Smart Campus System for Finding lost Persons and Objects using Image Recognition

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Abstract:

A Smart Campus System for Locating Missing Persons and Items is proposed to address the challenges of manually monitoring large volumes of surveillance video in academic environments. Traditional methods rely heavily on human observation, which is time-consuming and prone to error. The proposed system leverages deep learning and computer vision techniques to automate the detection and identification process using a reference image. By extracting key features such as shape, color, texture, and patterns, the system compares these with features from live or recorded video feeds. Advanced object detection and face recognition models are employed to identify potential matches, which are then evaluated using similarity measures such as Euclidean distance or cosine similarity. Upon detecting a positive match, the system generates real-time alerts through an interactive user interface. This approach significantly enhances efficiency, reduces manual effort, and improves detection accuracy, making it a scalable, reliable, and effective solution for smart campuses and public safety applications.

Keywords— Smart Campus, Computer Vision, Deep Learning, Image Recognition, Object Detection, Surveillance Systems, Feature Extraction, Similarity Matching, Real-Time Monitoring

I. INTRODUCTION

The Smart Campus System for locating missing individuals and finding lost things was built to deal with the difficulties associated with surveilling so much video footage and keeping track of millions of pieces of data on a campus. Manually searching through video to find a missing individual or item can not only take forever to do but is also likely to make you tired and that fatigue could lead you to make even more mistakes because you have so much data continuously flooding the system.

To solve this problem, using both computer vision and deep learning techniques, the Smart Campus System will be able to automatically detect and identify missing individuals or items using a reference image by analyzing the shape, color and pattern of what may be a close match for a live situation or for previously processed video.

II. LITERATURE REVIEW

Improvements made within computer vision and deep learning have enhanced object detection, recognition, and tracking accuracy and efficiency in the area of surveillance. The actual extraction of relevant visual characteristics from an image can be done using convolution neural networks (CNN). Two very helpful models for rapidly detecting objects as images flow through a video stream are YOLO (You Only Look Once) and SSD (Single Shot Detector).

There are a number of pre-existing systems focused on facial recognition and tracking of objects that rely on pre-existing datasets, sometimes with labeled identities, to store and track objects. Various methods of feature matching and measures of similarity can be utilized to achieve identification of subject images. In many

situations, such as the previously mentioned positioning of the objects being tracked, there exists a requirement for prior information regarding the subject of interest as well as the existence of either a large amount of data collected at the time of training and/or by using manual labelling.

More recent studies have examined the efficacy of using image matching systems to identify people using only limited amounts of data, such as through the comparison of only one reference image. By using the new systems, the potential removal of the requirement for storing highly sensitive data while at the same time making data associated with a person available for an individual are possible. However, even in these situations where large quantities of data are available to the investigator, there continues to be a need for further exploration into how to best utilize current data and how to define better parameters for the tracking of subjects.

III. METHODOLOGY

The system uses a modular architecture, where the three main components are: (1) input acquisition,
(2) an analysis engine, and (3) output visualization.

Research Methodology

The proposed project utilizes the use of System- based Design as the main methodology for thedevelopment of an AI-based image recognition system that takes visual data and then uses the combination of Predefined Logic and Deep Learning Methods to analyze for similarities between a reference image and video footage collected from surveillance systems.

Data Sources

The main source of input data for this system will include reference images of people or objects and video images of people and objects collected by the campus surveillance system. The functionality of the system will be measured based upon accuracy of detection, efficiency of matching and response time to different conditions.

Technology Tools and Products

Programming Language: Python. Back-End Processing Through the Use of: Advanced Image Processing Techniques, Deep Learning Models, Libraries to include: OpenCV, NumPy and TensorFlow or PyTorch. The work space that is used to develop and create the system will be VS Code.

Functionality Walkthrough

The user will provide a reference image of a lost person or object for the system to analyze. The system will take the reference image and extract visual features. The video feeds will be processed and divided into frames to analyze. Any detected objects or faces will be compared to the reference image to find any matches. The identified matched will be indicated to the user. The final output of the processing will be presented to the user along with notification of the output.

Analysis techniques

The system uses features extracted from the image using the combination of:

IV. RESULTS AND DISCUSSION

The new system is capable of performing well in both image identification and visual analysis of cameras. The system can correctly recognize and locate lost individuals or items by using pictures of those individuals or items. The system will also greatly lower the amount of manual work needed to search for someone or something. As a consequence, users can find matches quickly and take appropriate action due to the real-time notification feature and clearly highlighted images.

Key Observations

The system accurately identifies people and objects from surveillance video. Identified and recognized match results provide a visual representation of the matching results by providing a highlighted box around the recognized person or object. The system also provides the capability of analyzing large amounts of video, decreasing the need for continuous manual monitoring.

Comparison with Existing Systems:

Comparison to Previous Methods: Compared to the conventional methods of manual surveillance, the new system provides various advantages that include: Automatic detection of people and objects, Shorter response periods Higher levels of accuracy when identifying targets, Real-time monitoring and instant notification capabilities.

System Performance Evaluation:

Feature	**Result**	**Observation**
Detection Accuracy	High	Identifies persons/objects correctly
Matching Efficiency	Moderate	Can be improved with advanced models
User Interaction	Good	Easy to use

The above results indicate that the combination of computer vision technology coupled with deep learning algorithms within surveillance systems drastically improves efficiency, accuracy and usability of the system with respect to locating a lost person or item.

V. CONCLUSION

The Smart Campus System developed in this study provides a means for efficiently locating lost persons and items using image recognition and computer vision. This study has demonstrated how the use of AI (artificial intelligence) and machine learning to analyze data from surveillance systems can reduce the level of manual effort required to search for lost individuals and items and improve the accuracy of detection as well as the time taken to respond.

In this study, we have shown that the use of real- time notifications, visual enhancements and automatic detection makes it easier for users to
quickly identify and act upon matches, which in turn improves the safety of the campus, as well as improving the operational efficiency of the entire campus.

The Smart Campus System is a viable and scalable solution for increasing safety and monitoring within large-scale environments such as college or university campuses.

Future Work :

Integration of AI models to enhance matching & detection precision. An innovative web-based interface for easy interactions & monitoring capabilities. Support for greater range of scenarios & objects in detection. Visualisation & tracking of lost items & people on a real-time basis for increased interactivity during monitoring.

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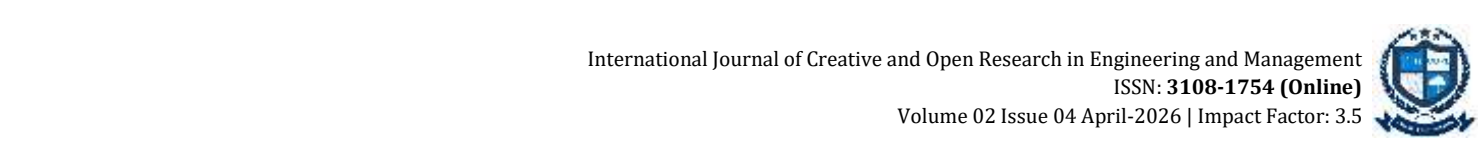
Surveillance dashboard Overview:

Reference Library Management:



New Scan Initialization screen:

Detection Results and Analysis output:

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