Drone Delivery System for Restaurant Orders
Team 127

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KFUPM Design Expo

Background

The project aims to develop a system to deliver restaurant orders in cities with high population density, and address problems such as delivery delays and cold meals. The system will provide high efficiency, lower costs and increased accuracy compared to traditional delivery methods. The novelty of this idea lies in the use of drones specially designed for restaurant delivery. While drone delivery systems have been explored in many industries, the focus on restaurant orders is relatively new. By targeting this area, the project can address the unique challenges and requirements of delivering food quickly and efficiently.

Introduction

– Problem Statement

Today's food delivery process faces challenges with long delivery times, traffic congestion in densely populated cities, and human errors. A drone-based solution is needed to improve delivery efficiency, reduce costs, and enhance customer satisfaction.

– Constraints
- ❖ Restricted Operational Distance
- ❖ Limits on Weight and Cargo
- ❖ Requirements for Landing and Delivery Locations
- ❖ Dependency on Weather Conditions

– Target Specifications
- ❖ Delivery Speed (From 30-40)
- ❖ Lead Time Order (Less than 30 min)
- ❖ Payload (Up to 2.5 kg of the order weight)

– Project Impact

The project has Impacts in many fields such as: Public Health, Safety, Global, Welfare, Cultural, Social, Environmental, Economic.

Product Design

The System Consists of:
- Drone
- Container
- The Web Site (Called NAZEL)

The Detailed Specifications

Metric	unit	acceptable value	ideal value
Weight	kg	(15-20)	16
airspeed	km/h	40-60	70
operating temperature	Celsius	-10 to 40	0 to 40
vertical speed	m/s	(3-6)	7
Lead time	Min	<50	<30
charging time	min	(60-90)	50
maximum payload	kg	(1-5)	6
maximum weight to take off	kg	24	27
camera resolution	pixel	(2-50)	50
altitude	m	200	250
flight time	min	(22-28)	35
range	km^2	(5-9)	10

Prototype Design

Testing / Validation

Controller Gravity Location Model

$$TC = \sum_{n=1}^{k} d_n D_n F_n$$
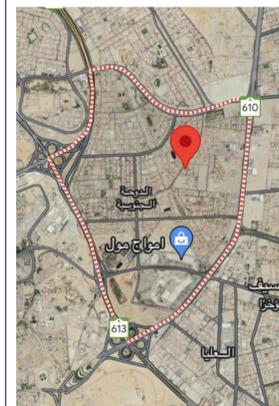
x_n , y_n : Coordinates of either customer or restaurant location n

F_n: cost of shipping one order for one KM

D_n: Num. of orders to be shipped between restaurant and customer per month

$$d_n = \sqrt{(x-x_n)^2 + (y-y_n)^2}$$

Controller Location	
x =	0.5
y =	0.5
Objective	
Cost =	$ 35

System Architecture

Ultrasonic Sensor	Arduino Uno
T- Motor	Controller
Battery	Camera

Conclusion

In conclusion, the combination of drone and a connected website for meal delivery presents a compelling solution with multiple benefits. It not only contributes to environmental sustainability by reducing emissions and traffic congestion but also enhances convenience, efficiency, and customer satisfaction. By embracing this innovative approach, we can pave the way for a more sustainable and technologically advanced future.