IOSR Journal of Computer Engineering (IOSR-JCE)
e-ISSN: 2278-0661,p-ISSN: 2278-8727, Volume 25, Issue 4, Ser. I (July. – August. 2023), PP 46-50
www.iosrjournals.org

Automated Smart Surveillance and Guidance for the Campuses

Prof. Sabyasachi Chakraborty(Guide)
Assistant Professor, Department of CSE-AI&ML), School of Engineering, Malla Reddy University
&
PhD Scholar(CSE-ML& DL), C.V Raman Global University, Bhubaneshwar, Odisha

V. Prabhas-Student, B.Tech(CSE-AI&ML, MRUH)
Ch. Prathamesh Student, B.Tech(CSE-AI&ML, MRUH)
A. Prathyusha Reddy Student, B.Tech(CSE-AI&ML, MRUH)
G. Pravallika Student, B.Tech(CSE-AI&ML, MRUH)
K. Pravallika Student, B.Tech(CSE-AI&ML, MRUH)
G. Preetham Reddy Student, B.Tech(CSE-AI&ML, MRUH)

ABSTRACT
The Smart Campus Surveillance-BasedGuidance System is a project designed to enhance the security and guidance of students on university campuses using advanced surveillance technologies. Our system employsa combination of smart technologies and physical infrastructure to provide improved services, decision-making, and sustainability.Our project aims to address the problem ofstudents wandering around the campus, getting lost, and missing classes, which can lead toacademic and social problems. The system monitors students' movements and guides themto their respective classrooms using a real-time guidance system. The front-end and back-end of the system are designed using Python programming language and two frameworks: Django or Tkinter. The choice of the framework depends on the complexity of the project and the preferred interface design. The system's database is managed using SQLlite, which provides fast and reliable storage of data.The project's front-end interface is designed to be user-friendly and responsive, with a focus on ease of use and accessibility. The back-end of the system is responsible for data storage, processing, and analysis, and it provides a robust and scalable platform for managing the surveillance data.

Date of Submission: 27-07-2023 Date of Acceptance: 07-08-2023

I. Introduction

Introduction about this project Automated Smart Surveillance and Guidance System for the campuses. Automated Smart Surveillance and Guidance System for campuses is a project that aims to improve campus safety and security by leveragingadvanced technology to monitor and detect potential threats. This system includes a network of cameras, sensors, and artificial intelligence algorithms that work together to detect suspicious activity and alert security personnel. The system also includes a guidancefeature that can assist students and staff in navigating the campus and finding their way around. This feature can help users locate specific buildings, rooms, and facilities, andprovide them with real-time information about their surroundings.

The system is designed to be fully automated, minimizing the need for human intervention, and reducing the risk of errors or false alarms. With this system, campuses can improve their security and safety measures while providing a more convenient and userfriendly experience for their students and staff.

II. Literature Survey

The literature review highlights the growing importance of smart surveillance and guidance systems for campuses. These systems offer enhanced security, efficient navigation, and personalized experiences for students, faculty, and staff. While there are challenges to address, the integration of advanced technologies in campus environments holds great potential for creating safe and smart learning environments. Future research should focus on addressing privacy concerns, optimizing system performance, and evaluatingthe long-term impact of these systems on campus communities.

III. Problem Statement

Smart security systems have notableadvantages over regular security systems.

Using a smart security system in universities allows educational institutions to combine smart technologies with physical infrastructurefor improvedservices, decision-making, campus sustainability etc.

Our project, Smart Campus Surveillance-Based Guidance System, is designed to help universities have an access to an advanced surveillance system to guidestudents to their classes accordingly.

It will help in monitoring students wandering in and around the campus and assist them in their respective classrooms.

In this project, the front end includes Html,CSS, and JavaScript and the back end includes Python. The database used is MySQL. The framework used is Django.

IV. Required Tools

Implementing a smart surveillance and guidance system for a campus typically requires a combination of hardware and software tools. Here are some essential tools commonly used in such systems:

Surveillance Cameras: High-resolution IP cameras with features like pan,tilt, zoom, and night vision capabilities. Dome cameras, bullet cameras, and PTZ (pan-tilt- zoom) cameras are commonly used for comprehensive surveillance coverage.

Sensors: Various sensors can be employed depending on specific needs, such asmotion sensors, door/window sensors, glass-break sensors, and environmental sensors (temperature, humidity, etc.). These sensors help detect and alert for specific events or conditions.

Network Infrastructure: Switches, routers, and cabling are necessary to establish a reliable network infrastructure for data transmission between cameras, sensors, storagedevices, and monitoring stations. Wireless access points may also be used for wireless camera connectivity.

Storage System: A centralized storagesystem is required to securely store the surveillance footage and other data. This canbe achieved through network-attached storage (NAS) devices, on-premises servers, or cloudbased storage solutions.

Video Management Software (VMS): VMS software provides a centralized interface for managing and monitoring the surveillance cameras. It allows security personnel to view live feeds, playback recorded footage, and manage camera settings. VMS often includes features like video analytics, motion detection, and event triggering.

Video Analytics Software: Advanced video analytics software utilizes artificial intelligence and computer vision algorithms to extract meaningful insights from surveillance footage.
It can perform functions such as facial recognition, object detection, crowdmonitoring, and abnormal behavior detection.

Guidance System Tools: For the guidance system, tools may include digital signage displays, interactive kiosks, mobile applications, and mapping software. These tools are used to provide real-time information,directions, and announcements to individuals on the campus.

Access Control System: Access control tools ensure authorized personnel have secure access to sensitive areas. These tools may include ID card readers, biometric scanners (fingerprint, iris, etc.), electronic locks, and access control management software.

Monitoring Station: A centralized monitoring station equipped with video display walls, monitors, and control consoles allows security personnel to monitor live camera feeds,respond to alerts, and manage the overall system.

Power Backup Systems: To ensure uninterrupted operation, backup power systems like uninterruptible power supply (UPS) units or generators should be in place to providepower during outages.

It's important to note that the specific tools and equipment required may vary based on the campus's size, layout, and security requirements. Consulting with security system integrators or professionals can help identify the most suitable tools for a particular campus environment.

V. Methodology

The Automated Smart Surveillance and Guidance System for campuses would rely onvarious methods and technologies to functioneffectively. Some of the key methods used bythe system might include:

Computer vision: The system's cameras would capture video and image data, whichwould be processed using computer vision algorithms to detect potential threats and suspicious activity. These algorithms might include object detection and recognition, facial recognition, and anomaly detection.

Machine learning: The system's algorithms would be trained using machine learning techniques to improve their accuracy and effectiveness over time. This might include supervised learning, unsupervised learning, and reinforcement learning.

Natural language processing: The guidance feature of the system would rely on natural language processing techniques to understand user queries and provide relevant information in real-time.

Sensor integration: The system would integrate data from various types of sensors, including motion sensors, temperature sensors, and sound sensors, to detect potential threats and monitor for unusual activity.

Cloud computing: The system would leverage cloud computing technology to process and analyze large amounts of data in real-time, allowing for faster and more accuratethreat detection and guidance information.

Multi Camera TrackingOptimization

$$W_{i,j} = O_{i,j}(aP_j + bS_{i,j})$$

In the formula, the variable $W_{i,j}$ represents the weight of the target j in the field of views of the camera i . The variables $O_{i,j}$ represent the occlusion state of the target j in the field of view of the camera i . The variable P_j represents the tracking priority manually assigned to the target j .The variables $S_{i,j}$ represent the divided image size of the target j in the field of view of the camera i . The

variables a and b represent the weightparameters of the target tracking priority andthe size of the segmented image in thecalculation of the weight function, and are dynamically adjusted according to the highest priority and the resolution of the video frame.If the target j in the view field i of the camera is in the occlusion state, the variable $O_{i,j}$ is 0.1, otherwise it is 1.

The tracking optimization algorithm is used to optimize the process of optimizing the camera in tracking an object in multi cameraenvironment. It determines the best camera for an object detection based on the weight factor. The steps of the tracking optimization algorithm POSRCA are as follows:

For the target j that needs to be assigned a camera, the central server calculates the weight function value $W_{i,j}$ $(i \in Q)$ of the target in the field of view of camera i , Q represents the set of all cameras that can see the target j .

Finding the maximum weight function

1) value W= max W of target j , assign target j to camer m for tracking, and update the camera tracking information stored in the central server database.
2) If there are N targets being tracked by camera m, in order to dynamically balance the tracking load and computing resources ofthe camera, the lowest priority trackingtarget in camera m is redistributed among the remaining cameras according to the abovesteps. While the system aims to be fully automated, human oversight would still be necessary to respond to potential threats or technical issues. This might include security personnel who are alerted by the system's alerts and can take appropriate action.

After assigning the best camera to the target for tracking, the remaining cameras that can see the target will not track it. The following situations will trigger the central server to execute the above optimization algorithm on a target:

A. Automatically refresh the weight function value of each tracked target in all visible cameras every certain time, and reassign the best camera to all targets.
B. The new target enters the surveillance field of view of the camera.
C. The target disappears from the assigned camera fieldof view.
D. The target appears blocked in the assigned camera.
E. Manually start the optimization algorithm to reassign cameras to a certain target.

In order to measure the tracking effect of the tracking optimization algorithm POSRCA in the entire

monitoring system in real time, the system introduced a function POTto quantitatively describe the performance of the tracking system.
The function POT is defined as:

$$P_{all} = POT(C_1, C_2, ..., C_r; Q_1, Q_2, ..., Q_m)$$

$$= \sum_{i=1}^{n} \sum_{j \in \Theta_I} POT(C_i; Q_j) = \sum_{i=1}^{n} \sum_{j \in \Theta_i} W_{i,j}$$

The variable Θ_I represent the set of all targets assigned to the camera i for tracking.

1.Optimization of Monitoring using Bayesian Rule

$$\Pr(A \mid B) = \frac{\Pr(B \mid A)\Pr(A)}{\Pr(B)} \quad \alpha\ L(B \mid A)\Pr(A)$$

Where A is the surveillance events we need to detect, B represents the known conditions as the underlying features that we can observe. Based on a large number of observations of objects, we can get more accurate $\Pr(A \mid B)$.
This number can largely help the system to predict the events that will happen by knowing the underlying features.
However, in order to arrive at an accurate prior probability $\Pr(A \mid B)$, it often requires a large amount of statistical data, which is inefficient in actual execution.
Therefore, using Bayes' rule we can transform the problem of calculating the prior probability into the problem of obtaining the posterior probability $\Pr(B \mid A)$. Since the number of occurrences of A events will be much less than the number of occurrences of B observations, it is relatively easy to obtain the posterior probability, so that the required prior probability can be calculated more easily.

Overall, the Automated Smart Surveillance andGuidance System for campuses would rely on a combination of advanced technologies and human oversight to ensure campus safety and provide a convenient and user-friendly experience for students and staff.

Fig.1: BASIC METHODOLOGY FOR SMART SURVEILLANCE

VI. Architecture

The architecture of a smart surveillance and guidance system for a campus typically involves multiple components working together to achieveeffective monitoring, data processing, and guidance capabilities. It's important to note that the architecture may be customized based on specific campus requirements, such as the number of surveillance points, the size of the campus, and the desired functionalities. Working with security system integrators or professionals can help tailor the architecture to meet the unique needs of the campus**.**

Fig.2: BASIC ARCHITECTURE

VII. Conclusion

An Automated SmartSurveillance and Guidance System for campuses is a promising solution toenhance safety and security on campuses. This system utilizes advanced technologies such as Artificial Intelligence, MachineLearning, and Computer Vision to detect and identify potential threats and guide individuals to safety in emergency situations. Byimplementing this system, campuses can reduce response times, improve situational awareness, and prevent potential security incidents.Additionally, the system provides real-time monitoring and data analytics to campus security personnel, enabling them to make informed decisions and take necessary actions in a timely manner. Overall, the Automated SmartSurveillance and Guidance System for campuses is a valuable tool for enhancing safety and security on campuses, providing a saferenvironment for students, staff, and visitors.

VIII. Future Work

This system has a wide range ofuses in various fields, such as banking, forensic department, etc. The reason thissystem is quiet useful is due to the fact that it is highly compact and it provides face detection and an instant notification about the same through email. In addition to this face recognition can also be tried in future. Recognition is the main part of any securitysystem. Usually for a best recognition system, we require a well-trained database, which can provide the base for our recognition. So to obtain the database, first collect the images of the subject individual for the recognition. Once we obtain andtrain our system, we can provide face recognition.

References

[1] C.T. Yang, S.T. Chen, J.C. Liu, Et Al. "On Construction Of An Energy Monitoring Service Using Big Data Technology For The Smart Campus,"Cluster Computing,Vol.23, No.1, Pp.265-288, March, 2020.

[2] I. Yaqoob, I.A.T. Hashem, A. Ahmed, Et Al. "InternetOf Things Forensics: Recent Advances, Taxonomy, Requirements, And Open Challenges," FutureGeneration Computer Systems, Vol.92, Pp.265- 275, March, 2019.

[3] Y. Lin, J. Yang, Z. Lv, Et Al. "A Self-Assessment Stereo Capture Model Applicable To The Internet Of Things", Sensors, Vol.15, No.8, Pp. 20925-20944, 2015.

[4] J. Li, G. Feng, W. Wei, "Psotrack: A RFID-Based System For Random Moving Objects Tracking In Unconstrained Indoor Environment" IEEE Internet Of Things Journal, 2018, Vol.5, No.6, Pp.4632-4641.

[5] W. Wei W, M. Guizani M, S.H. Ahmed Et Al. "Guest Editorial: Special Section On Integration Of Big Data And Artificial Intelligence For Internet Of Things", IEEE Transactions On Industrial Informatics, Vol. 16, No.4, Pp.2562-2565, 2020.

[6] M. Noura, M. Atiquzzaman, M. Gaedke. "Interoperability In Internetof Things: Taxonomies And Open Challenges," Mobile Networks And Applications, Vol.24, No.3, Pp.796-809, July, 2019.