# Basic Drones Dynamics DASL 106 Dongbin Kim.





Drones and Autonomous Systems Lab @ UNLV

# Contents: Week 1

- Introduction : Unmanned Aerial Vehicle.
- Introduction : *Lego Flybrix*
- Flybrix Assembly, Test Flight.



### Introduction: Unmanned Aerial Vehicle.



- Origine of Drone :
- The word is orginated from Sound from flying bees.
- -Unmanned Aerial vehicles manipulated through wireless signal
- Initial Drones :
- -Developed for practice for Missile target in Air Force in early 20th century -Widely used in military weapons in early 21th century.
- Widely used in military weapons in early 21th
- -Media : « Drone War »
- Modern Drones :
- -Weapon carrying -> Camera, Military -> Civilian.
- -Commercial drones are widely used in Media, Industries, Personal purposes.



#### Introduction: Drone Research in DASL.







Old Project
Mobile Manipulating UAVs.
-Cargo Carrying UAVs.
-UAV Applications

- Current Project
- Skywriting UAVs.
- New Mobile Manipulating UAVs



Ref. daslhub.org

### Introduction: Principle of UAVs



- Two pairs of fixed pitched propellers.
- Two Counter Clockwise (CCW)
   Two Clockwise (CW)
- Third of Newton's Law applied : Different direction of torques yield each other for control. A Multi-rotor hovers or adjusts its altitude by applying equal thrust to all four rotors.
- Three movements : Roll, Yaw, Pitch movements are run by independent variation of the speed of each rotor.





- Various Type of Multi-copter's propeller direction.
- The number of CW, CCW direction of propellers must be even.





- ESC(Electronic Speed Controller)
  - -Controls the rotor to spin at variable speeds, depending on control inputs
- Flight Controller
  - -'brain' of UAVs'
  - -Controlling ESCs through power distribution.
  - -Most of it nowadays have GPS or gyro sensor inside, guarantees stable flight.
  - **Example** : Pixhawk, Eagletree Vector, etc.



Ref. http://www.droneybee.com/how-quadcopters-work/



Drones and Autonomous Systems Lab @ UNLV



- **Radio Transmitter** 
  - -Controls the flight movements through Radio receiver.
  - -Implement various flight modes by channels
- Radio Receiver.
  - -Transmit the signal to the controller.
  - -Communication with servos



## Introduction: LEGO Flybrix



DASL

Drones and Autonomous Systems Lab @ UNLV

### Introduction: LEGO Flybrix





- Pros
  - Easily build, Crash-friendly.
  - No tool needed
  - Simple flight process
  - Control Sensor data and Tune motor through Chrome apps.
- Cons
  - -Very sensitive flight -> Unstable flight.
  - -Late response from transmitter signal
  - Chrome apps and other open sourses are not built well yet.



### Introduction: LEGO Flybrix





- Technical Specification
  - -Weight : 57g
  - -Battery : 3.7V-380mAh, Li-Po.
  - -Propellers : 59mm
  - -Overall Size : 100mm X100mm
  - -Size and build can easily change.
  - -Main Board : 96Mhz ARM Cortex-M4 processor in Arduino. -JC-S Transmitter.



## Introduction: LEGO Flybrix Assembly

#### 1. Firmware installation in Flight controller(Click)

2. Instruction for Assembly (Click)

3. Test Flight



## Homework

#### • Creat better building for Flybrix Quadcopter.

