# SWEN 755
# Software Architecture

# Assignment 2

**Heartbeat Tactic Implementation**

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# 1-Availability Requirements

Outlined below are the availability requirements for essential components of the proposed Unmanned Aerial Vehicle (UAV) system. The availability requirements are divided into two categories: 1- Critical Components – 2- Non-Critical components

**Critical Components:**

**1- Obstacle Avoidance:**
In order for the UAV to remain airborne during its flight, the UAV must be able to continuously detect and identify obstacles in its path and surrounding. Obstacles include other aerial vehicles, birds, ground elements (e.g. trees, people, and buildings).

**2- Object Detection:**
The UAV must be able to continuously detect objects based on the required criteria that has been determined by the GCS.

**3- Data Transmission:**
The UAV must continually transmit and receive telemetry data from the Ground Control Station.

**4- Telemetry:**
The UAV must be able to send the telemetry data back to the GCS at any time.

**Non-Critical Components:**

**1- Geo-Fencing:**
The UAV must have the ability to store a list of "no-fly-zone" GPS coordinates. The UAV should not violate the no-fly-zone if geofencing is enabled.

**2- Mission Planning:**
The UAV must, at all times, ensure that its current navigation course/path is compliant with the Mission Plan.

**3- Adverse Weather Detection:**
Based on current and forecasted weather data, the UAV must land or return to base if it will encounter unfavorable weather conditions in its path

**4- Simultaneous Localization and Mapping:**
The UAV must continually construct or update a map of an unknown environment while simultaneously keeping track of its location with the UAV itself.

# 2- Component Diagram

This section provides the component diagram. As it is shown in Diagram 01, the architecture of the system divides the overall system into different subsystem, where each subsystem is a process of its own.

The subsystems are grouped into the following categories:
- Critical Monitor
- Non-Critical Monitor
- Critical Modules
    - Obstacle Avoidance
    - Obstacle Recognition
    - Telemetry
    - Data Transmission
- Non-Critical Modules:
    - Geo-Fencing
    - Mission Palnning
    - SLM
    - Weather Detection

Communication between the subsystems is achieved using NamedPipes. As explained by Microsoft: "A *named pipe* is a named, one-way or duplex pipe for communication between the pipe server and one or more pipe clients. All instances of a named pipe share the same pipe name, but each instance has its own buffers and handles, and provides a separate conduit for client/server communication. The use of instances enables multiple pipe clients to use the same named pipe simultaneously."

**Heartbeat Detection**

Heartbeat detection is achieved by identifying if a pipe has a valid connection. When a subsystem (i.e. process) is killed, the .NET Framework automatically disconnects the pipe.

**Process Hanging Detections**

Each module continuously transmits a message (i.e. heatbeat) during normal operations every 2 seconds. The same pipe is used to transmit the connection from client to server. If the monitor detects a delay of more than 2 seconds it fires a notification.
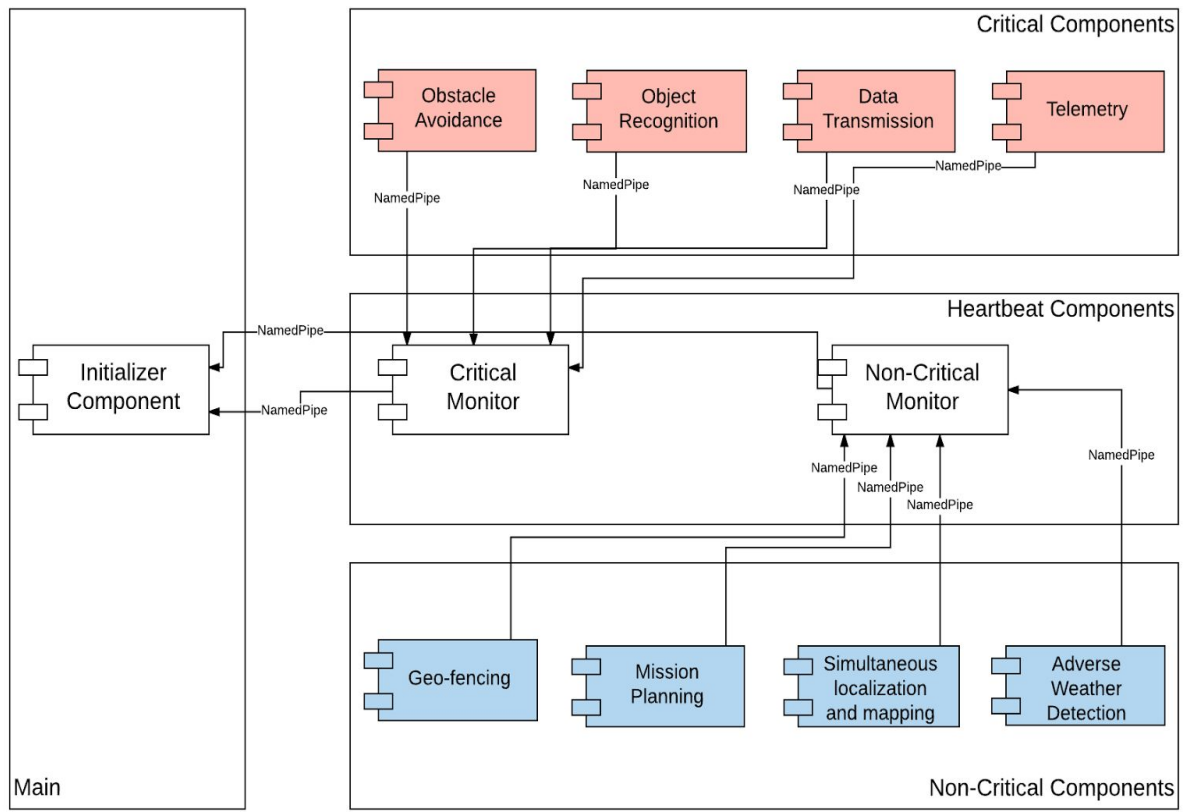
**Diagram 01: Architecture Overview (Subsystem view)**