DRONE DELIVERY WITH OBJECT DETECTION

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Introduction

The evolution in technology over the last century has changed people's approach in performing daily activities. This is often evident when considering, washing machines, dish washers, vacuum cleaners, etc. We observe the focus on "drones" (unmanned aircrafts directed by remote control) and Unmanned Aerial Vehicles (aircrafts piloted by remote control) which are now widely available in the commercial market, among many other advancements. In fact, commercial drones and UAVs are quite cheap instrument that enables users to access areas that are normally difficult/dangerous to reach. Drones and UAVs could soon bring enormous changes in delivery services. A delivery drone typical design is about what is being delivered, and where it must be delivered. As a consequence, the application of drones in last mile delivery introduces new issues to handle. The future challenge underlying this application is not so much the design of drones for parcel delivery, but to provide the security to customers (i.e., sender/receiver)

Objective

Unmanned aerial vehicles (UAVs), or drones, have been successfully utilized in disaster management, 3D mapping and precision agriculture. Recently, drones are considered as an effective solution to express delivery. Drones will soon be delivering the packages, but the concerns are receiving damaged packages, interference from people and weather, and packages being delivered to the wrong address. This project is mainly concerned with safe and secure delivery. The main objective of our model is to detect the object (product for delivery) and notify both sender and receiver the details of the object. In this model, we aim to build a drone that delivers faster, also detects the product and notifies the details to the users.

Methodology

3.1. Methods and Procedure

As shown in figure 1, there are few simple steps in this method:
1. Detect the object
2. Send text message to sender and receiver
3. Take off from the base location

4. Go to delivery location
5. Drop the package in the location
6. Return to the base location

This model uses a first-person view drone (FPV) which is an UAV with a camera which transmits the live video feed to mobile device, goggles, a headset or any another display devices. The pilots of FPV drones see what the drone sees, by using this drone we ensure the proper pickup and dropping of the package

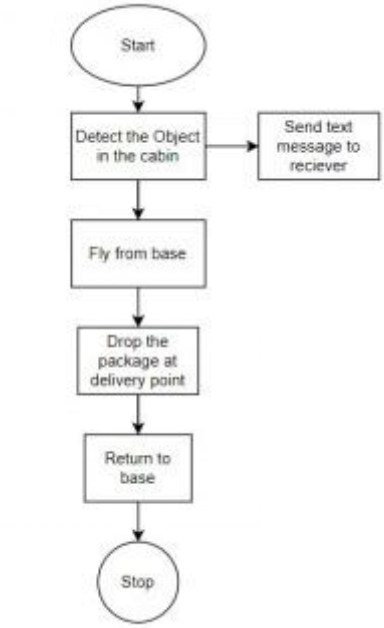

Fig. 1: Working model of drone

To detect the object, this model uses PIR infrared sensor which is placed in the delivery cabinet. ESP32 cam module captures the image of the object with Arduino uno r3, and PIR sensor connected with SIM900A GSM GPRS Module with RS232 Interface to send the text message through telegram bot. The sensor detects when the object is placed and notifies the end users with captured image of object and a message.

Working
To assemble a FPV drone we need several parts. Usually, FPV drones are either H or X shaped. We assemble a X shape drone so that it’s easier to place a delivery cabinet for the drone. A typical FPV drone parts are as mentioned below:
1.4 Propellers
2.4 Motors
3.Frame
4.Electronic Speed Controller(ESC)
5.Flight Controller
6.Lithium-Polymer Battery
7.Antenna
8.Radio Control Transmitter and Receiver

The drone is now a fully manual drone, pilot uses a remote to operate the drone, it has a control range of 40 km i.e., LOS of front camera in the drone is 40km. The pilot can see everything in a 40km range from where drone is. The flight time of the drone is 7-8 mins with a maximum speed of 140-180 kph. Drone uses a Li-Po battery which rechargeable. The drone now weighs 650 gm.
Additionally, for drone delivery we have included a delivery cabinet to the model which has a payload of 500 gm and flight time of 5 mins with payload. To add a cabinet, we've included a servo of 9 gm. The cabinet's servo is used to close and open the door of the cabinet.

Object Detection Module:

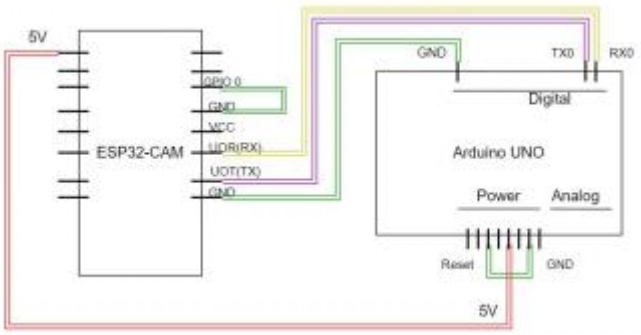

Fig.2: ESP32 CAM to Arduino UNO board

ESP32-CAM is a small, compact ESP32-based development board with an integrated camera. It also has GPIO pins to connect it with few modules and a Micro SD card slot for reading and saving images and data. We program both PIR sensor and ESP32 board using Arduino IDE
As shown in fig.2., we have used an ESP32-CAM to construct a motion sensor detector with photo capture in this model. When your PIR sensor detects motion, it awakens, takes a picture, and stores it in the micro SD card.

SMS Alert Module:

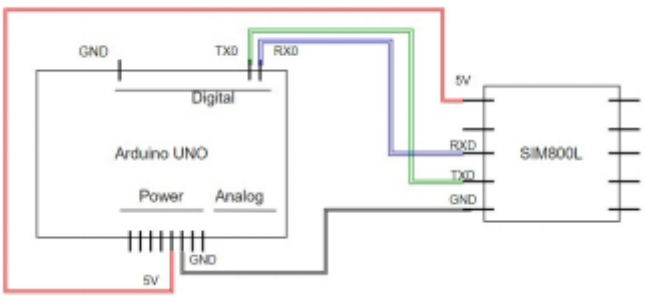

Fig.3: Arduino UNO board to GSM SIM800L

We used SIM 800L module which is a miniature cellular module that allows for GPRS transmission and to send and receive messages. The SIM 800L is interfaced with Arduino UNO board. Once the object is detected, an SMS is sent to the receiver & the images

which are captured will be sent to a software application of the mobile This project makes use of GSM technology to communicate between mobile and embedded devices.

Delivery Module:

This module refers to moving product from point A to point B, and back to point A. This model is manually controlled by the pilot. The model with payload of 500gm capacity, with speed 140 kph. The flight time is 15 mins with payload. Once the product is received from the sender the pilot directs the drone to the delivery location. Once at the receiver's destination, the pilot slows down the drone, descends to delivery approximately 5-7 meters from the ground and then releases the product in the cabinet in the delivery point. Once the product is dropped in the destination, the drone takes off from the destination and its way back to the pilot/sender.

The receiver needs ensure to collect the product when dropped. The only requirement from the end user in this module is to ensure there is enough place to drop the package.

Result and Conclusions

This method has successfully delivered a product in online shopping, but it can also be utilized for other objectives, such as providing medical services or military purposes, particularly in a country like India, where logistics encounter numerous challenges on the ground. Although the primary focus of our research was on ensuring secure delivery, this module assures the model's safety by sending an SMS when the product is discovered, preventing fraud and incorrect delivery.

Scope for Future work

This project deals with a systematic process of online delivery using manual drone assuring the safety of the product being delivered. The drone will deliver the parcel to the customer following manual instructions. However, the future scope remains of designing an autonomous drone.

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