Drone Prognostics
Estimating Remaining Useful Life (RUL) of a Drone Battery

Department of Mechanical Engineering

Presented by	**Nimmagadda Sashank**	Roll Number	**ME18B160**
Project Guide	**Prof. N. Arunachalam**	Date	**22nd September 2022**

About the Project

Due to the excellent performance and being cost effective, Aerial Drones and UAVs are widely being used in various fields ranging from civil, military to delivery.

But, the accident rate of these drones & UAVs are higher than manned aircrafts. Therefore, the sensor data monitoring of drones has become an area for scope of research to further support Drone Prognostics and Health Management.

The aim of this project is to evaluate the effect of various flight and the drone operating parameters have on its battery life. The effect of these parameters are observed quantitatively from the data acquisition by the corresponding sensors.

Methodology

- Develop the state space model of the drone with Kinematics and Dynamics model equations, to evaluate the effect various parameters like current torque speed, how much current is drawn by the motor, etc on the battery.

- Develop an analytical model.

- Testing the drone with real data through attached sensors.

- Develop a data-driven model to validate results.

Literature

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3. Cyber-Physical Systems with Multi-Unmanned Aerial Vehicle based Cooperative Source Seeking and Contour Mapping - Jinlu Han (Utah State University) - *2014*
4. On-board Sensor Data Monitoring System For Unmanned Aerial Vehicle PHM - Min Jiang, Benkuan Wang, Datong Liu - *2019*
5. Real time Diagnostics and Prognostics of UAV Lithium-Polymer batteries - Nick Eleftherogloua, Dimitrios Zarouchas - *2019*
6. Prognosis and Health Management for the prediction of the UAV flight endurance - R. Schacht Rodríguez, J.C. Ponsart, C.D. García Beltrán - *2018*
7. Intelligent data-driven prognostic methodologies for real-time remaining useful life of Lithium Polymer batteries of unmanned aerial vehicles - Sina Sharif Mansouri, Theodoros Loutas - *2019*
8. Survey on Unmanned Aerial Vehicle Networks: A Cyber Physical System Perspective - Senior Member IEEE - Jiao Zhang, Jibo Wei, Member, IEEE, Senior Member IEEE - Jiaxun Li - *2020*
9. Actuator fault detection and isolation on a quadrotor unmanned aerial vehicle modeled as a linear parameter-varying system Julio Alberto Guzmán-Rabasa, Francisco Ronay López-Estrada, Brian Manuel González-Contreras - *2018*

Drone & Sensor Data

DJI Mavic Mini - 2

Detailed specifications - https://www.dji.com/mini-2/specs

Sl. No.	Drone parameters	NASA dataset parameters	
1	time(millisecond)	time(ms)	
2	datetime(utc)		
3	latitude		
4	longitude		
5	height_above_takeoff(feet)		
6	altitude_above_seaLevel(feet)		
7	height_sonar(feet)		
8	speed(mph)		
9	distance(feet)		
10	mileage(feet)		
11	voltage(v)	voltage(V)	(Drawn from the battery)
12	max_altitude(feet)		
13	max_ascent(feet)		
14	max_speed(mph)		
15	max_distance(feet)		
16	xSpeed(mph)		
17	ySpeed(mph)		
18	zSpeed(mph)		
19	compass_heading(degrees)		
20	pitch(degrees)		
21	roll(degrees)		
22	isPhoto		
23	isVideo		
24	rc_elevator		
25	rc_aileron		
26	rc_throttle		
27	rc_rudder		
28	rc_elevator(percent)		
29	rc_aileron(percent)		
30	rc_throttle(percent)		
31	rc_rudder(percent)		
32	gimbal_heading(degrees)		
33	gimbal_pitch(degrees)		
34	battery_percent		
35	voltageCell1		
36	voltageCell2		
37	voltageCell3		
38	voltageCell4		
39	voltageCell5		
40	voltageCell6		
41	current(A)	current(A)	(Drawn from the battery)
42	battery_temperature(f)	battery temperature(C)	
43	altitude(feet)		
44	ascent(feet)		
45	flycStateRaw		
46		battery capacity(Ah)	$5/ month
47		load current (A)	(Taken by the load)
48		load voltage(V)	(Taken by the load)