CHAPTER ONE

INTRODUCTION

1.1 Overview

A guidance system is a device or group of devices used to navigate a ship, aircraft, missile, rocket, satellite, or other crafts. Typically, this refers to a system that navigates without direct or continuous human control. Systems that are intended to have a high degree of human interaction are usually referred to as a navigation system [1].

A guidance system has three major sub-sections: Inputs, Processing, and Outputs. The input section includes sensors, course data, radio and communication links, and other information sources. The processing section is composed of one or more CPUs, integrates this data and determines what actions, if any, are necessary to maintain or achieve a proper heading. This is then fed to the outputs, which can directly affect the system's course. The outputs may control speed by interacting with devices such as turbines, and fuel pumps, or they may more directly alter course by actuating ailerons, rudders, or other devices [1].

An unmanned aerial vehicle (UAV) is an aircraft without a human pilot on board. Its flight is controlled either autonomously by computers in the vehicle or under the remote control of a pilot on the ground or in another vehicle [2].

There are a wide variety of UAV shapes, sizes, configurations, and characteristics. Historically, UAVs were simple remotely piloted aircraft, but autonomous control is increasingly being employed. They are deployed predominantly for military and special operation applications, but also used in a small but growing number of civil applications, such as policing and firefighting, and nonmilitary security work, such as surveillance of pipelines.

UAVs are often preferred for missions that are too difficult for manned aircraft.

1.2 Problem Statement

In recent years, Sudanese Armed and Security Forces have, deployed and used a number of UAV's, which are imported from other technologically developed countries. However, until the moment there is no fully produced UAVs by Sudanese industries due to the lack of technology and scientific researches in this field.

Sudan Military Industries may be now capable of producing small and medium range Rockets, but till this moment no guided Rockets (Missiles), guided bombs or UAV's have been produced as far as known.

The Increasing demand for guidance, navigation and autopilot systems for military, security and civil purposes requires much of researches and development to be done on this type of applications and technology.

1.3 Objectives

The goal of this research is to develop and design a low cost and simple guidance, navigation and flight control Autopilot system.

1.4 Methodology

- Literature review of Autopilot design and implementation.
- Selection of Sensors, Microcontroller, Actuators, Communication devices and Airframe model according to the desired performance, cost and time.
- Generation of guidance, navigation and control algorithm
- Integration of the Autopilot system as a microcontroller board.
- Testing of the system.

1.5 Organization

This dissertation is organized into five chapters as follows. Chapter one gives an introduction to the UAV. It presents the problem definition and variables and the objectives of this research. Chapter Two presents a background and historical overview of UAV Systems. Chapter Three presents the principles of control and algorithms. Chapter Four presents the UAV system hardware and software implementations.

Chapter Five will conclude the work and discuss directions for future work.