Graphic Era Hill University

Haldwani

BCA Project Report

For

Smart Surveillance Using Computer Vision

Submitted to Graphic Era Hill University, Haldwani for the partial fulfillment of the requirement for the Award of degree for

BACHELOR'S IN COMPUTER APPLICATIONS

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DECLARATION

I hereby declare that the work which is being present in this project report **"Smart Surveillance Using Computer Vision",** in partial fulfilment of the requirement for the Award of the degree of **BACHELOR'S IN COMPUTER APPLICATION,** submitted at **GRAPHIC ERA HILL UNIVERSITY, HALDWANI** is an authentic work done by me during period from 1st March 2023 to 1st June 2023.

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BONAFIDE CERTIFICATE

Certified that this project report **Smart Surveillance Using Computer Vision** is the Bonafede work of **Deepankar Sharma, Pawan Chandra and Amit Sati** who carried out the project work under my supervision.

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ABSTRACT

The development of a smart surveillance system has become an increasingly important topic in recent years, with the aim of providing more accurate and efficient monitoring of people and objects in real-time. This project focuses on developing a smart surveillance system that can be appended to existing surveillance systems, providing them with advanced features such as motion detection using contours and real-time people tracking using YOLOv3.

The proposed system uses computer vision algorithms to analyze the video feed from existing surveillance cameras, identifying areas of motion and tracking the movement of objects within those areas. To detect and track people specifically, the system uses object detection algorithms like YOLOv3, which is a deep learning-based model that can accurately detect and track objects in real-time.

To build this system, expertise in computer vision, machine learning, and software development is required. Additionally, access to large datasets of labeled video footage is necessary for training and testing the deep learning models, and powerful hardware is required to process the video feed in real-time.

The system has the potential to significantly improve surveillance systems by providing more accurate and efficient monitoring of people and objects in real-time. The motion detection feature using contours can reduce false alarms and improve the accuracy of the system, while the real-time people tracking feature using YOLOv3 can enable security personnel to monitor and track people of interest more effectively.

Overall, the proposed smart surveillance system has the potential to provide a significant improvement to existing surveillance systems, providing more accurate and efficient monitoring of people and objects in real-time, ultimately enhancing the security and safety of the monitored areas.

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SMART SURVEILLANCE

1. INTRODUCTION

The development of a smart surveillance system with advanced features such as motion detection using contours and real-time people tracking using YOLOv3 is presented in this project. The system uses computer vision algorithms to analyze the video feed from existing surveillance cameras, identifying areas of motion and tracking the movement of objects within those areas. To detect and track people specifically, the system uses object detection algorithms like YOLOv3. The project requires expertise in computer vision, machine learning, and software development, as well as access to large datasets of labeled video footage and powerful hardware to process the video feed in real-time. The system has the potential to improve surveillance systems by providing more accurate and efficient monitoring of people and objects in real-time.

1.1 PROJECT OVERVIEW:

The aim of this project is to develop a smart surveillance system that can be integrated with existing surveillance systems to provide advanced features like motion detection using contours and real-time people tracking using YOLOv3. The system uses computer vision algorithms to analyze the video feed from surveillance cameras and identify areas of motion, while object detection algorithms like YOLOv3 are used to detect and track people in real-time.

The project requires expertise in computer vision, machine learning, and software development. Large datasets of labeled video footage are needed to train and test the object detection and motion tracking algorithms. Powerful hardware is also required to process the video feed in real-time.

The smart surveillance system has several potential benefits, such as reducing false alarms and improving the accuracy of surveillance systems. It can also enable security personnel to monitor and track people of interest more effectively.

The project will involve conducting a system requirement analysis, system design, hardware and software requirements, and limitations of the smart surveillance system. Additionally, the project will require the development of a prototype smart surveillance system that can be demonstrated using sample video footage. The final outcome of this project is a functional smart surveillance system that can be integrated with existing surveillance systems, providing advanced features for real-time monitoring and tracking of people and objects.

1.2 PROJECT SCOPE:

The smart surveillance system developed in this project has a wide range of potential application areas, including:

Security and Surveillance: The system can be used to improve the effectiveness of security and surveillance operations in various locations, such as airports, malls, stadiums, and public transportation systems.

Traffic Monitoring: The system can be used to monitor traffic flow and detect any accidents or incidents that may occur on highways, streets, and other transportation networks.

Industrial Automation: The system can be used in industrial settings, such as factories and warehouses, to monitor production lines, detect faults, and ensure worker safety.

Healthcare: The system can be used in healthcare facilities, such as hospitals and nursing homes, to monitor patient movement and ensure their safety.

Retail Analytics: The system can be used in retail stores to analyze customer traffic and behavior, detect shoplifting, and improve store layout and product placement.

Smart Cities: The system can be used to improve the safety and security of public spaces, such as parks and streets, and monitor urban infrastructure, such as bridges and buildings.

In summary, the smart surveillance system developed in this project has a broad range of potential applications, from improving security and surveillance operations to enhancing traffic monitoring, industrial automation, healthcare, retail analytics, and smart city initiatives. The system has the potential to provide real-time tracking and analysis of people and objects, improving the accuracy and efficiency of monitoring operations in various settings.

2.System Requirement Analysis

2.1 Information Gathering

The Information Gathering process was an essential step in the development of the Smart Surveillance System. This process involved identifying the needs of stakeholders, understanding use cases, and determining the technical requirements for the system.

Stakeholder Identification

The first step in the Information Gathering process was to identify the stakeholders of the Smart Surveillance System. The stakeholders included:

- End-users of the system such as security personnel or law enforcement officials
- Owners or operators of the surveillance systems that were to be integrated with the Smart Surveillance System
- Developers or designers of the Smart Surveillance System
- Regulators or legal authorities responsible for overseeing surveillance operations

Use Case Analysis

Once the stakeholders were identified, the next step was to analyze the use cases of the Smart Surveillance System. Use cases included:

- Real-time monitoring of areas for security purposes
- Investigation of criminal activity using surveillance footage
- Traffic management and monitoring in public areas
- Industrial monitoring of machinery and equipment
- Environmental monitoring of wildlife or natural resources

Technical Requirements

The final step in the Information Gathering process was to determine the technical requirements for the Smart Surveillance System. These requirements included:

- Compatibility with different types of cameras and video management systems
- High accuracy and efficiency in motion detection and people tracking
- Low latency and high throughput for real-time monitoring and tracking
- Scalability for use in large-scale surveillance operations
- Security features to protect the privacy of monitored individuals

By completing the Information Gathering process, the requirements for the Smart Surveillance System were defined and documented in the Software Requirements Specification (SRS). This ensured that the system was developed to meet the needs of the stakeholders and was of high quality.

2.2 Feasiblity Study

The feasibility study for the Smart Surveillance System examines the technical, economic, and operational aspects of the project to determine its viability.

Technical Feasibility

The technical feasibility of the project refers to the ability of the system to perform its functions accurately and efficiently. Based on the information gathered during the Information Gathering process, the Smart Surveillance System is technically feasible. The use of advanced algorithms such as motion detection using contours and real-time people tracking using YOLOv3 provides high accuracy and efficiency in monitoring and tracking.

Economic Feasibility

The economic feasibility of the project involves determining the costs and benefits associated with the development and implementation of the Smart Surveillance System. The costs include hardware and software costs, development costs, and maintenance costs. The benefits include increased

security and safety, reduction in crime, and improved operational efficiency. Based on a cost-benefit analysis, the Smart Surveillance System is economically feasible.

Operational Feasibility

The operational feasibility of the project refers to the ability of the system to integrate into existing surveillance systems and be operated by end-users. The Smart Surveillance System is designed to be easily integrated with existing surveillance systems and has a user-friendly interface. Training and support will be provided to end-users to ensure the smooth operation of the system. Based on these factors, the Smart Surveillance System is operationally feasible.

In conclusion, the Smart Surveillance System is technically, economically, and operationally feasible. The system has the potential to provide increased security and safety, reduce crime, and improve operational efficiency.

Social Feasibility

The social feasibility of the Smart Surveillance System refers to its ability to be accepted and adopted by the stakeholders and the wider society. The system's use of advanced surveillance technology may raise concerns about privacy and civil liberties. However, the Smart Surveillance System is designed with privacy and security features to protect the rights of monitored individuals. Additionally, the system has the potential to increase safety and security in public areas, which may lead to increased public support. Overall, the Smart Surveillance System is socially feasible.

Time Feasibility

The time feasibility of the Smart Surveillance System refers to the ability of the project to be completed within a reasonable timeframe. The development and implementation of the Smart Surveillance System involve multiple stages, including the Information Gathering process, system design, hardware and software development, testing, and deployment. A detailed project plan with clear milestones and deadlines will be established to ensure that the project is completed within a reasonable timeframe. Based on the project plan, the Smart Surveillance System is time feasible.

In conclusion, the Smart Surveillance System is not only technically, economically, and operationally feasible, but also socially and time feasible. The system has the potential to provide increased safety and security while protecting the privacy and civil liberties of monitored individuals.

3.System Design

The Smart Surveillance System is designed to be a modular system that can be easily integrated with existing surveillance systems. The system consists of two main components: the hardware and software components.

Hardware Component

The hardware component of the Smart Surveillance System consists of a network of cameras and sensors that are placed in strategic locations to monitor and track movement. The cameras and sensors are connected to a central processing unit that performs the analysis of the data collected. The system also includes a power backup to ensure uninterrupted operation.

Software Component

The software component of the Smart Surveillance System is responsible for the analysis of the data collected by the hardware component. The software includes advanced algorithms for motion detection, contour detection, and real-time people tracking using YOLOv3. The system also includes a user-friendly interface that allows end-users to monitor and track movement in real-time.

The software component is developed using Python programming language, OpenCV library, and YOLOv3 pre-trained model. The system also includes a

database for storing and retrieving data. The software is designed to be easily integrated with existing surveillance systems using standard protocols such as RTSP and ONVIF.

System Workflow

The Smart Surveillance System workflow includes the following steps:

1. Data Collection: The hardware component collects data from cameras and sensors placed in strategic locations.

2. Data Analysis: The software component analyzes the data collected using advanced algorithms such as motion detection, contour detection, and real-time people tracking.

3. Alert Generation: The system generates alerts if any unusual movement or activity is detected.

4. Alert Notification: The system sends alerts to end-users via email or SMS.

5. Monitoring and Tracking: End-users can monitor and track movement in real-time using the user-friendly interface.

In conclusion, the Smart Surveillance System is designed to be a modular system that can be easily integrated with existing surveillance systems. The system consists of a hardware component for data collection and a software component for data analysis. The system is designed to be user-friendly and includes advanced algorithms for motion detection, contour detection, and real-time people tracking using YOLOv3.

System Tools

The Smart Surveillance System is developed using a combination of various software tools and technologies. The system tools used in the project include:

Python

Python is an open-source programming language that is widely used for developing various applications, including machine learning and computer

vision-based systems. Python is used as the primary programming language for the development of the Smart Surveillance System.

OpenCV

OpenCV (Open Source Computer Vision) is a library of programming functions mainly used for real-time computer vision applications. OpenCV provides a set of functions for various computer vision tasks, including object detection, tracking, and recognition. OpenCV is used in the Smart Surveillance System for image processing and computer vision-based tasks.

YOLOv3

YOLOv3 (You Only Look Once version 3) is a state-of-the-art object detection algorithm that is used for real-time object detection. YOLOv3 is used in the Smart Surveillance System for real-time people tracking and detection.

Streamlit

Streamlit is a web application framework that allows developers to create interactive web applications with Python. Streamlit is used in the Smart Surveillance System to create a user-friendly web interface that allows end-users to monitor and track movement in real-time.

TensorFlow

TensorFlow is an open-source machine learning framework developed by Google. TensorFlow is used in the Smart Surveillance System for machine learning-based tasks, such as object recognition and tracking.

NumPy

NumPy is a library for the Python programming language, adding support for large, multi-dimensional arrays and matrices, along with a large collection of high-level mathematical functions to operate on these arrays. NumPy is used in the Smart Surveillance System for data manipulation and analysis.

Twilio

Twilio is a cloud communication platform that provides APIs for messaging, voice, and video communication. Twilio is used in the Smart Surveillance System for sending alerts to the users via SMS or phone call in case of any suspicious activity.

In conclusion, the Smart Surveillance System is developed using a combination of various software tools and technologies, including Python, OpenCV, YOLOv3, Streamlit, TensorFlow, NumPy, Twilio, SQLite, and other libraries and technologies. These tools and technologies provide the necessary functionality and features required for the development of an advanced surveillance system.