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**Drone Rescue**

**Graduation Project 1**

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## A project submitted in partial fulfilment of the requirements for the **degree of** **Bachelor** of Science in (Computer Science)

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# Abstract

**Project Objective:**

The goal of this project is to facilitate the search for missing or lost individuals for rescue teams and to significantly reduce the search time. This will be achieved using artificial intelligence integrated with a camera mounted on a drone.

One of the key objectives is to verify the condition of the missing person once detected by the camera. The system will then send a message via artificial intelligence that includes the person’s location and their health status.

**Methodology Used for Project Execution:**

The methodology we will use for this project is Agile programming, specifically the Kanban approach. We chose this type because it meets our requirements effectively. Kanban requires the team to answer three questions in each meeting:

1. What will we work on this week?

2. What will we work on next week?

3. What have we completed so far?

Additionally, this approach is not suitable for large companies; it is typically used by startups, as it is designed for small projects with a few team members. One of its main features is that once a specific task is completed, it is presented to the client for review.

**Project Overview:**

In our vast deserts and remote areas, many people lose their lives, despite the significant efforts of the Ministry of Interior's Border Guard. The harsh reality of fatalities in these distant locations has prompted us to seek a solution to this problem.

Our project aims to assist this ministry and other relevant agencies in searching for lost individuals by developing a model that utilizes artificial intelligence and drones. This system will help assess the condition of the lost person and send their location to rescue teams. We hope this solution will be effectively implemented by the relevant authorities and will contribute to reducing the scale of this issue.

**Keywords** Agile programming Kanban , Search for lost individuals, Drone camera, Health status

# Acknowledgement

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**Technology using**

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# Chapter 1: Introduction

## Introduction

In our present time, with the rise of artificial intelligence (AI) entering various fields such as agriculture, irrigation, safety, driving, quality inspection, and even government services, extending to military devices and weapons, the main reason for AI's integration into these areas is to simplify human life and increase the surplus of time gained from machines completing tasks faster than humans. All these factors aim to fulfill humanity's desire for perfection and comfort. From our limited perspective, we believe this is the reason behind the widespread adoption of AI in various domains, as it has helped solve many problems.

## Problem Definition

One significant issue faced by humanity is the loss of people or their disorientation in remote areas or crowded places, such as during Hajj and Umrah, where the missing individual may not know their location or how to navigate out of their situation. In vast deserts and remote locations, people can become lost more quickly. To address this issue, ministries have established teams to rescue those who are lost, and these teams are continually striving to enhance their operations and improve their speed in locating missing individuals. Thus, the idea of "Rescue Drones" was conceived to contribute to increasing efficiency, flexibility, and the speed of achieving results.

## Project Objectives

* 1-Support Rescue Efforts:

Assist the Ministry of Interior's Border Guard and other relevant agencies in searching for lost individuals in vast deserts and remote areas.

* 2-Utilize Advanced Technology:

Develop a model that integrates artificial intelligence and drone technology to enhance search and rescue operations.

* 3-Reduce Fatalities:

Contribute to reducing the number of fatalities in remote areas by providing faster and more efficient rescue operations.

* 4-Cover Wide Areas:

Expand the search range to cover vast areas of deserts and remote locations using drones and artificial intelligence.

## Project Scope

The boundaries of this project are:

* The system will operate in both remote areas, such as deserts, and crowded environments, including during Islamic Hajj, where individuals are at risk of getting lost.
* The drone will have autonomous navigation capabilities, allowing it to scan large areas without manual intervention.
* Using camera-based detection and GPS tracking, the drone will locate lost individuals and immediately send their location to rescue teams.
* The primary users will be Saudi Civil Defense.
* The project will follow an Agile Kanban methodology.
* Health monitoring features are excluded from this project due to budget

## Project Timeline

Table 1.1 represents the timeline for project completion.

Table 1.1 Project timeline

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **TimeLine** | | | **Project Name** | | **Project** | | | **Project Start** | | | | | | **Project End** | | | | | |  | | |
|  | **Duration** |  |  | | **Date** | |  | |  | | **Date** | |  | |
| **Drone Secure** | | **69 Days** | | | **01-Oct-2024** | | | | | | **30-Dec-2024** | | | | | |
|  | | | **Task Description** | | | | | **October** | | | | | | **November** | | | | | | **Dec** | | |
|  | **Chapter** |  |
| **No.** | **Start Date** | **End Date** | | | | **1st** | **2nd** | | **3rd** | | **4th** | **1st** | **2nd** | | **3rd** | | **4th** | **1st** | **2nd** |
|  |
|  | | |
| Ch1 | | | Preparing the introduction and the overview of the project, its objectives, scope, and timeline of the project. | | | | |  |  | |  | |  |  |  | |  | |  |  |  |
| 01-Oct | 7-Oct | | | |
| Ch2 | | | analysis outlines specify functional and non-functional requirements necessary for the successful implementation. | | | | |  |  | |  | |  |  |  | |  | |  |  |  |
| 08-Oct | 21-Oct | | | |
| Ch2 | | | Discussing relationship between the relevant work and our own work. | | | | |  |  | |  | |  |  |  | |  | |  |  |  |
| 22-Oct | 28-Oct | | | |
| Ch3 | | | Reporting the methodology and mechanisms used in the implementation of the project. And reporting the specification process which contains requirement elicitation and **analysis**. | | | | |  |  | |  | |  |  |  | |  | |  |  |  |
| 01-Nov | 07-Nov | | | |
| Ch4 | | | Reporting the system **design** process that includes converting these requirements into graphical models. | | | | |  |  | |  | |  |  |  | |  | |  |  |  |
| 08-Nov | 28-nov | | | |
| Ch5 | | | Summarizing what has been achieved during the work stages and what challenges and obstacles have occurred during these stages along with the ambitions and future vision of this project. | | | | |  |  | |  | |  |  |  | |  | |  |  |  |
| 29-Nov | 04-Dec | | | |
| Review | | | Summarizing the abstract and report the acknowledgement etc. | | | | |  |  | |  | |  |  |  | |  | |  |  |  |
| 5-Dec | 11-Dec | | | |

## Document Organization

This report indicates five chapters:

**Chapter 1: -**

introduced an overview of the project, its objectives, scope, and timeline of the project.

**Chapter 2: -**

will review and discusses the history and studies related to the project. Moreover, will discuss Relationship Between the Relevant Work and Our Own Work.

**Chapter 3: -**

will contain the methodology and mechanisms used in the implementation of the project. Moreover, will report the specification process which contains requirement elicitation and analysis including data collection and identifying the project functional and non-functional requirements.

**Chapter 4: -**

will report system design process that incudes converting these requirements into graphical models.

**Chapter 5: -**

will summarize what has been achieved during the work stages and what challenges and obstacles have occurred during these stages along with the ambitions and future vision of this project.

# Chapter 2: Literature Review

## Introduction

In this chapter, we will discuss the general concept of previous projects that are similar to our project, "Drone Secure." We will also briefly explain the relationship between these past projects and our own.

## Background

Search and rescue (SAR) missions, especially in dessert environments, are considered highly challenging and unpredictable. Two factors play an important role in determining the outcome of the SAR mission:

* Time: In most SAR scenarios, missing individuals are usually in difficult situations with limited access to essential resources, such as water and food. This makes time a crucial factor in the success of the SAR mission.
* Environment: SAR missions often take place outside urban areas, where the environments can be challenging for rescue teams to locate missing individuals. Deserts, mountains and valleys can significantly slow down the entire rescue operation.

Artificial Intelligence will play a significant role during the SAR mission. Integrating object detection into drones allows them to accurately identify humans, which will help rescue teams cover larger and more difficult areas in a shorter period of time.

## Related Work

The use of drones in SAR missions has been attracting attention due to their capability to quickly cover large and difficult areas. Given the critical nature of SAR mission where time and environmental conditions are crucial, research has explored various approaches to improve the use of drones in locating missing individuals in challenging environment such as deserts. Drones can significantly reduce search time by providing arial views, enabling faster response to emergencies (Gorgan et al., 2020). This is very important in environments where access to essential resources is limited. Despite the benefits of multiple sensor types, drone based detection models still face issues when identifying small scale objects. Zhu et al. (2020) reported that models like YOLO and Faster R-CNN achieved less than 35% mean average precision (mAP) for small-scale objects in the VisDrone challenges, indicating the ongoing need for improvement in the detection capabilities of drones under real world SAR conditions. Another challenge in SAR missions is the resilience of drones to communication failures and challenging environmental conditions. Decentralized control methods are necessary to maintain operational efficiency when connectivity is unreliable, particularly in remote areas (Grogan et al., 2020). Additionally, privacy concerns must be considered, as drones collect data not only on missing persons but also on others nearby. Addressing these challenges is crucial for the responsible deployment of drones in SAR missions (Mayer et al., 2019). The VisDrone dataset (Zhu et al., 2020) is an important resource for improving Drone based SAR technologies. It provides a large set of drone images, which are useful for training and testing object detection models. The dataset helps solve challenges found in drone images, such as different camera angles, changes in size, and motion blur. These issues are very important for SAR missions, where it is necessary to accurately identify people in different types of environments.

## Summary

This chapter looked at how drones can be used in search and rescue (SAR) missions, especially in difficult places like deserts. By using AI and object detection, drones can make rescue efforts faster and more efficient. However, challenges still exist, such as finding small objects accurately, handling communication problems, and making sure people's privacy is protected.

We talked about how datasets like VisDrone can help improve the ability of drones to detect objects better. We also noted the need for drones to work well even when communication is weak. These ideas support our project, which aims to make rescue missions more reliable, accurate, and respectful of privacy.

# Chapter 3: System Analysis

## Introduction

In this chapter, we will analyze the project using a set of systematic approaches. We will start by gathering information from previous projects similar to ours, which will help us clarify the main features of the project in a simple and direct way. By studying past experiences, we will better understand potential challenges and available opportunities.

In the second part, we will explain these features in greater detail by identifying the requirements. We will focus on dividing the requirements into two categories: functional requirements and non-functional requirements.

## Requirements Elicitation

In this section, we will focus on identifying and extracting the project requirements.

Starting with engaging in discussions with stakeholders, specifically the customers and users, who, in our case, will be the members of our project group. Our goal is to clearly identify both the functional requirements and the non-functional requirements

### Functional Requirements

* **Real-Time Video Capture:**

The drone camera should capture real-time video footage of the search area.

* **Object Detection:**

The drone camera should use AI to detect and identify humans in the video feed during search operations.

* **Autonomous Area Scanning:**

The drone should autonomously navigate over predefined search areas, continuously scanning and recording the environment using the camera.

* **GPS Location Tagging:**

The drone system should automatically associate GPS coordinates with any detected individuals.

* **Emergency Alerts:**

When a person is detected, the system should trigger an alert and provide the video feed and GPS coordinates of the detected individual

### Non-Functional Requirements

* **Performance:**

The camera should capture high-quality video, ideally at 1080p resolution with a minimum frame rate of 30 frames per second (fps), ensuring clear real-time video and accurate object detection during search operations

* **Reliability:**

The system must maintain 99% uptime, operating continuously for 2 hours in temperatures between -10°C and 50°C, resistant to dust and wind.

* **Durability:**

The drone and camera hardware must withstand 1.5-meter drop tests and 30 km/h winds, ensuring resistance to shocks and harsh conditions.

### User Requirements or Domain Requirements

We have chosen to focus on User Requirements because the project aims to address the practical needs of the end-users, who are the rescue teams. These requirements are designed to improve their efficiency in search and rescue operations in remote areas and ensure that the system is easy to use, effective, and reliable.

User Requirements:

* **Real-Time Location Tracking:**

The system must provide real-time GPS coordinates of the lost individual to rescue teams.

* **Wide Area Coverage:**

The drones should be able to cover vast desert areas efficiently to locate missing individuals.

* **Emergency Alerts:**

The system must send automatic alerts to rescue teams when a lost person is detected, including their location.

* **Visual Data Provision:**

The system should transmit live video or images to rescue teams to provide visual data of the surrounding environment

## Requirements Specification

### Use Case Diagram

### 3.3.1 Use Case Description

## Developmental Methodology

## Summary

# Chapter 4: System Design

## Introduction

## Architectural Design

## Object Oriented Design

### Structural Static Models

#### Class Diagram

#### Class Diagram Description

### Dynamic Models

#### Sequence diagram

## Data Modeling

## Summar

# Chapter 5: Conclusion and Future Work

## Conclusion

## Goals Achieved

## Limitations and Future Work

##### Limitations:

##### Future Work:

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