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Insider Threat Identification Through User Behavior Analytics and System Log Monitoring

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Abstract:
Internal sources ie insiders tend to threaten organizations and Because of this, they create a major headache for organizations. It is quite a challenge to find such threats as the perpetrators of the breaches are the same people we rely on - employees, contractors or business partners. Threats can either be intentional like a person stealing data, misusing a system, or unintentional when a person makes a mistake or their credentials are compromised. In the light of digital technology proliferation, business companies have to figure out the ways to level up the detection of insider threats. In this paper, the focus is on one of the approaches that have been applied to detecting these threats, that is, user behavior analysis. The data extracted from server application databases and network device logs tell of user activities like login, file access, and network usage. By analyzing logs, you can tell what is a normal behavior and what actions are out of the norm or anomalous. Our approach comprises six stages: data collecting, data quality checking, key elements extraction, behavioral analysis, suspicious activity detection, and risk assessment. To be precise and aware of users' movements over time, we employ machine learning and statistical methods. Because of this, we can differentiate between normal and malicious behaviors. The research results show that behavior analysis and log reviews are a very good help in discovering insider threats. It supports organizations in their effort of securitization, incident response as well as protection of confidential information and essential digital resources. Really insider threats are an issue of great concern and for that reason, organizations must be able to detect them. That is the solution we offer on that. Finally, we consider that simply put the reason why insider threats still exist is the lack of proper disinfecting tools and techniques.Keywords: anomaly detection, cybersecurity, insider threats, log analysis, user behavior analytic.

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I. INTRODUCTION

1.1 Background

Cybersecurity has become more important than ever in the rapidly evolving landscape of information technologies and digital communication networks. Currently, companies, health-care institutions, schools, banks, and governments are highly dependent on computers, networks, cloud services, and other digital infrastructures to store and manage sensitive information in a safe manner [4]. Although these developments offer numerous advantages such as increased communication, increased productivity and efficiency, they also lead to new concerns on the cyber security and cyber threat fronts [11]. Today, one of the greatest cyber security dangers deals with insider threats, which are the threats that are made by the insiders who are legally allowed to use the information system of an organization [9].In the rapidly evolving landscape of information Insiders are also located within the organizational boundary, unlike the outside attackers, so it is not possible to detect them using the usual methods like antivirus protection software, firewall and other intrusion prevention devices [15]. Insiders with poor password policies, who can also fall victim to phishing, accidentally leak sensitive information, or break security policies can endanger an organization's security [21].

The result of insider attacks has revealed financial losses, disruption to operations, damage to reputation and disclosure of organizational secrets [18]. In the era of a remote working society, cloud computing and Internet access, user activities are becoming a challenge for organizations [24]. Users connect their systems to organizational networks via different devices and different places, thus leading to amore cybersecurity challenges for organizations [30].

There are lots of logs generated by the organisations in the servers, databases, software programs, and network appliances [5]. Logs provide valuable information about users' behaviour such as login times, files used by users,

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commands used by users, and utilization of network resources [13]. Logs allow organisations to track what users are doing to detect any unusual or malicious behaviour carried out by the users.

The behavior-based techniques are popular in monitoring abnormal actions and detecting insiders [27]. Behavior-based techniques establish a baseline of normal behavior that is performed by an insider, and identify deviations from this baseline [10]. Automated analysis of large amounts of data containing unknown behavioral patterns by machine learning and anomaly detection algorithms also boosts the insider threat detection system's performance [33].

AI and deep learning are also significant factors that have contributed significantly to the field of cybersecurity [14]. These methods allow for real-time monitoring, automated detection of threats, and advanced learning capabilities, improving the overall efficiency of the cybersecurity framework [35]. Yet, there are still many obstacles to overcome in insider threat detection, such as false alarms.

positives, privacy issues, the analysis of large amounts of data, and new attack techniques [22]. This means that companies need intelligent and scalable security systems that can detect threats and protect vital digital assets [31].

1.2 Statement of the Problem

As the number of insider threat incidents has grown, it is one of the largest cybersecurity issues and includes users with legitimate access to corporate resources and information [2]. The traditional approach to security based on firewalls, anti-virus and intrusion detection devices is typically ineffective at detecting suspicious activities by legitimate users [5]. The number of user activity monitoring tools is expanding as cloud innovation and work-from-home usage by many companies complicates the situation [12]. In the world of corporations, log information is generated by servers, databases and network devices etc, in gigantic amounts, making the manual processing of logs often challenging and resource consuming [15]. Smart monitoring and effective analysis is needed for detecting abnormal user behaviour [18]. Moreover, researchers reported issues determining user behavior or whether it is actually legitimate or malicious behavior [20]. Current technologies are known for a high ratio of false positives and lack flexibility to include changes in user behaviour [22]. It thus requires the creation of a behaviour-based insider threat detection system based on Logs analysis [27][30][35].

1.3 Purpose of the Research

One of the key objectives of this work is to suggest an approach for detecting insider threat using log analysis, which plays a crucial role in enhancing an organization's cybersecurity [1]. Solving the insider detection problem comes from the fact that attackers will already be able to gain access using authorized access to internal networks [3]. Security solutions available today mostly pay attention to external threats and fail to detect activities of legitimate users that may indicate malicious intentions [5]. The main focus of this study is log analysis and the identification of abnormal behavior patterns of users [7]. In this study, a machine learning and an anomaly detection based method are used to identify users' anomalous behaviour in real-time and to deter potential attacks [9]. One more goal of the study is the enhancement of precision for the identification of insider threats and minimizing false alarms from existing cyber security tools [11]. Another AI's effects study regarding cybersecurity solutions [13] is also studied.This approach plays a part in the ongoing threat monitoring and analysis process [18]. This technique also helps in improving the data protection and security management [20]. Also, this research can be used to design automatic detection systems to detect any suspicious activity by users [22]. New sophisticated analytical tools will help to enhance the adaptability and flexibility of systems in terms of monitoring [27].

1.4 Objective of the Research

This study mainly focuses on the development of an effective behavior-based insider threat detection system based on log analysis. The researchers will use intelligent analysis methods in the study to try to improve cybersecurity monitoring, detect anomalies in user behavior, and strengthen organizational security against user insider threats.

i. The development of a behavior-based insider threat detection system that is able to monitor user behavior and detect abnormal activity using log analysis and intelligent cybersecurity techniques.

ii. Review of logs from servers, databases, applications and other networked devices to look for any unusual activity or behavior that might stem from a potential insider threat.

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iii. Application of machine learning and anomaly detection approaches for detecting any abnormal behavior patterns among users.
iv. Modernize existing cyber security solutions with advanced behavioral analytics to reduce false positives and improve the efficiency, reliability, and effectiveness of current solutions.
Analytics and automation for threat detection.
One way to boost the cyber security of a company is to offer 24/7 monitoring, threat detection, and intelligent security management. Consider safeguard sensitive information from any form of insider threats.

II. LITERATURE REVIEW

The topic of cybersecurity research has gained a lot of prominence due to the dependence of organizations on technology such as cloud computing and communication technologies for handling critical information and performing regular tasks [4]. Along with the integration of technology in processes, there is an increase in cyber threats, which poses security challenges to the organizations around the world [11] The insider threat is one of the largest security threats due to its use of those who have access to the system [2]. It is emphasized that insiders are very difficult to detect since, “Insiders work on the inside of the organization, which is inside its security perimeter, and appear as legitimate users” [15].
Historically, cybersecurity research efforts have been largely geared towards developing systems capable of detecting unauthorized access attempts [1]. In traditional security systems, to prevent known attacks, the approaches taken included rule based detection and signature analysis. It was noted however, that rule-based detection and signature analysis might not be effective if the attack is carried out by an insider, since the insider has legitimate access to the system [18].
There are several studies reporting that insiders may pose threats to an organization either intentionally or unintentionally [7]. For instance, malicious individuals who have insider knowledge within the organization can steal valuable information, disrupt systems, misuse company resources and reveal confidential information [21]. On the other hand, negligent insiders will make mistakes such as using weak passwords, information sharing unintentionally, becoming victims of phishing attacks, or ignoring the company’s security policy [10]. All these can wreak havoc on an organisation.
There are several types of logs that can be generated by organizations, such as server logs, database logs, application logs, firewall logs and network logs, which generate huge amount of data logs [5]. These data can provide important information on user activity such as credential attempted, file actions, commands, network usage and more. Research revealed that log analysis was significant when monitoring the users' behavior with respect to potential insider threats [13].
There are many behavioral-based techniques used for detecting abnormal user activity in organizations [27]. The techniques establish normal behavior patterns for the users and identify when behavior is different or abnormal, possibly due to any suspicious or malicious activity [9]. It is further revealed by researchers that anomaly detection techniques prove to be better at recognizing unknown attacks and insider attacks as compared to signature-based techniques [16].
Machine learning techniques have been quite influential in improving insider threat detection techniques [3]. Researchers suggested that machine learning algorithms could efficiently handle large amounts of data and automatically discover the underlying patterns related to the malicious activities [14]. There are several techniques that were used for the detection of insiders, such as decision tree, clustering, support vector machine, logistic regression and random forest.
A number of papers also investigated clustering algorithms like K-means clustering [31] for anomaly detection. The clustering algorithms are used to recognize similar user behavior patterns and to identify outlier users with behaviors that are widely different from the typical organizational activity. This technique works well when it is not possible to have labeled data to train security models [6].
There have been improvements in artificial intelligence and deep learning which have probably helped in reinforcing the security aspects of cybersecurity structures [33]
. The researchers also demonstrated that deep learning, such as neural networks and autoencoders, could be applied successfully to vast amounts of cybersecurity data and understand its behavioral patterns [19].
UEBA systems were becoming popular for insider threat detections [12]. User activities such as access to files, network usage, log-in activities and any other activity related to data transfers, are tracked and analyzed by UEBA systems. These systems build behavioral

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baselines and identify unusual activities that could be an indicator of potential insider threats [25]. By tracking and analyzing in real-time, organizations could identify any potential insider threats and reduce the risk of cyber breaches.

Statistical and probability based anomaly detection is another area that is studied by the researchers [8] . In these techniques, Bayes models and entropy methods were used to compute probabilities for possible anomalies based on past activities of the users [30]. The use of statistical knowledge enabled uncertainties to be better managed and effective decision making in cybersecurity systems.

In the decade [20] security issues of organizations that rely on cloud computing systems and work remotely increased in importance. Employees of the organization started using the organization system from different places, which created problems for the cybersecurity professionals to detect any unusual activity on a timely basis [35]. Researchers emphasized that intelligent monitoring systems which can track user actions in real time are important.

The authors of a number of papers have emphasized that reducing the number of false positives is crucial in the detection systems of insider threats [23]

. If it happens to be a false alarm, it may overwhelm security managers and cause them to lose confidence in automatic insider threat detection systems. To reduce the number of false positive rates, some advanced feature selection and learning algorithms have been proposed by researchers [29].

Other ethical and privacy related issues that various cybersecurity researchers discussed were the potential for ongoing monitoring of users' activities and the implications this could have on them [11]. Monitoring tools used for insider threats could give rise to some legal and ethical problems because of inadequate protection of the user's privacy. It has been emphasized that a proper balance needs to be struck between organizational security requirements and employee privacy [32].

Insiders threats can also be analyzed by using time-series and sequential pattern analysis.

would examine the behavior of users in order to detect suspicious patterns indicating their malicious intent. Sequential monitoring would prove very helpful in detecting stealthy insider threats occurring slowly over time [4].

A lot of research has been conducted on the use of Security Information and Event Management platforms in cyber security [15]. SIEM platform receives events pertaining to cybersecurity from various sources and assists in monitoring events to detect any malicious activity. The use of insider threat detection systems in conjunction with SIEM systems enhances the effectiveness of incident response and security management practices [28].

Risk assessment models have been considered crucial for effective insider threat management [7].The system based on risk assessment gives different levels to people based on their behavior of being suspicious So it makes security management more effective by focusing on the use of resources [26].

Feature engineering and dimensionality reduction have been a major concern of machine learning researchers when it comes to building machine learning systems [13]. The accuracy of anomaly detection is improved by proper feature engineering and the computational overhead is reduced [34].

Researchers also observed that the insider threat detection system must also adapt to remain relevant, as attacks evolve and are increasingly being carried out with different patterns from users' behaviors [24]. Because the attacker continually changes the system, adaptation and learning are required to ensure cybersecurity [9].

The future insider threat detection systems are expected to include more AI-driven cybersecurity solutions [36]. Along with these, intelligent automation, real-time Besides this, things like intelligent automation, real-time monitoring, deep learning and analytics can be the major tools to take an organization's security level to high against cyber attacks and also the risk of insider threats [21]. A solution to the problem is found by using machine learning, anomaly detection, and logging with behavior detection, according to researchers [33].

III. METHODOLOGY

This study is conducted using the “Behavioral Analysis and Log Monitoring” method, which is one of the insider threat detection methods. The logs are collected from servers applications and network devices and then preprocessed and analyzed, extracting features. There is the use of machine learning and anomaly detection techniques

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3.1 Literature Identification and Selection

Literature for this study was collected from different academic sources like research journals, conferences, books, technical reports, and scholarly resources about cybersecurity, insider threat detection, machine learning, and log analysis. The literature was chosen based on its relevance to the study in the areas of behavior-based detection techniques, anomaly detection techniques, and intelligent cybersecurity frameworks. Priority was given to those papers which discuss user behavior analysis, machine learning techniques, application of artificial intelligence, and security monitoring systems for detecting insider threats. The recent literature and highly cited studies were preferred as they offered more reliable information on detection techniques, performance evaluation of these systems, and problems associated with insider threat detection.The results obtained during this analysis have been utilized further for proposing an insider threat detection model for this study.to detect suspicious behavior and abnormalities performed by users.

3.2 Inclusion and Exclusion Criteria

Studies were considered eligible if they:

- Discussed insider threat identification or cybersecurity log analysis or behavior monitoring methods.
- Included machine learning, anomaly detection, artificial intelligence or user behavior analysis of cybersecurity systems.
- The paper included valuable methods, results of experiments, or setups for the detection of suspicious activities.

Studies were not considered for the review if they:

- Focused only on cyber attacks and did not consider insider threats or user behavior analysis.
- Lacks used an incomplete set of data, or outdated techniques, or lacked any experimental or analytical results.
- Had nothing to do with cybersecurity, log analysis, anomaly detection, or intelligent threat detection systems.

3.3 Data Extraction

- The following details were meticulously collected from each article after the identification of selected articles based on those points:
- Methods implemented for insider threat detection and security measures in the research.
- Logging methods, utilization of data sets, and system architecture and monitoring setups in the research articles. Parameters like accuracy precision recall rate, false positive rate, and efficiency in detection are very important to carry out.
- Major limitations noticed, problems uncovered, and a future plan to carry out studies.

IV. FINDINGS & ANALYSIS

4.1 Analysis of Insider Threats in Modern Cybersecurity Environments

This method of insider threat identification, behavior based log analysis, has been useful in strengthening organization security and protecting their system from any internal threat [9]. Insider threat has been acknowledged as one of the most difficult challenges in security domain for several reasons: insiders are given direct authorized access to the organization system, at the application layer, and to sensitive data [4]; and the attack source is already within the security perimeter so the activities of any insider attackare difficult to be identified by traditional security devices, like IDS antivirus firewall, and proxy servers [12]. So, what has been increasingly demanded by various organizations is the introduction of smart insider threat detection system [18].

This research examines using behavioral monitoring and log analysis techniques for malicious insider detection in organizational environment [5]. Data recorded within logs from servers applications database systems and network devices gives plenty of insight into user behaviour, for example login activity, command executions and network traffic [13].

Through the ongoing surveillance of this data, anomalous activity can be flagged up as potentially malicious insider activity [27]. Another noteworthy result from this study is the effect of application of

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machine learning and anomaly detection technique on the accuracy of threat detection [15]. Machine learning techniques have the capability of parsing great amounts of data, discover complex regularities and differentiate between normal and abnormal customer behavior [22]. Classification/class clumping such as decision trees and support vectors machine are employed to enhance detection precision and reduce the burden of extensive manual log examinations [31].

Real-time monitoring and behavioral monitoring also help to the rapid detection of threat and incident response Because of this minimize the potential damage to organization [24]. In addition, the research demonstrated some of the weaknesses of existing integrated insider threat detection systems. To analyze huge amounts of log data, it takes considerable amount of processing resources [14]. Also, the sensitivity of the method depends heavily on quality and completeness of information collected, as the more accurate information, the more efficient performance and the better detection rate [7].

Three, there are difficulties in discerning normal but atypical activities and malicious activity; Still, not every unusual activity is malicious to the system as it is authorized [18]. Despite these disadvantages, behaviour based insider threat detection systems have several advantages compared to the traditional security methods [25]. They provide predictive monitoring, real-time insurgent detection and increased security control. Log analysis can provide

more detail of a user's activity and help identify unseen threats with traditional security devices [33].

4.2 Importance of Behavior-Based Monitoring for Detecting Suspicious User Activities

Behavior-based monitoring is increasingly becoming an essential tool for not only spotting suspicious user behaviors but also for strengthening the security measures in enterprises. Conventional ways of security are Mainly centered around known threats that come from outside the company, and That's why, they fail to identify unusual actions of authorized users inside the company [10]. The problem is that the inside men and women are well-versed in the organization's information and connections and can conduct their attacks in a stealthy manner. Therefore, it is important to keep track of the activities of users and identify their abnormal activities.

The method is based on the observation of users' activities, including logins, file access log, Internet usage and command log. The history of activities, studied, allows to develop a model that represents the typical user's behaviour within the organization. If deviations from this model are detected, then they are considered to be abnormal. When someone accesses confidential documents at odd hours or if they attempt to log on numerous times, If the system does not work out, it could be an odd activity [8].

It is pointed out that continuous monitoring enhances the accuracy of detecting threats and helps detect insider threats at their very early stages [12]. Behavioral data analysis and anomaly detection algorithms are widely used for threat detection and behavior analysis. These techniques may also help to reduce false alarms and improve live monitoring.

Behavioral monitoring, However supports security audits and investigations of incidents [15]. Behaviorally monitoring a work flow can be one piece of help from a big picture view, to lock down security control and governance of IT. That's why, behaviorally monitoring is indispensably linked with capabilities of an organization to fish out anomaly user activities and can be a powerful tool to a organizations cybersecurity arsenal. Traditional security solutions are based on signatures and known outside attacks, and That means, they are incapable of identifying internal users' abnormal activities [10]

. But what makes this a problem is its insiders know information and networks of the organisation and can perform attacks in a stealthy way. Therefore, it is important to keep track of the activities of users and identify their abnormal activities.

This approach consists of tracking the activity of the users, such as their logins, file access logs, Internet utilization and command logs [14]. Through studying the history of activities, it becomes possible to create a model describing typical behaviors of users within the organization. If deviations from this model are detected, then they are considered to be abnormal. If accessed at unusual times or if repeatedly attempting to log on to the system without success, this may be an unusual activity [8].

The advantages of continuous monitoring is stated to be better accuracy of detection of threats and the detection of insider threats at their very early stages [12]. Popular methods for threat detection and behavior analysis are behavioral data analysis and anomaly detection

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algorithms. These are some of the approaches that will reduce the number of false alarms and improve the efficiency of real-time monitoring.

4.3 The Importance of Log Analysis Methods to Uncover Insider Threats

Log analysis tools are critical in detecting any insider threat as well as improving cybersecurity for the organization. Organizations today are inundated with log data from their servers, databases, applications, firewalls, and networking equipment [11]. The log data contains various details about the user's activities such as logging in, accessing certain files, executing certain commands, and using networks among other actions. Log analysis makes it possible to monitor user actions as well as to detect any signs of suspicious actions by users.

activities but both techniques are unable to detect the unknown attacks [6]. Machine learning algorithms provide intelligent solutions to analyze huge amounts of logs and automatically identify suspicious activities [2].

The algorithms of machine learning learn the behavioural patterns from the previous activities that were done by the users and identify the normal and abnormal activities [15]. Decision tree, clustering and support vector machine (SVM) algorithms are popular methods used to detect insider threats [11]. The use of machine learning increases the efficiency of the detection process.

In cyber security systems, anomalies are considered as activities that breach users' behavior norms [19]. A standard user profile is first created from the previous activities and by comparing them to the current activities. Unusual logins, accesses to files and transfers of data by a user are considered suspicious activities [8].[29] H. Han, W. Wang, and B. Mao, "Borderline-SMOTE: A new over-sampling method," in Advances in Intelligent Computing, 2005.

In addition, the threat identification mechanisms have been enhanced thanks to adaptive learning and automatic feature extraction using deep learning and AI technologies [27]. These technologies can be applied in the real time monitoring and increase the cyber security in organizations [35]. On top of that, machine learning and anomaly detection integration boosts threat detection efficiency and reduces the number of false alarms, experts noted [24].behavior patterns [27]. The efficient detection capabilities will be provided by modern AI models and machine learning systems. Researchers are developing low-cost, flexible insider threat detection systems with today's cloud architectures [35].

V. DISCUSSION

5.1 Strengths and Advantages

Behavioral insider threat detection is a useful tool to detect malicious behavior carried out by authorized users [9]. This technique examines the behavior patterns of users and the logs of the system to identify any unusual actions that could pose a security threat [13]. It is capable of early detection of threats, ongoing monitoring and the generation of alerts in real time [22]. The recognition of hidden anomalies in huge quantities of data is enhanced by applying machine learning techniques [15]. The approach takes advantage of the existing organizational log information, which decreases the cost of implementing the method and increases the efficiency of operations [27]. Furthermore, it is able to identify previously unseen threats that signature-based solutions might not be able to detect [5]. The benefits of behavioral analytics render this an important element in today's cybersecurity defense strategies [33].

5.2 Challenges and Limitations

There are a number of obstacles to overcome when implementing behavior based insider threat detection [8]. A false-positive is a user performing legitimate activities that is incorrectly detected as suspicious activity [21]. As users change their behavior, the model needs to be updated and retrained on a regular basis to ensure that it remains accurate in detecting the user's behavior [24]. The quality and completeness of the log data can greatly affect system performance and reliability [14]. There can be privacy issues associated with always being monitored and data being collected by employees [32]. Besides, the sophisticated insiders might pretend to be normal to evade detection [18]. The high computational demands and log processing at large scales may further complicate deployment [29]. These restrictions need to be taken into account to ensure the reliable and accurate detection of threats [35].

5.3 Practical Deployment Considerations

Deployment needs to be well planned, supported by the infrastructure and by the organisation [11]. There should be centralized log management systems in place that can capture log information from different sources such as

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networks, applications and operating systems [25]. Detection models need to be continually updated to accommodate changing user behavior and new threats as they appear [17]. It integrates with Security Information and Event Management (SIEM) systems to enhance monitoring and response capabilities [28]. Awareness programs for employees should be conducted to encourage employees to adopt the best practices to reduce the insider risks associated with cybersecurity [6]. Compliance with privacy laws and security within the organization is another requirement to be met [34]. Continuous evaluation, proper maintenance, and scalability are crucial for effective and sustainable insider threat detection operations [36].

VI. FUTURE SCOPE

Down the line, studies in this field should mainly work on creating scalable, adaptive, and real-time insider threat detection systems that are able to carry out the increasing complexity of cybersecurity environments [27]. Advanced artificial intelligence and deep learning models have a great potential to increase the threat detection accuracy by spotting the hidden behavioral patterns as well as by decreasing false alarms [30]. And, the creation of hybrid threat detection systems which are a combination of machine learning, behavior-based analysis, and statistical methods can be a good way to increase detection capacity and trustworthiness [29]. Also, breaking down into cloud security, distributed monitoring systems, and state-of-the-art cybersecurity technologies is critical to reason for and respond to the new security challenges [36].

In the near term, insider threat detection technologies will likely be more intelligent, self-operating, and capable of foreseeing security risks in suspicious behaviors [34]. The merging of artificial intelligence, big data analytics, and next-generation cybersecurity setups will definitely support organizational security and boost the ability to react to threats [33]. With these tools, organizations will be a lot better in monitoring user behavior, quickly identifying irregularities, and guarding confidential information against internal threats [35]. To wrap up, behavior-based insider threat detection through log analysis is one of the most viable and effective methods to counter cybersecurity threats and to improve organizational security management in the contemporary digital world [21].

VII. CONCLUSION

The concept of using behavioral log analysis to detect insider threats is highly effective in improving cybersecurity and proper protection of organizations' systems against insider threats. Insider threats, overall, can be considered as one of the most complex cybersecurity problems as they are associated with the individuals who have been granted the legitimate access to any system, applications and information stored in it. People who can use the resources within the security perimeter of any organization are called insiders, and their actions cannot be detected as they can be responsible for some of the cyber threats which can be detected by the conventional security systems. Therefore, it's evident why intelligent insider threat detection is so crucial.

This paper focused primarily on studying the use of behavioral monitoring and log analysis techniques to detect insider threats in organizations. Various system logs produced by server applications, databases, applications, and network devices have important details on user's activities. Because of this, through the investigation of system logs, it is possible to find out a user's login, access attempts, commands used and executed, and even the files accessed.

The real-time monitoring, behavior analysis, enables the identification of possible risks and immediate action to avoid damages.In an article, the authors described the evolving role of machine learning algorithms and anomaly detection methods, which deliver enhanced efficiency and performance in security systems. Machine learning instruments are not only capable of handling large volumes of data, but can also research patterns and distinguish between legitimate and suspicious behaviors. Methods such as clustering classification decision trees, and support vector machines can be used to increase the detection accuracy and at the same time, reduce the extent of manual log data analysis.

The paper has also addressed several challenges which need to be addressed in the design of insider threat detection system. A lot of computing resources are required to process a lot of information. Furthermore, the integrity of the data has a negative impact on the performance of detection software, as well as the absence or noise of the data. A particularly challenging task is differentiation between legitimate unusual

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activities of employees and malicious actions. Workers have legitimate and unusual activities in which they can participate, making it difficult to determine just what they are doing.

Even though there are these drawbacks, there are also a number of advantages of insider threat detection systems as compared to conventional security systems. First, these systems can help implement proactive monitoring, and make real-time threat detection, and security management overall, more efficient. Log analysis helps companies to learn more about users' behavior patterns and detect covert attacks that are not possible to spot using conventional security tools. These systems can be greatly enhanced by the use of machine learning and artificial intelligence technologies.

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