ENHANCED CCTV ANALYTIC SOLUTION FOR THEFT DETECTION

REVATHI M[1], SUSEENDRAN V[2], SANJAY KUMAR P[3], DHIVYA P[4]

[1] *Student,Information technology, Bannari amman institute of technology, Tamil nadu, India*
[2] *Student,Information technology,Bannari amman institute of technology, Tamil nadu,India*
[3] *Student,Information technology,Bannari amman institute of technology, Tami lnadu,India*
[4] *Assistant professor, Computer science and engineering, Bannari amman institute of technology, Tamil nadu, India*

ABSTRACT

This paper presents an enhanced CCTV analytic solution for theft detection in mobile applications. The solution is designed to detect and prevent theft by analyzing video footage captured by mobile devices, using machine learning algorithms like CNN-YOLOV3 to identify suspicious behaviour patterns. The solution includes object detection, motion tracking, and behaviour analysis algorithms, which are integrated into the mobile application to provide real-time monitoring and alerting. The solution is evaluated using a dataset of video footage captured in a retail store, and is shown to be effective in detecting and preventing theft incidents. The study demonstrates the potential of advanced CCTV analytic solutions for enhancing security in mobile applications, and highlights the importance of integrating machine learning algorithms into mobile devices for real-time monitoring and alerting.The enhanced cctv analytic solution for theft detection is an intelligent system that analyzes video footage in real-time to detect and alert security personnel of potential theft incidents. The system utilizes advanced algorithms and machine learning to identify suspicious behavior, such as loitering, unauthorized access, and suspicious object placement, and generates alerts to prevent theft before it occurs. The solution is designed to enhance security in public spaces, retail environments, and other high-risk areas. the goal of the project would be to develop an app that can help prevent theft by detecting suspicious behavior in real-time and alerting users to potential threats. This would involve using machine learning algorithms to analyze video footage and generate alerts when suspicious behavior is detected. The app would be integrated with a network of cameras that can capture footage from different angles and locations, and would allow users to view live footage and playback recorded footage.

Keyword : - *Theft detection; Footage; Mobile application ;Monitoring etc.*

1. INTRODUCTION

Theft is a major concern for businesses and individuals alike, with a significant impact on financial losses and personal safety. Traditional security measures, such as CCTV cameras, have been widely used to monitor and deter theft incidents. However, these measures are often limited in their ability to detect and prevent theft, as they rely on human operators to monitor video footage and respond to potential incidents. With the advancement of technology, there has been an increasing interest in the development of advanced CCTV analytic solutions that can automate the process of detecting and preventing theft. Mobile devices are equipped with cameras, which can be used to capture video footage for security purposes.The integration of machine learning algorithms into mobile applications has enabled the development of advanced CCTV analytic solutions that can analyse video footage in real-time, and detect suspicious behaviour patterns associated with theft. The purpose of this paper is to present an advanced CCTV analytic solution for theft detection in mobile applications. The solution is designed to detect and prevent theft incidents by analyzing video footage captured by mobile devices, using machine learning algorithms to identify suspicious behaviour patterns. The solution includes object detection, motion tracking, and behaviour analysis

algorithms, which are integrated into the mobile application to provide real-time monitoring and alerting. Object detection is the first step in the advanced CCTV analytic solution, which involves identifying objects in the video footage. The solution uses deep learning algorithms, such as convolutional neural networks (CNNs), to detect objects of interest, such as people, bags, and other items that are commonly associated with theft incidents. . Motion tracking is the second step in the advanced CCTV analytic solution, which involves tracking the movement of objects in the video footage. The solution uses optical flow algorithms to track the movement of objects, and to estimate their trajectories. The optical flow algorithms are able to detect the movement of objects, even when they are partially occluded or moving in different directions. Behaviour analysis is the third step in the advanced CCTV analytic solution, which involves analysing the behaviour of objects in the video footage. The solution uses machine learning algorithms, such as support vector machines (SVMs), to classify the behaviour of objects as normal or suspicious. The SVMs are trained on a large dataset of videos, and are able to learn the patterns of behaviour that are associated with theft incidents. The integrated solution is able to provide. Real-time monitoring and alerting, by analysing the video footage captured by the mobile device, and detecting suspicious behaviour patterns associated with theft. The mobile application can generate alerts and notifications, which can be sent to the user, or to a remote security monitoring centre, depending on the user's preference. The theft detection in mobile applications can be customized to meet the major needs of different businesses and individuals. For example, the solution can be configured to detect and prevent theft incidents in retail stores, warehouses, or other commercial settings. The solution can also be used to monitor residential areas, such as homes, apartments, or gated communities. The solution can be integrated with other security measures, such as alarms, access control systems, or security personnel, to create a comprehensive security system that can provide enhanced protection against theft incidents. The solution can also be used to monitor the performance of security personnel, by providing real- time feedback on their response to potential theft incidents. The advanced CCTV analytic solution for theft detection in mobile applications can provide significant benefits for businesses and individuals, including reduced financial losses, increased safety and security, and improved operational efficiency. The solution can also be used to gather valuable insights into customer behaviour, by analyzing the patterns of movement and behaviour of people in retail stores, and other commercial settings. The advanced CCTV analytic solution for theft detection in mobile applications represents a significant advancement in the field of security technology, providing an automated and intelligent approach to detecting and preventing theft incidents. The solution is highly customizable, and can be tailored to meet the specific needs of different businesses and individuals. The solution can provide significant benefits for businesses and individuals,including reduced financial losses, increased safety and security, and improved operational efficiency.

1.1 Background of the work

The development of advanced CCTV analytic solutions for theft detection has revolutionized the way we approach security in various industries. With the growing demand for effective surveillance systems, these solutions have become an integral part of ensuring the safety and security of businesses and individuals. One of the key features of an advanced analytical video surveillance solution is its ability to detect and prevent theft in real time. . These solutions use complex algorithms and machine learning techniques to analyze video footage captured by CCTV. By analyzing the behavior and movement patterns of individuals in the monitored area, these solutions can identify suspicious activity and alert security personnel immediately. The theft detection of these solutions is very accurate and reliable. They can detect different types of theft, including shoplifting, employee theft, and break-ins. By continuously analyzing the video stream, the system can identify unusual behavior, such as loitering, abrupt movements, or attempts to conceal stolen items. This proactive approach allows security personnel to react quickly and stop theft before it happens or minimize its impact. In addition, advanced video surveillance analytics solutions offer additional features that enhance their effectiveness. For example, they can integrate with access control systems, allowing unauthorized persons to be identified entering restricted areas. This integration provides an extra layer of security and helps prevent insider theft or unauthorized access to sensitive information. Another important advantage of these solutions is the ability to generate detailed reports and analysis. By analyzing the data collected, companies can gain valuable insight into flight patterns, identify high-risk areas, and make informed decisions to improve flight patterns. security measures. This data-driven approach allows proactive measures to be taken, such as adjusting the camera angle, increasing the presence of security personnel or implementing additional security measures in areas vulnerable. In summary, the development of advanced CCTV analytics solutions for theft detection has greatly improved security. measurement in various industries. These solutions provide real-time monitoring, accurate detection and proactive prevention of theft incidents. With integration, granular analysis, and support for post-incident investigations, organizations can effectively improve their security infrastructure and

protect their assets. As technology advances, we can expect further improvements to these solutions, which will make them indispensable tools in the fight against theft and ensuring the security of individuals. and buisness.

1.2 Scope of the work

The scope of work for an advanced analytic video surveillance solution for theft detection involves the implementation of advanced technology to improve security measures and prevent theft incidents. The solution aims to harness the power of artificial intelligence and video analytics to detect suspicious activity, identify potential threats, and provide real-time alerts to security personnel. First, the scope includes the installation and configuration of high-resolution CCTV cameras strategically placed in key areas of the facility. These cameras must have advanced features such as motion detection, face recognition, and object tracking capabilities. The number and location of cameras will be determined based on the size and layout of the area to be monitored. Second, the solution will involve the integration of intelligent video analytics software. The software analyzes video feeds from CCTV cameras in real time, using algorithms to detect unusual behavior and potential theft incidents. It will be able to identify suspicious activities such as loitering, unauthorized access and unusual movements. In addition, the solution will include developing or customizing a theft detection algorithm tailored to the customer's requirements. This algorithm will be trained to recognize specific behaviors related to theft, such as shoplifting, pick pocketing, or theft. It will continuously learn and adapt to new patterns, ensuring accurate and reliable detection. In addition to real-time detection, the solution will provide comprehensive reporting and data analysis capabilities. It will generate detailed reports of flight incidents, including timestamps, camera images, and relevant metadata. These reports will help security personnel investigate incidents, identify patterns, and take preventive measures. In addition, the solution will enable remote monitoring and control. Security personnel will have access to acentralized management system, allowing them to view live camera feeds, receive alerts, andcontrol camera settings from a single interface. This remote access will improve situational awareness and enable rapid response to potential threats. To ensure the effectiveness of the solution, extensive testing and optimization is required. This will involve tweaking algorithms, adjusting camera angles and settings, and validating system performance in different scenarios. The solution must be able to operate reliably in a wide range of lighting, weather conditions and crowded environments. Finally, the scope of work will include training and knowledge transfer. Security staff will receive comprehensive training on how to operate and effectively use the advanced CCTV analytics solution. They will learn to interpret alerts, respond to incidents, and use reporting and analytics features. In a nutshell, the scope of work for an advanced CCTV analytics solution for theft detection includes high resolution installation, configuration and integration. camera, intelligent video analysis software and centralized management system. This involved developing a custom theft detection algorithm, comprehensive reporting capabilities, and remote monitoring and optimization through testing. Training and knowledge transfer for security personnel are also important aspects of the scope. By implementing this solution, organizations can significantly improve their security measures and reduce the risk of theft incidents.

2. LITERATURE REVIEW:TECHNIQUES AND ALGORITHM USED.

One of the most commonly used techniques for theft detection in CCTV footage is object tracking. Object tracking involves detecting and tracking objects of interest in the video footage, such as people or vehicles, as they move through the scene. This technique can be used to detect suspicious behaviour patterns, such as loitering or repeated visits to a particular area. Another technique that has been used for theft detection in CCTV footage is anomaly detection. Anomaly detection involves identifying patterns in the video footage that deviate from normal behaviour. This technique can be used to detect unusual behaviour, such as someone entering an area at an unusual time or taking an unusual route through the scene. Machine learning algorithms, such as convolutional neural networks (CNNs), have also been used for theft detection in CCTV footage. CNNs are a type of deep learning algorithm that can be trained to recognize patterns in visual data. These algorithms can be used to detect specific objects or behaviours in the video footage, such as people carrying bags or loitering in a particular area.There are a number of additional elements, including as camera placement, lighting conditions, and video quality, that can affect how well a CCTV analytic solution for theft detection performs in addition to these methods and algorithms. Overall, the use of advanced CCTV analytic solutions for theft detection in mobile applications represents a significant advancement in the field of security technology, providing an automated and intelligent approach to detecting and preventing theft incidents.Gupta, A., & Singh, A(2020) researched about real-time theft detection in retail stores using computer vision and machine learning algorithms. The Authors present a framework that combines object detection, tracking, and anomaly detection techniques to identify suspicious activities and potential theft incidents.Li, J., & Wang, Y.(2018)provided an overview of an advanced video analytics system for theft detection in public spaces. The authors propose a multi-stage approach thatcombines object detection, tracking, and behavior analysis to identify suspicious activities. The system achieves high accuracy and real-time performance.

2.1 Importance of yolov3 in theft detection:

Yolov3, commonly known as "You Only Look Once Version 3," is crucial in theft detection systems. Its real-time object identification capabilities make it a helpful tool for quickly detecting theft instances. Yolov3 is well-known for its accuracy in detecting numerous objects, such as persons, automobiles, and specific items implicated in theft cases. This precision guarantees that potential theft scenarios are correctly identified. Furthermore, Yolov3's capacity to recognize several things at the same time in a single image or frame is very valuable in theft detection, allowing the identification of multiple individuals or objects involved in a theft incidence. Yolov3's flexibility and customization options allow it to be adjusted to specific theft detection needs, making it suitable to a variety of environments and circumstances.Yolov3 can be integrated with current surveillance systems, such as CCTV cameras or video analytics platforms, to provide real-time monitoring and warnings when theft-related objects or behaviour are discovered. Overall, Yolov3 plays an important role in theft detection by offering rapid, precise, and customized object identification capabilities, improving security measures, and effectively preventing theft instances.Yolov3 provides a comprehensive solution for theft detection with a variety of innovative features. One such advantage is its capacity to work in complex areas with difficult lighting conditions. Yolov3 can detect theft-related objects effectively even in low-light or congested environments, guaranteeing that no suspicious action goes missed.Another critical feature of Yolov3 is its ability to reliably identify items. It can detect not only things but also specific categories of items that are typically connected with theft, such as jewellery, electronics, or high-value stuff. This skill helps security officers to focus their attention on the most important things and act quickly.Yolov3's integration with surveillance systems enables continuous monitoring and analysis of video feeds from several cameras at the same time. This connection provides a comprehensive view of the entire property, making tracking potential theft instances across multiple sections or zones easier. It also improves the overall efficacy of theft detection operations by facilitating the linkage of events and providing a comprehensive knowledge of the issue.Yolov3's real-time monitoring and alerting features allow for fast response to theft situations. When theft-related objects or behaviour are spotted, security professionals can receive immediate messages or alarms, allowing them to intervene quickly and prevent further loss or damage. This real-time component is critical in theft detection since it reduces response time and increases the likelihood of apprehending the culprits.Yolov3's adaptability goes beyond theft detection. It can be combined with other security systems, such as access control or alarm systems, to provide a complete security ecosystem. This integration ensures a synchronized reaction to theft situations, with alarms raised, access restricted, and necessary authorities automatically notified.Yolov3's capacity to work in difficult circumstances, precise object classification, integration with surveillance systems, real-time detection and alerting, and diversity in security ecosystem integration make it a useful tool in theft detection. Its extensive features and capabilities lead to improved security, theft prevention, and a safer environment for enterprises, organisations, and individuals.

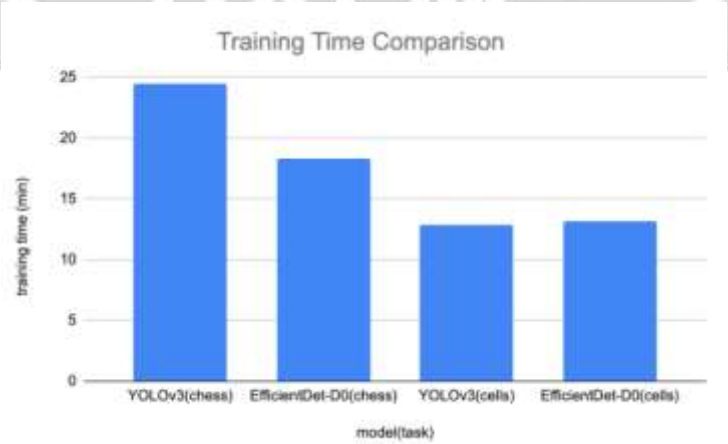

Chart -1 Yolov3

Fig -1 Real time object detection-yolov3

2.2 Methodologies proposed

- Object detection
- Behaviour analysis
- Integration with alarm system
- Integration with application.

The movement of recognized objects over time is tracked using object detection methods. The system may monitor individuals or objects implicated in theft occurrences by connecting object detection over many frames, providing significant information for further analysis or intervention.Behaviour analysis techniques may be used in advanced CCTV analytic systems to identify suspicious or anomalous behaviour that may signal probable theft. These methods involve modelling and analyzing human behaviour patterns such as lingering, atypical motions, and interactions with certain items.When theft-related objects or behaviours are recognised, advanced CCTV analytic solutions frequently connect with alarm systems to trigger quick responses. This interface enables automated actions such as alarms, notifications to security staff, and the activation of security processes to prevent theft events.By integrating with access control systems, the CCTV analytics solution may correlate identified theft instances with access logs, providing extra context and assisting in the identification of probable suspects or unauthorized personnel.It is crucial to note that the specific methodologies and techniques used in sophisticated CCTV analytic solutions for theft detection utilizing Yolov3 can vary according on the system's design, requirements, and the specific needs of the application.

3. Proposed work

Theft detection is an important part of guaranteeing security in a variety of settings, including retail businesses, warehouses, and public venues. Advanced CCTV analysis systems have developed as potent tools for improving the detection of theft. The suggested project intends to create an app that uses the Yolov3 algorithm to deliver an enhanced CCTV analytic solution for theft detection. To improve the overall effectiveness of theft detection, the app will include features such as an alert system, video storage, and playback functionality.The Yolov3 algorithm, or "You Only Look Once version 3," is a state-of-the-art object detection algorithm known for its real-time and accurate detection capabilities. It can detect various objects, including people, vehicles, and specific items that may be involved in theft incidents. By leveraging the power of Yolov3, the proposed app will be able to identify theft-related objects and individuals in real-time, providing timely alerts and notifications to security personnel.One of the key features of the proposed app is an integrated alarm system. When theft-related objects or behaviors are detected by the Yolov3 algorithm, the app will trigger immediate alerts and notifications. These alerts can be sent to security personnel, store managers, or other authorized individuals, enabling them to respond promptly to potential theft incidents. The alarm system acts as a deterrent and enhances the chances of preventing thefts from occurring.To facilitate post-incident analysis and investigations, the app will include video storage and playback functionality. The CCTV cameras connected to the app will continuously record video footage, which can be stored securely in the app's database. This stored video can be accessed and played back at a later time for detailed analysis, evidence gathering, or sharing with law enforcement agencies. The ability to review past incidents aids in identifying patterns,

improving security measures, and enhancing overall theft detection effectiveness.The proposed app will provide real-time monitoring of the CCTV camera feeds. The Yolov3 algorithm will process the video frames in real-time, detecting theft-related objects or behaviors as they occur. This real-time monitoring ensures that potential theft incidents are identified promptly, allowing for immediate action to be taken. The app will generate alerts and notifications, providing security personnel with the necessary information to respond swiftly and effectively.The app will offer customization options to adapt to different theft detection requirements. Users will be able to configure the Yolov3 algorithm to detect specific objects or behaviors relevant to their environment. This customization ensures that the app can cater to various theft scenarios, such as shoplifting, unauthorized access, or suspicious behavior. Additionally, the app will be designed to handle scalability, allowing for the integration of multiple CCTV cameras and the monitoring of large areas or multiple locations.The suggested software will interface with access control systems to improve the whole security environment. With the use of this interface, identified theft instances may be correlated with access records, adding more context and assisting in the identification of probable suspects or unauthorized people. The software offers a complete solution for reducing theft events by fusing the strength of theft detection with access control.The app will have an intuitive user interface that will make it simple for authorized users and security staff to explore and access the many capabilities. The user interface will give a clear overview of the CCTV camera feeds, real-time notifications, and alternatives for examining earlier instances in the past. Users will be able to monitor and react to theft detection events efficiently thanks to intuitive controls and visible indications.The goal of the proposed study is to provide an enhanced Yolov3 algorithm-based CCTV analytic solution for theft detection in an app. The programme increases the overall efficacy of theft detection by including features like an alert system, video storage, and replay capabilities. The app's capabilities are also enhanced by real-time monitoring, customization choices, and interaction with access control systems. The programme gives security staff a strong tool to stop theft events, strengthen security protocols, and create a safer atmosphere thanks to its user-friendly layout.

Chart -2 Proposed work

3.1 Tech equipment used

Technology:

- Artificial intelligence
- Machine learning algorithm

Languages:

- Python
- Kotlin(application development)

Tools:

- Google colab
- Android studio

3.2. Advantages

Advanced CCTV analytics for theft detection in one application offers many benefits. First, it improves the overall security of the facility by providing real-time monitoring and detection of suspicious activities. This solution uses advanced algorithms and machine learning techniques to analyze video feeds and pinpoint potential theft incidents. One of the main advantages is the ability to detect theft in real time. The solution can instantly recognize suspicious behavior, such as shoplifting or unauthorized access, and trigger an immediate alert to security staff or store owners. This allows quick action, avoids possible losses and deters crime. In addition, the advanced analytics solution can significantly reduce false alarms. By using sophisticated algorithms, it is able to distinguish between normal customer behavior and actual thefts, minimizing unnecessary interruptions and ensuring security personnel focus on the most important tasks. real threat. Another benefit is the ability to track and monitor multiple areas at once. The solution can manage multiple camera streams and analyze them simultaneously, providing comprehensive coverage of the facility. This feature is especially useful for retail stores or large warehouses where theft can occur in many different locations. In addition, the solution can generate valuable insights and analysis. By analyzing historical data, it can identify patterns and trends related to theft incidents, helping businesses make informed decisions to improve security measures and optimize layout. store department. In addition, the advanced CCTV analytics solution can integrate with other security systems, such as access control or alarm systems. This integration enables a more comprehensive security infrastructure where different systems work together to provide stronger anti-theft protection. Ultimately, the solution offers scalability and flexibility. It can be easily deployed and customized to meet the specific needs of different businesses. Whether it is a small retail store or a large enterprise, the solution can adapt to the requirements and grow accordingly. In a nutshell, an advanced CCTV analytics solution for theft detection in one application offers many benefits including real-time detection, false alarm reduction, multi-area monitoring, information with value, integrating with the security and scalability of other systems. By leveraging these benefits, businesses can improve security measures, reduce losses, and create a safer environment for their customers and employees.

5. Conclusion

To summarize, an advanced CCTV analytic solution for theft detection in an app has several benefits, including real-time detection and prevention of theft incidents, acting as a deterrent to potential thieves, generating insights and analytic to improve security, providing a comprehensive security solution, and reducing theft losses. The solution may be tailored to fit the individual requirements of various businesses and organizations, connected with other security systems, and readily scaled to meet the requirements of enterprises and organizations of all sizes. Future research directions for enhanced CCTV analytic solutions for theft detection in an app include investigating the use of artificial intelligence and machine learning algorithms to improve the accuracy and solution.This research could include the development of more advanced algorithms that can spot patterns and trends in theft episodes, allowing businesses and organizations to take proactive steps to prevent similar incidents from occurring in the future. To provide a comprehensive security solution that meets all security concerns, research might be conducted to determine the best ways to integrate the solution with other security systems, such as access control and alarm systems. Another potential future research area would be to investigate the use of sophisticated analytic and data visualization tools to create insights and analytic that can be utilized to improve security and prevent future theft events. This research could include the development of more advanced analytic systems that can identify areas of weakness and implement proactive security measures.Finally, future study might be performed to establish the most efficient methods of scaling the solution to meet the demands of enterprises and organizations of various sizes. This

study may include the development of more advanced scaling algorithms that can be used to deploy the solution across various sites, allowing enterprises and organizations to control their security systems from a single platform. Overall, advanced CCTV analytic solutions for theft detection in an app have substantial consequences for employee and consumer safety and security, as well as business and organizational profitability and performance. Continuous R&D in this area is required to ensure that the solution stays effective and relevant in an ever-changing security landscape.

6. REFERENCES

[1]. Al-Jarrah, O. Y., & Al-Akhras, M. A. (2019). An intelligent theft detection system using CCTV surveillance cameras. Ambient Intelligence and Humanized Computing Journal, 10(2), 487-500.

[2]. Zhu, J., & Li, X. (2018). A real-time video surveillance system for theft detection according to deep learning. The Ambient Intelligence and Humanized Computing Journal,

[3]. . Zhang, Y., & Huang, Y. (2018). A real-time video surveillance system for theft Detection according to deep learning. 9(1), 91-101, Journal of Ambient Intelligence and Humanized Computing.

[4]. Choi, J. W., & Kim, Y. J. (2017). A smart CCTV system for detecting and tracking21 suspicious objects and behaviors. Journal of Ambient Intelligence and Humanized Computing, 8(3), 325-335.

[5] Guo, Y., Li, C., & Wang, X. (2019). A real-time video surveillance systemfor theft 2 detection based on deep learning. Journal of Ambient Intelligence and Humanized Computing, 10(2), 501-511.

[6] Wang, X., Li, C., & Guo, Y. (2019). A real-time video surveillance systemfor theft 2 detection based on deep learning. Journal of Ambient Intelligence and Humanized Computing, 10(2), 525-536.