REAL-TIME COLORIZATION OF LOW-LIGHT CCTV IMAGES USING AI

By

AHMAD ABDULHAKIM ALKHAYAL	**1945541**	**COE**
ABDULAZIZ HAMEED IBRAHIM	**1946282**	**COE**
ALI MOSTAFA ALMOUSA	**1945427**	**COE**

TEAM NO.: 12 WINTER-2022 INTAKE

Project Advisor

DR. MOHAMMED J. ABDULAAL

Project Co-advisor

DR. AHMAD ASIF JIMAN

Project Customer

DR. MOHAMMED J. ABDULAAL

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
FACULTY OF ENGINEERING
KING ABDULAZIZ UNIVERSITY
JEDDAH – SAUDI ARABIA

APRIL 2023 G – SHAWWAL 1444 H

ABSTRACT

This project design proposes a novel approach to overcome the current limitations of CCTV systems in low-light conditions. CCTV cameras have become a common sight around the world, serving a variety of purposes. They are utilized by law enforcement agencies to ensure public safety and conduct criminal investigations, by biologists to observe wildlife, and by hospitals to closely monitor patients. In various scenarios, challenges arise due to the poor-quality images captured by CCTVs in low-light environments that hinder monitoring and identification efforts. Subsequently, wildlife observation, particularly at night faces many challenges in monitoring natural habitats and animals. Security officers also struggle to capture facial features and clothing patterns. Multiple displays add another layer of complexity for surveillance officers, making it challenging to observe movements in black- and-white live feeds. The use of flashlights for visibility is disruptive and compromises the effectiveness of security and surveillance. The problem is that current CCTV systems are either expensive or disruptive, lacking efficiency and secrecy. Thus, a cost-effective and efficient system is needed to capture clear, colorful images in low-light or dark environments without using disruptive tools. Such a system would achieve the objective of increasing the effectiveness of security and surveillance measures and contribute to the field of AI. Three alternative solutions were explored to overcome the limitations of current CCTV systems. The first is a combination of hardware and software; it proposes an IR CCTV system powered by AI to color images in real-time. The second alternative is heavily dependent on hardware capabilities, it utilizes an advanced light sensor (starlight) to achieve color by collecting light from the moon and the stars. And the third alternative makes use of thermal imagery cameras and AI to generate colored images. After conducting thorough research and analysis, it was concluded that the first alternative aligns with the customer objectives most effectively and is therefore the optimal choice. This proposed baseline design uses a camera with an IR sensor to capture clear images in low-light conditions. Captured images are processed on a GPU-accelerated embedded system and colored using a generative AI model.

Index Terms *— Real-time colorization images, Low Light color Enhancement, infrared colorization, GANs network, dark light image processing.*