SENTINEL: INTELLIGENT MULTI CAMERA FACE DETECTION, RECOGNITION AND TRACKING SYSTEM

A PROJECT REPORT

Submitted by,

ISRAR AHMED - 20201CAI0107
RISHI RAGAV V - 20201CAI0128
RAKSHITH M B - 20201CAI0117
MOHD FAIZAN USMAN SAIT - 20201CAI0090

Under the guidance of,

Mr. SHEIK JAMIL AHMED
Assistant Professor, Computer Science and Engineering

in partial fulfillment for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING

At

PRESIDENCY UNIVERSITY
BENGALURU
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PRESIDENCY UNIVERSITY

SCHOOL OF COMPUTER SCIENCE ENGINEERING

CERTIFICATE

This is to certify that the Project report **"SENTINEL: INTELLIGENT MULTI CAMERA FACE DETECTION, RECOGNITION AND TRACKING SYSTEM"** being submitted by "ISRAR AHMED", "RISHI RAGAV V", "RAKSHITH M B", "MOHD FAIZAN USMAN SAIT" bearing roll number(s) "20201CAI0107", "20201CAI0128", "20201CAI0117", "20201CAI0090" in partial fulfilment of requirement for the award of degree of Bachelor of Technology in Computer Science and Engineering is a bonafide work carried out under my supervision.

Mr. SHEIK JAMIL AHMED
Assistant Professor
School of CSE&IS
Presidency University

Dr. ZAFAR ALI KHAN
Associate Professor & HoD
School of CSE&IS
Presidency University

Dr. C. KALAIARASAN
Associate Dean
School of CSE&IS
Presidency University

Dr. L. SHAKKEERA
Associate Dean
School of CSE&IS
Presidency University

Dr. SAMEERUDDIN KHAN
Dean
School of CSE&IS
Presidency University

PRESIDENCY UNIVERSITY

SCHOOL OF COMPUTER SCIENCE ENGINEERING & INFORMATION SCIENCE

DECLARATION

We hereby declare that the work, which is being presented in the project report entitled **SENTINEL: INTELLIGENT MULTI CAMERA FACE DETECTION, RECOGNITION AND TRACKING SYSTEM** in partial fulfilment for the award of Degree of **Bachelor of Technology** in **Computer Science and Engineering**, is a record of our own investigations carried under the guidance of **Mr. SHEIK JAMIL AHMED, ASSISTANT PROFESSOR, School of Computer Science Engineering & Information Science, Presidency University, Bengaluru.**

We have not submitted the matter presented in this report anywhere for the award of any other Degree.

Signature

ISRAR AHMED	**20201CAI0107**
RISHI RAGAV V	**20201CAI0128**
RAKSHITH M B	**20201CAI0117**
MOHD FAIZAN USMAN SAIT	**20201CAI0090**

ABSTRACT

Sentinel is an innovative multi-camera system revolutionizing video surveillance through intelligent face detection, recognition, and tracking. Employing advanced computer vision and deep learning models, the system ensures accurate face detection under challenging conditions, enhancing its reliability in diverse environments. By integrating facial recognition technology with a comprehensive database, Sentinel enables rapid identification and alerts for known individuals of interest. The system's intelligent tracking algorithms allow for seamless monitoring and tracking of individuals across multiple camera feeds, mitigating the limitations of conventional surveillance. Sentinel's scalability ensures compatibility with various surveillance camera systems, promoting widespread adoption. Additionally, the system prioritizes privacy by adhering to ethical data handling practices, securely managing facial data in compliance with privacy regulations. Sentinel's cutting-edge architecture marks a significant leap forward in video surveillance capabilities, offering a comprehensive solution for real-time face detection, recognition, and tracking. Its applicability spans across sectors such as public safety, law enforcement, and critical infrastructure protection, making it a vital tool in bolstering security measures and ensuring efficient surveillance operations.

ACKNOWLEDGEMENT

First of all, we indebted to the **GOD ALMIGHTY** for giving me an opportunity to excel in our efforts to complete this project on time.

We express our sincere thanks to our respected dean **Dr. Md. Sameeruddin Khan**, Dean, School of Computer Science Engineering & Information Science, Presidency University for getting us permission to undergo the project.

We record our heartfelt gratitude to our beloved Associate Deans **Dr. Kalaiarasan C and Dr. Shakkeera L,** School of Computer Science Engineering & Information Science, Presidency University and **Dr. ZAFAR ALI KHAN,** Head of the Department, School of Computer Science Engineering & Information Science, Presidency University for rendering timely help for the successful completion of this project.

We are greatly indebted to our guide **Mr. SHEIK JAMIL AHMED, ASSISTANT PROFESSOR**, School of Computer Science Engineering & Information Science, Presidency University for his inspirational guidance, and valuable suggestions and for providing us a chance to express our technical capabilities in every respect for the completion of the project work.

We would like to convey our gratitude and heartfelt thanks to the University Project-II Coordinators **Dr. Sanjeev P Kaulgud, Dr. Mrutyunjaya MS** and also the department Project Coordinators "**Dr. MULARI PAREMESWARAN**".

We thank our family and friends for the strong support and inspiration they have provided us in bringing out this project.

ISRAR AHMED

RISHI RAGAV V

RAKSHITH M B

MOHD FAIZAN USMAN SAIT

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1.1 Overview

Video surveillance has undergone a remarkable transformation, evolving from rudimentary closed-circuit systems into an essential pillar of modern security and monitoring technologies. This progression reflects the increasing importance of visual data capture and analysis in today's world. Video surveillance involves the deployment of cameras, sensors, and recording devices to monitor specific locations continuously, generating a wealth of visual data for various applications. This discussion delves into the multifaceted world of video surveillance, exploring its historical evolution, technological advancements, and the diverse range of sectors that rely on this crucial tool. The concept of video surveillance can trace its roots back to the mid-20th century when closed-circuit television (CCTV) systems were initially introduced. These early systems, often associated with banks and governmental facilities, consisted of analog cameras connected to monitors and recording devices. While these systems had limited capabilities, they marked the inception of a technology that would go on to reshape the landscape of security and monitoring. As technology advanced, so did video surveillance. The transition from analog to digital systems in the late 20th century was a pivotal moment in the field. Digital video surveillance introduced many benefits, including higher resolution, increased storage capacity, and more flexible data management. These systems allowed for remote monitoring, enabling users to access live or recorded footage from virtually anywhere with an internet connection. Moreover, digital cameras could be integrated with other technologies, such as facial recognition software and motion detection, enhancing their effectiveness for various applications. The 21st century ushered in an era of rapid innovation in video surveillance technology. High Quality camera nowadays output more information per square inch of area. These cameras are now capable of capturing images in low-light conditions and adverse weather, further expanding the range of scenarios where video surveillance can be applied. The advent of artificial intelligence (AI) and machine learning algorithms brought a new dimension to video surveillance. These technologies enable automated analysis of video data, allowing systems to detect anomalies, recognize faces, and

track objects in real-time.

Such capabilities have increased the accuracy and efficiency of real time video surveillance systems. The applications of video surveillance have also proliferated over time. Initially, it was primarily used in high-security environments like government facilities, banks, and casinos. However, as technology became more accessible and affordable, its use expanded into various sectors. Today, video surveillance is integral to public safety, urban planning, transportation, retail, residential security, and much more. In law enforcement and public safety, video surveillance is pivotal in crime prevention, investigation, and community protection.

1.2 Problem Statement

Video surveillance aims to gather information, to prevent crime, protect property, person, or object and to inspect the scene of crime. The participants are required to build a pipeline that acquires images from multiple CCTV cameras and carry out face detection, face recognition and tracking of selected individuals.

1. Acquisition: Multiple static CCTV cameras are considered.
2. Face detection & Recognition: detect the faces and recognize the individuals
3. Multiple Person Tracking: Out of the recognized individuals, track target individuals across multiple cameras. The pipeline must have list of recognized individuals' details, from which the user can select target individuals.

1.3 Existing System

[1] 'Probabilistic recognition of human faces from video by q Shaohua Zhou,* Volker Krueger, and Rama Chellappa' provides an existing solution. The research explores advanced methodologies for human face recognition in video surveillance, emphasizing a probabilistic framework. Investigating still-to-video and video-to-video scenarios, a novel time series state space model is introduced to integrate temporal information. This model simultaneously characterizes kinematics and identity using motion vectors and identity variables. For still-to-video recognition, a tracking-and-recognition approach is proposed, addressing challenges such as poor video quality and pose variations. In video-to-video recognition, the model generalizes still templates to video sequences, employing exemplar-based learning. The methodology is validated through experiments on datasets with pose/illumination variations, demonstrating its efficacy in dynamic surveillance environments.

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Drawbacks

Despite its advancements, the proposed approach may face challenges in scalability and computational complexity, particularly when dealing with extensive video datasets. The integration of exemplar-based learning introduces a dependency on the quality and representativeness of selected video representatives, which might affect recognition accuracy. Additionally, the generalizability of the model across diverse surveillance scenarios requires careful consideration of image representations and transformations. Balancing computational efficiency and model adaptability remains an ongoing concern, necessitating further optimization for real-world applications.