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**Title: Webcam Application for High Risk Independent Resident**

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***Course:* Computer Science**

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# Abstract

This display the development of a webcam application that are designed to monitor the resident under high risk or other venerable situations which could lead to injury or potential hazards. It will combine with local weather information support and Convernutionary Neuron Network (CNN) for image recognition to help user to identify the situation and status of high-risk residents.

This report will provided full process of its development and the theory of key elements. Although the project partially achieved many of the design goal for a monitor application, this project provided a clear idea of what are the key elements for a monitor application for this type of tasks. It provides a potential pathway for a comprehensive and a mature monitor application for the smart devices and IoT.

# Acknowledgements

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# Chapter 1 – Introduction

## 1.1 Background

Traditional healthcare and monitoring systems have long relied on human supervision and warden. Even in professional environments such as nursing homes, constant individual supervision is not always feasible. Furthermore, there have been reported cases of neglect or even abuse in residential care facilities. On the other hand, many high-risk individuals, including elderly people, live alone without immediate access to assistance. In the UK alone, there are 3.3 million pensioners who live independently (Office for National Statistics, 2023) and are at risk of possible injuries or unconsciousness at any moment. The possibility of such an event would only increase with age. Delays in medical response due to undetected falls can lead to severe health deterioration or even death (WHO, 2021). Moreover, as extreme weather conditions become more frequent than ever before, vulnerable individuals who live on their own may refuse to use heating or cooling appliances, often due to cost or personal habits. This has caused casualties of illnesses related to temperatures like hypothermia or dehydration every year.

The demand for technologies that assist high-risk individuals who are living independently is increasing with more reliable and more powerful tools and equipment as the technologies have improved in terms of computational power and networking for the past decades. This project aims to address that need by developing a prototype webcam monitor application system for detecting whether a person has fallen using computer vision techniques and machine learning. By using a camera, the system captures images at a rate of two frames per second, processes them using a Convolutional Neural Network (CNN), and classifies the user’s pose to determine whether a fall has occurred.

If a fall is detected, the system will automatically notify a pre-configured contact, enabling a timely response. Falls are one of the leading causes of injury-related death among adults in many countries. Additionally, another module provides health-related feedback based on temperature and humidity, helping ensure that the resident is living in safe conditions.

## 1.2 Project Aims and Objectives

The core objective is to design and implement a real-time fall detection system using images captured by a webcam and analysed via a CNN-based pose estimation model. The secondary objective is to provide environmental advice based on sensor data.

Primary Objectives:

* Capture webcam images at a consistent frame rate.
* Train and deploy a CNN to classify human poses.
* Determine if a set of poses indicates a fall.
* When a fall is detected, pass the message to relevant contactor.

Secondary Aspirations: (Implementation subject to time and complexity constraints)

* Provide a text-based advisory system based on environmental conditions.
* Record daily activity time
* Log medication intake times.
* Deliver personalized alerts or reminders based on behavioural patterns.

## 1.3 Scope and Constraints

This project is developed under academic constraints and does not extend to clinical or regulatory compliance for medical-grade devices. The system is intended as a prototype to demonstrate feasibility rather than a commercialised product. While the application is designed to operate on consumer-grade hardware (laptop and webcam), and is not designed for multi-camera setups or advanced motion tracking.

Due to the incident during training of the model, this application is tested and trained on a CPU-based system. Hence, the CNN model complexity and the speed of image processing are limited.

## 1.4 Ethics Review

This monitoring system does not store or process personally identifiable information beyond what is necessary for fall detection and alert generation. The project has received ethics approval (Reference: TETHIC-2025-110551) from the Technology Faculty Ethics Committee, confirming that it involves no physical, psychological, or environmental risks.

## 1.5 Report Structure

This report is structured as follows:

Chapter 2 - Literature Review: Critical analysis of relevant studies in the fall detection, pose estimation, and ambient health monitoring.

Chapter 3 – Methodology: Justification of the development approach, neural network design, and system structure.

Chapter 4 – Requirements: Functional and nonfunctional requirements.

Chapter 5 – Design: Detailed system architecture, data flow, and model selection.

Chapter 6 – Implementation: Description of key components including webcam interfaces, CNN training, and alert mechanism.

Chapter 7 – Testing and Evaluation: Verification of results against requirements and performance benchmarks.

Chapter 8 – Conclusion and Future Work: Summary of findings and potential improvements.

# Chapter 2 – Literature Review

## 2.1 Introduction

This chapter will be discuss the literature related to