TEAM 033

Drone Based System for Pavement Inspection

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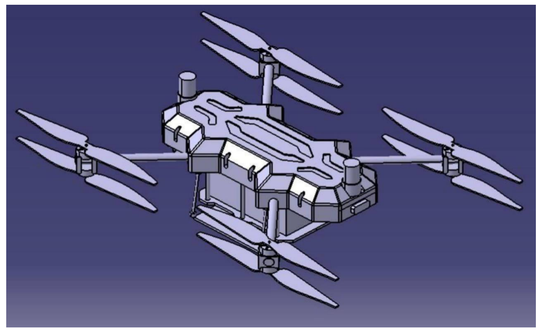
PROPLEM STATEMENT

The Drone-Based Pavement Condition Monitoring System is designed to detect and localize pavement defects accurately and efficiently using a quadcopter equipped with a variety of sensors and a built-in camera. The system focuses on collecting and analyzing sensor data to assess pavement conditions in real time, while the camera supports visual documentation and verification of the monitored areas. This approach ensures efficient, reliable, and comprehensive pavement inspection with minimal human intervention.

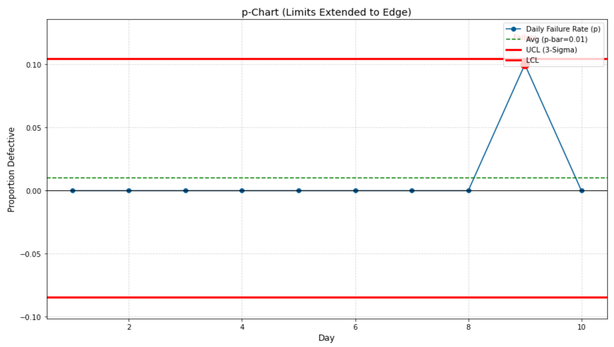
Prototype design

- CAD Model of the system was designed using CATIA V5



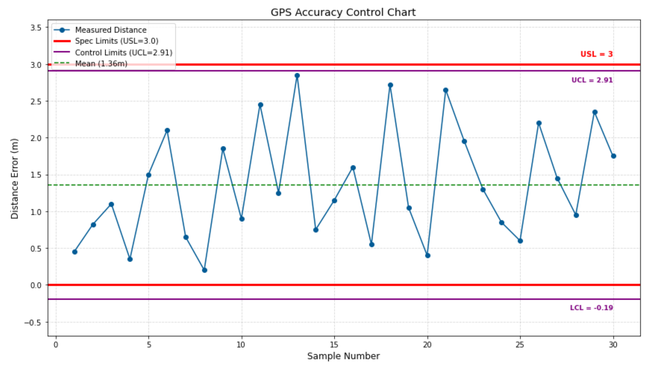
Testing

- **Test:** 10-day endurance run (100 total cycles).
- **Metric:** Component failure proportion (P-Chart).
- **Result:** Reliable System maintained near-zero failure rate.



Validation

GPS accuracy verified across multiple locations in KFUPM.
Max deviation allowed < 3 meters.
Validated. Average error was 1.36m (well within limits).



Specifications

maximum payload = 2KG

frame size of the drone < 50 cm (diagonal motor-to-motor)

Battery capacity should <= 5000 mAh
The drone fly altitude: 1.2 m

maximum flight speed = 2 m/s

minimum flight time = 15 minutes
communication range ≥1.3 KM

must operate reliably in ambient between 0°C and 50°C

Minimum air resistance of 3.5m/s
must operate on: 5V

Integrated Specifications

The system shall have a failure probability < than 1% per run

Should cover $1000m^2$ per run

Location accuracy of 3 meters or better

Constrains

Drone maximum take-off weight of 25kg (GACAR 107).

Easy part replacement.

The attachments should not have negative impact on the drone aerodynamic.

Maximum initial investment of SR 5,000.

Operate should be certified by GACA (GACAR 107).

Drone should have GPS tracking system (GACAR 107).

Maximum altitude of less than 120m AGL (GACAR 107).

Conclusion

The interdisciplinary UAS platform successfully achieved all safety and performance standards for automated inspection. This validated system reliably converts raw pavement data into optimized maintenance routes, establishing a robust and efficient solution for modern runway management.