredibly by being able to make understandings between spatial connections and giving arrangements based on real-world future applications.

The primary fine craftsmanship virtual world was made within the 1970s. As the innovation created, more aesthetic programs were delivered all through the 1990s, counting highlight movies. When commercially accessible innovation became more broad, VR festivals started to develop within the mid-2010s. The primary employments of VR in exhibition hall settings started within the 1990s, seeing a critical increment within the mid-2010s. Also, exhibition halls have begun making a few of their substance virtual reality accessible. Virtual reality's growing showcase presents an opportunity and an elective

channel for computerized marketing. It is additionally seen as a unused stage for e-commerce, especially within the offered to challenge conventional "brick and mortar" retailers. In any case, a 2018 think about uncovered that the lion's share of products are still acquired in physical stores.

Within the case of instruction, the employments of virtual reality have illustrated being competent of advancing higher arrange thinking, advancing the intrigued and commitment of understudies, the procurement of information, advancing mental propensities and understanding that are for the most part valuable inside an scholastic context. A case has moreover been made for including virtual reality innovation within the setting of open libraries. This would allow library clients get to cutting-edge innovation and special instructive experiences. This might incorporate giving clients get to virtual, intelligently duplicates of uncommon writings and artifacts and to tours of celebrated points of interest and archeological burrows (as within the case with the Virtual Ganjali Khan Extend)

## 3.4 Selected work

After studying various papers and different approaches of anomaly detection, we have decided to develop a virtual reality application, where a user can able to drive a car.

**Chapter 4**

# Methodology

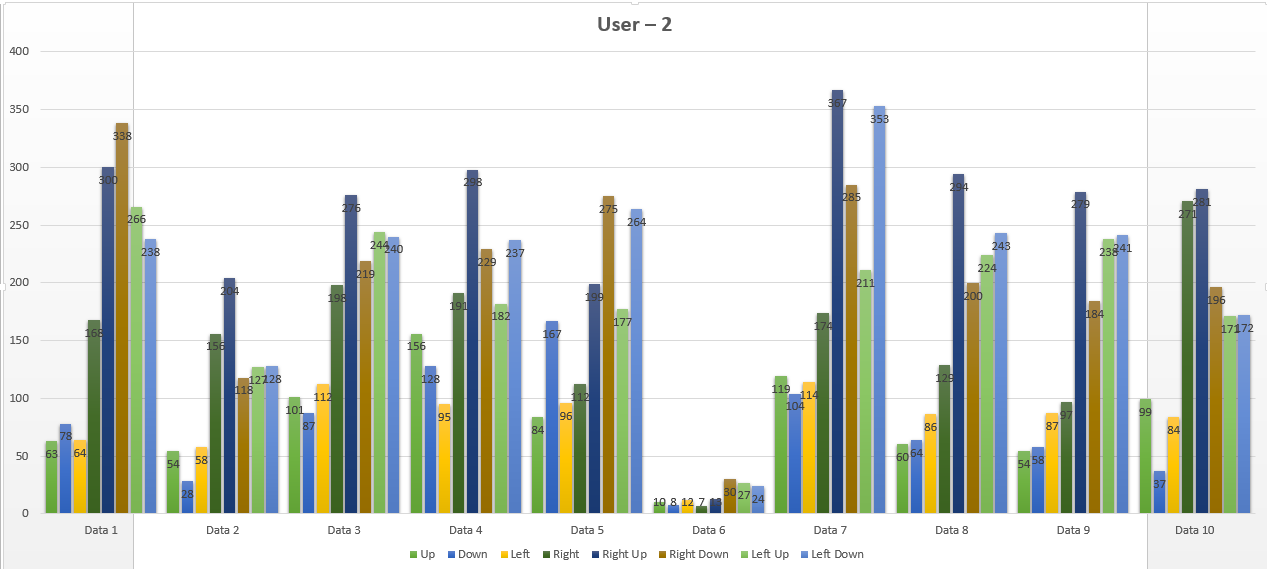
## 4.2 Apparatus

**Chapter 5**

# Features Analysis

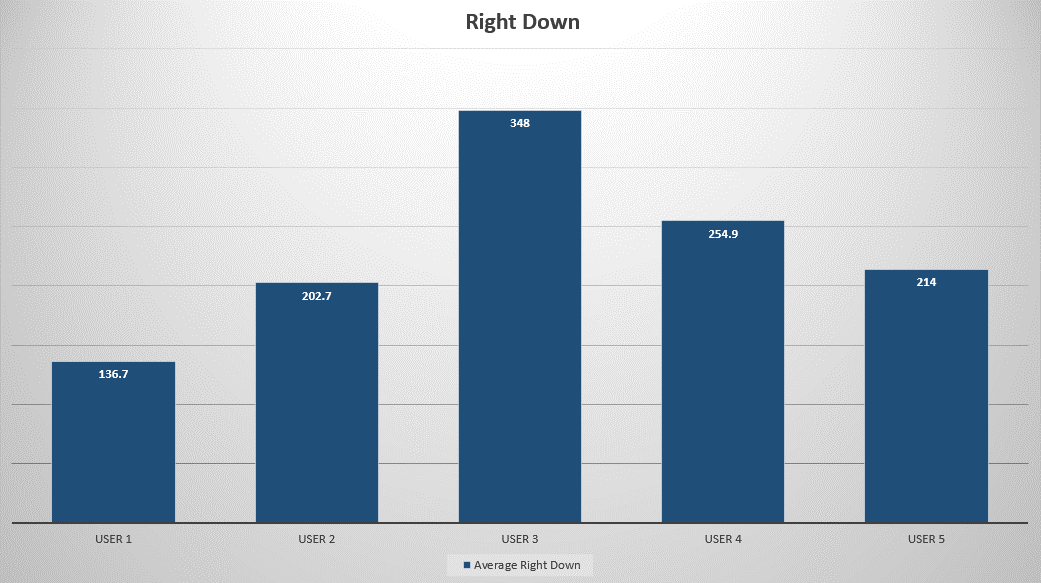
We have prepared some graphical analysis for different users by which we can say that mouse actions between different users are totally different. In this section we have provided the details of the main tasks performed by the behavior analysis process. We have used 10 sessions of data in which of every session contains 6000 mouse coordinates in 10 minutes for a specific user. There are 5 users in total for our experiment.

## 5.1 Movement direction

****

**Figure 3:** Eight directions in 10 minutes for 10 data

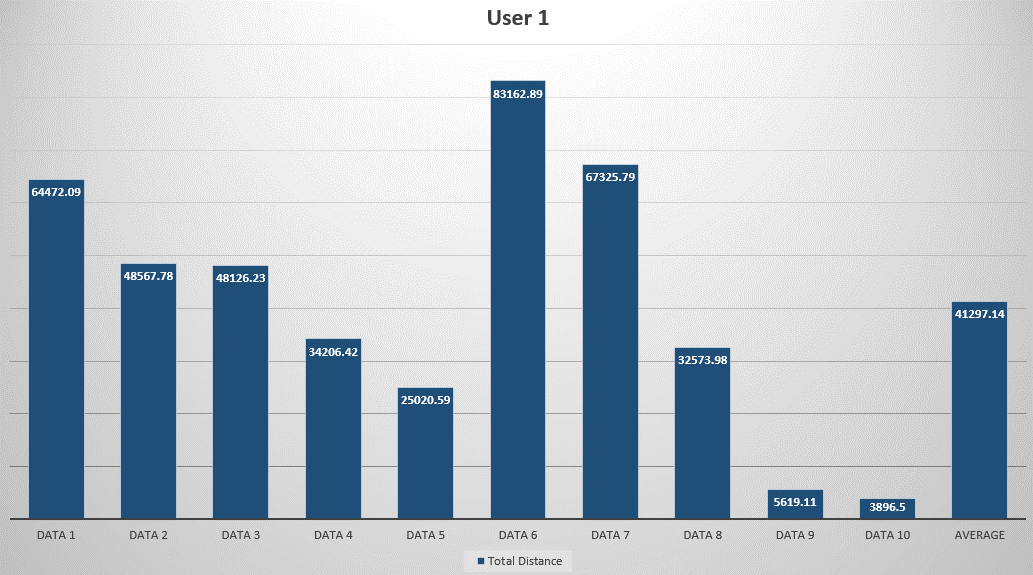
The above graph is for User 2. Here is the average direction of Right Down for all users.



**Figure 4:** Difference between right down direction

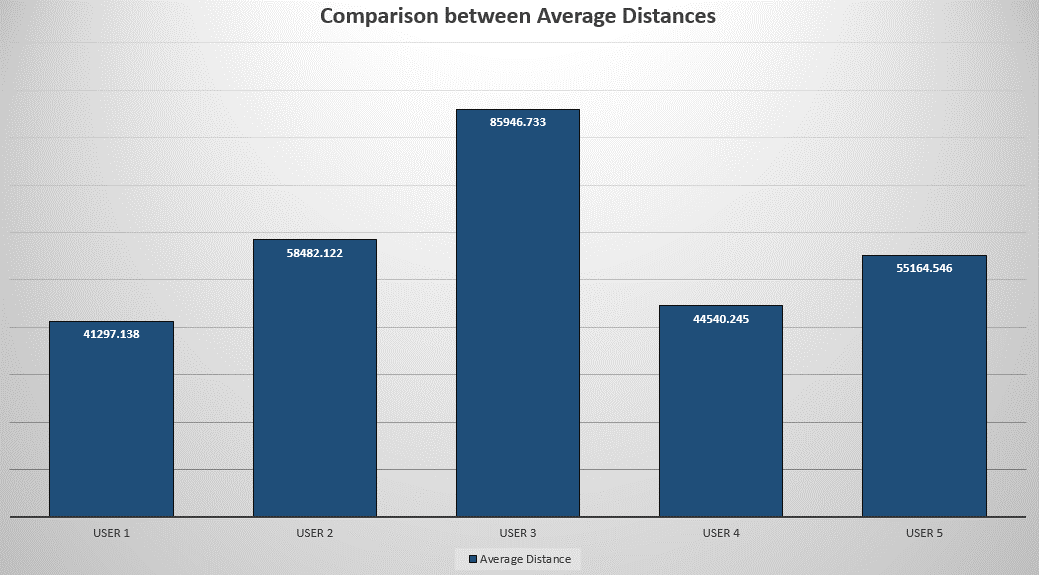
We have plotted this graph for up, down, left, right, right up, left up and left down also.

## 5.2 Total and average distance



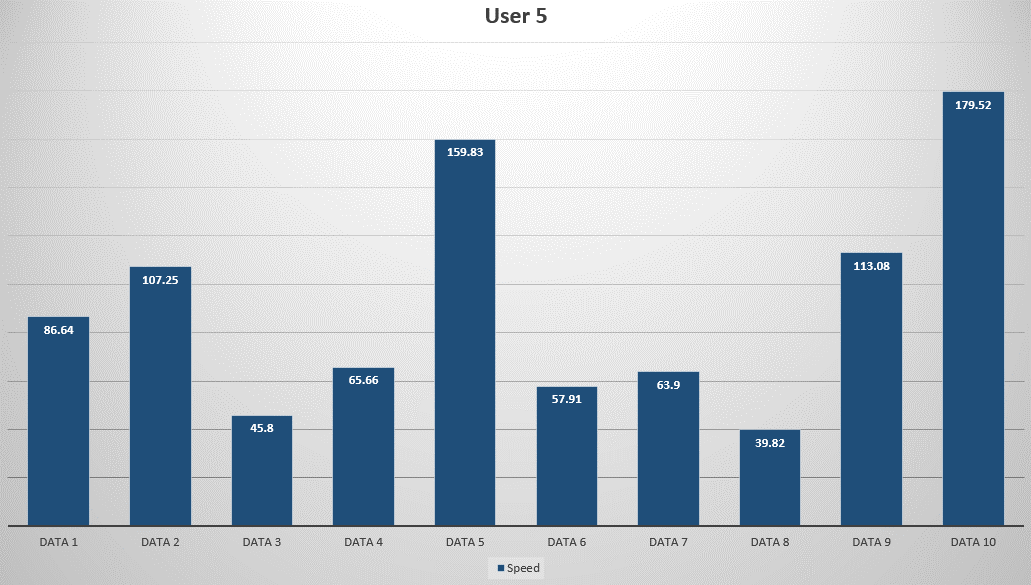
**Figure 5:** Total traveled distance in 10 minutes

We have plotted four more graphs for user 2, 3, 4 and 5. As a result we can see the difference of average distance between them which is shown in the following graph.

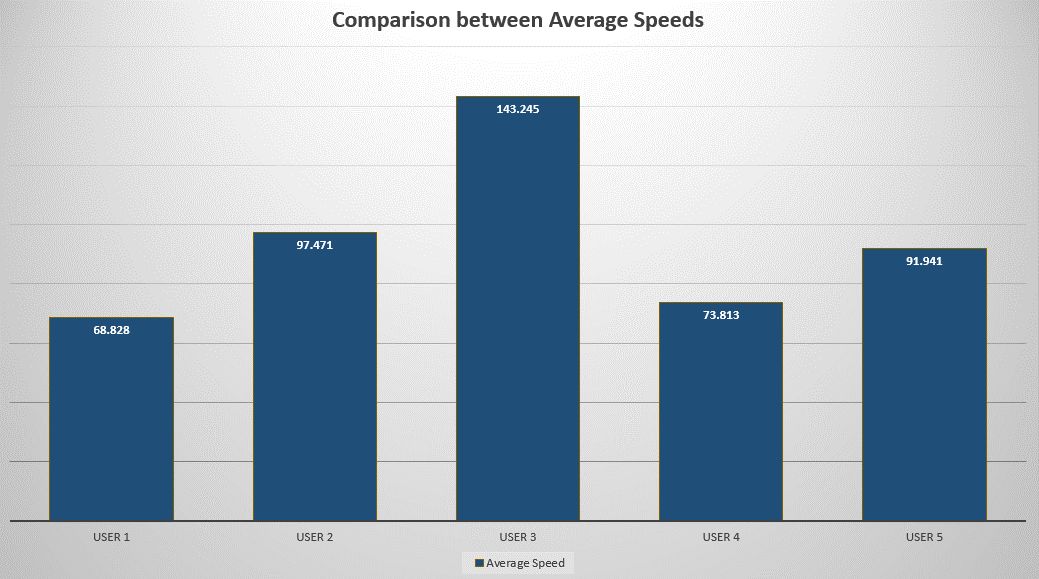


**Figure 6:** Difference between average distances

## 5.3 Mouse cursor’s speed

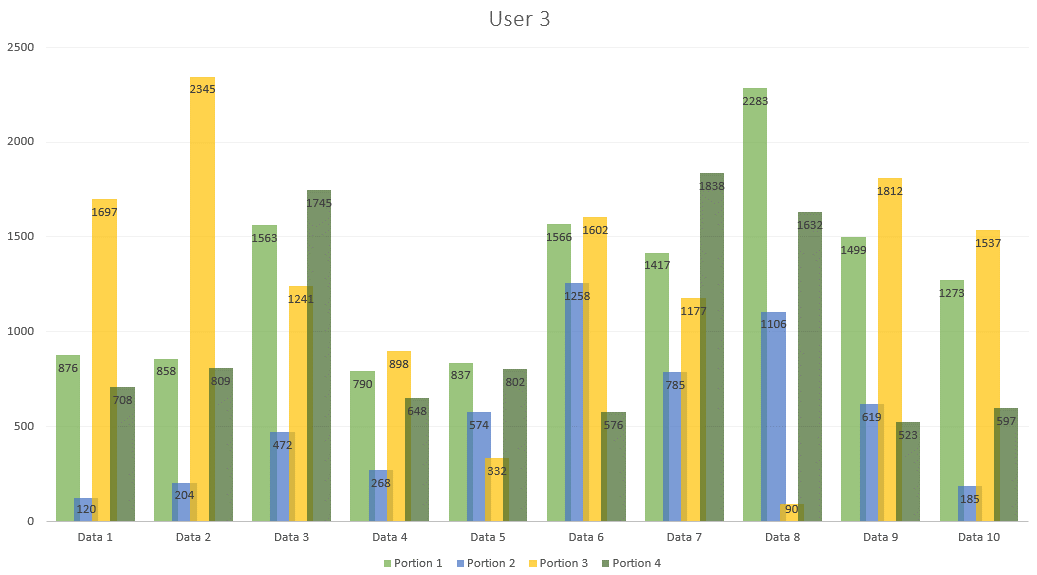


**Figure 7:** Cursor's speed in 10 minutes

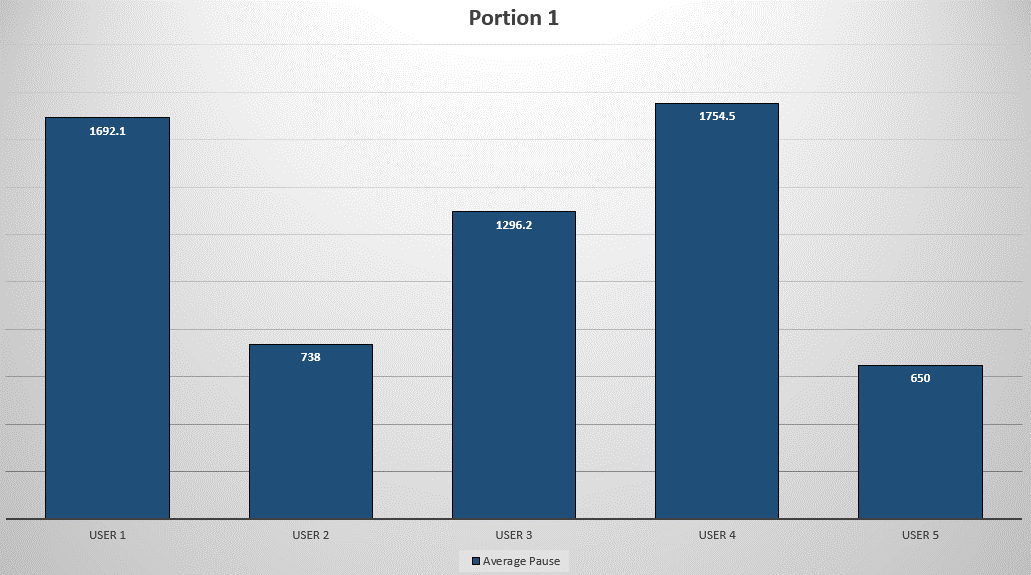


**Figure 8:** Differences between average speeds

## 5.4 No movement

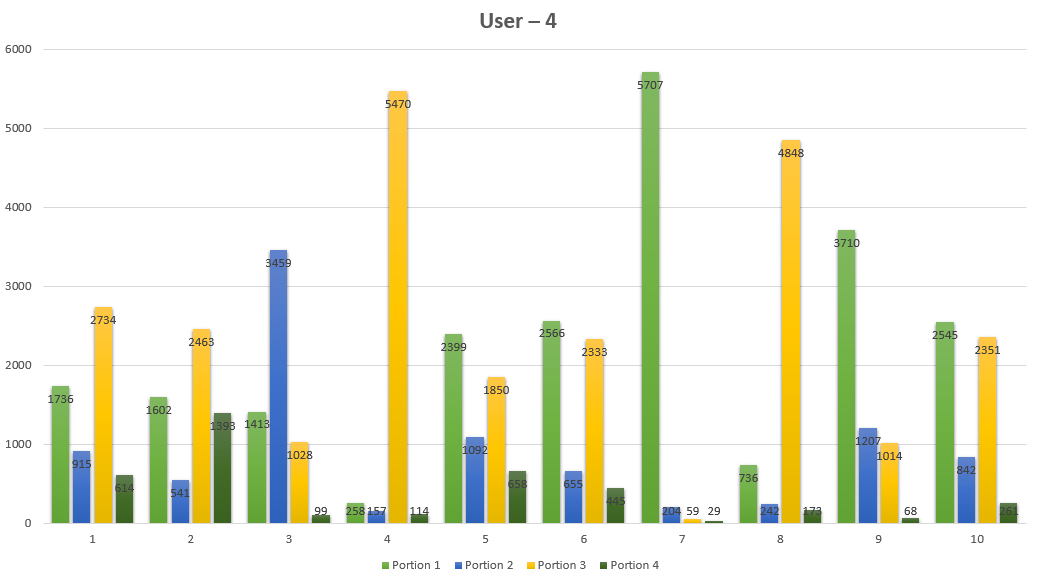
****

**Figure 9:** Pausing coordinates in all portion

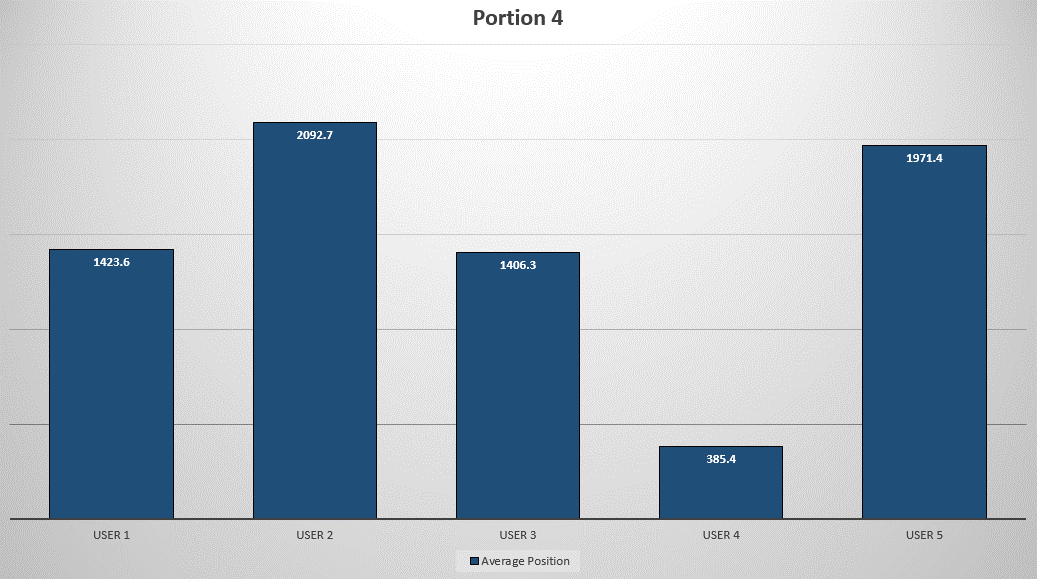


**Figure 10:** Average pausing coordinates at portion 1

## 5.5 Mouse cursor’s portion

****

**Figure 11:** Movement coordinates in different portion



**Figure 12:** Average coordinates at portion 4

**Chapter 6**

# Future Work

We have tried to implement our ownmethod to detect an anomalous user by analyzing their mouse movements. We have also shown some basic features of mouse movements for a specific user and then combined them to realize the actual difference between users’. The algorithm of detecting the anomalous user is not fully implemented. Before implementing a functional algorithm we will also calculate:

* the average speed against the movement direction.
* the average traveled distance for a specific period of time with respect to different movement directions.
* the average of silence periods between movements.
* the amount of silence in a time interval.
* the percentage of the silence time to movement time.

We think that these types of features will help us to detect anomalous user more accurately.

**Chapter 7**

# Conclusion

The simple feature set of directions, direction changes, mouse coordinates’ portion, pausing coordinates, average distance and speed of mouse cursor and relations between our described features above proved to be useful in classification actual and anomalous user. So after performing various experiments on mouse movement and studying the behavior pattern for different users, we can say that detection of the anomalous user by mouse movements is possible. This work will play a vital role in our computer security system.

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