COLLEGE OF ENGINEERING & TECHNOLOGY

Department: Electronics and Communications Engineering, Cairo

Graduation Project Description Form

Project Supervisor(s): Dr Bassem Sheta

Project Title: UAV navigation using integrated GPS and INS systems

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Duration from 9/2013 ___till 7/2014 _____

Product Category

Algorithm___ Hardware____ Software____

Standards:

Safety: UL, CE_____ IEEE _____ FCC___

Other _____

Practical Realization Form

PCB _____ Firmware__ Embedded CPU Kit (ARM, ..etc): _____

PC Software _____ Ready-made Package___ DSP Kit__ FPGA Kit_

VLSI Schematics __ VLSI Layout ___ VLSI Silicon (ASIC)_____

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Language

VHDL/Verilog Matlab C/C++/Java _____

Productization

Finished Product Form:__ Possible Commercialization _____

Amount of funds needed for buying components: _____

IEEE GOLD Made-In-Egypt/Engineering Day: _

ITAC (ITIDA) or NTRA Funding Application:_

Testing

Functional__ Simulation__ Parameters__ Final Hardware___Other:

Lab Test Setup

EMC _____ Environmental_____ Microwave _____ Analog Lab_____
Other:

CAD Tools *(No unauthentic software is allowed):*

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Elective Classes Required:

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Abstract

In recent years, the utility of the Unmanned Aerial Vehicle (UAV) has greatly increased in applications such as, surveillance, law enforcement and aerial mapping. Furthermore, UAVs are quickly becoming an integral part of both military and commercial operations. For these classes of applications, accurate UAV navigation is considered a critical element for the safe operations of the vehicle. UAV payload is a critical factor which controls the mission capabilities of the UAV. UAV missions include infrastructure and asset management, aerial mapping, post disaster damage assessment, agriculture and environmental monitoring, construction and mining and reconnaissance and weapon delivery.

In recent years there has been an explosion in the number, type and diversity of system designs and application areas of UAVs. However, generally speaking all UAVs typically share the following major component:

1. Navigation component.
2. Remote sensing component.

To date, most UAV navigation systems rely mainly on the Global Positioning System (GPS) receivers as the primary source of information to provide the position of the vehicle. GPS is able to provide precise positioning information to an unlimited number of users anywhere on the planet.

The integration of Inertial Navigation System (INS) with its Inertial Measurement Unit (IMU) and GPS provides a system that has superior performance than each individual system. For instance, GPS derived positions have approximately white noise characteristics over the whole frequency range. The

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GPS-derived positions and velocities are therefore excellent external measurements for updating the INS with position parameters, thus improving its long-term accuracy. Similarly, the INS can provide precise position and velocity data for GPS signal acquisition and reacquisition after outages.

This project aims to develop and implement a comprehensive navigation system for a quadcopter system utilizing GPS/INS system.

Components list:

Part Name	Quantity
Autopilot-Ardupilot Mega AMP2.5 (with 3Axis Gyro-3Axis Accel-3Axis Compass-Pressure Sensor)	1
Skylab UART GPS Module (For Microcontroller and Arduino)	1
IMU -3 Axis Gyro + 3 Axis Accelerometer (InvenSense MPU-6050)	1
Color LCD 128x128 (Nokia)	1
Quadcopter Carbon Fiber Frame	1
Brushless Motor Kit (980KV Motor + 20A ESC + 10x45 Propeller + Propeller Adaptor + Motor Mount)	4
Propeller EPP 10X4.5 (Standard Rotating)	10
Lithium Polymer Battery (11.1 V, 2200 mAH)	1
Arduino Xbee Shield with zigbee Module	1
USB-XBEE Adaptor (Connect Zigbee to PC)	1
Zigbee Pro- 63 mw PCB Antenna Series2 Wireless Module (Long Distance)	1
6-channel 2.4GHz Computer Radio System	1
camera	1

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Tasks:

1- Theoretical background on microcontrollers, APs, GPS, IMU, sensors integration.

2- Connect GPS receiver to the appropriate microcontroller and develop the required software to read its data.

3- Connect the IMU to the appropriate microcontroller and develop the required software to read its data.

4- Ardupilot connection to the quad copter and make the necessary parameter tuning.

5- Camera connection to the autopilot and write the necessary software.

6- Mission planning (flight path determination and time of flight estimation)

7- Flight testing and error reporting.

8- Project report submission.

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References and Links