

# Autonomous Operation and Controlling of Unmanned Ariel Vehicle (UAV) using Internet

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**Abstract** - Nowadays, Unmanned Aerial Vehicle (UAV) is an important technology for military and security application. Various missions can be done using UAVs such as surveillance in unknown areas, forestry conservation, disaster affected areas and spying enemy territory. Application which is developed in this research has a purpose to simulate condition in war zone for spying the enemy. This system consist of a multipurpose drone with features like HD video recording camera, night vision, drop facility (used for delivering food packets and health kits to soldiers on war field), Radar, water landing capability, Integrated GPS module for long distance controlling and data transmitting. It also includes computer software for drone and controller interface. Through utilizing modern telecommunication networks, we present a UAV capable of intelligent remote waypoint navigation. Through the use of a web interface employing mapping software, users are able to specify remote waypoints for the UAV to navigate. The UAV maintains an internet connection through 4G LTE (or 3G if necessary), allowing monitoring and control within regions of no Wi-Fi or radio reception. The UAV is controlled through a Raspberry Pi, employing GPS and 4G modules, along with a suite of sensors including a 10 megapixel camera. Utilizing various image processing algorithms for object detection, the UAV can coordinate flight patterns to perform tasks such as object tracking and surveillance. Through utilizing GPS in tandem, the UAV can perform intelligent searching operations.

**Key Words:** UAV, Security and Surveillance, GPS, Monitoring, Camera, Internet

## 1. INTRODUCTION

The UAV is an acronym for Unmanned Aerial Vehicle, which is an aircraft with no pilot on board. UAVs can be remote controlled aircraft (e.g. flown by a pilot at a ground control station) or can fly autonomously based on pre-programmed flight plans or more complex dynamic automation systems. UAVs have most often been associated with the military but they are also used for search and rescue, surveillance, traffic monitoring, weather monitoring and fire fighting, and other applications.

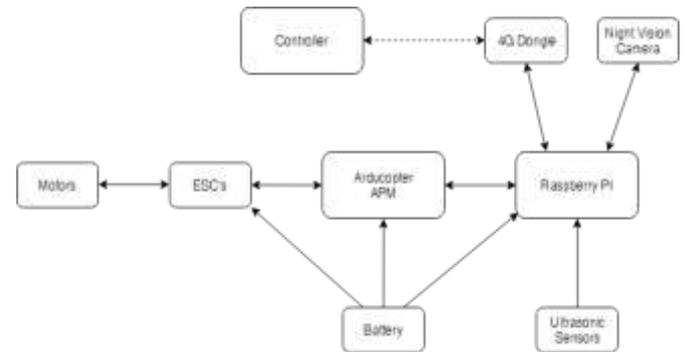


Fig -1: Block Diagram

Various missions can be done using UAVs such as surveillance in unknown areas, forestry conservation, and spying enemy territory. UAVs are also being used for monitoring remote land areas that are difficult to reach by foot. This UAV can be controlled via the internet and it will be accessible from anywhere. It will be equipped with pick and drop facility to provide delivery of med kits, food packets during natural calamity.



Fig -2: Actual System

### 1.1 AUTONOMOUS OPERATION USING GPS

An UAV can be controlled using plethora of software's however we are using the software named "Mission Planner" to control the UAV autonomously. In this system drone is able to utilise a variety of on board sensors to complete tasks. Two common sensors are global positioning system (GPS) devices and cameras. Through the use of a GPS device, the drone is able to locate itself in terms of latitude, longitude and altitude. This system can be used to allow the drone to follow a set of predefined waypoints. The

number of waypoints can be decided by the user and height of waypoints can be different at different positions. An on board camera can be used to allow the drone to perform tasks based on what is immediately visible.[1]

The system consists of four Ultrasonic Sensors which acts as Radar to display the information about different obstacles in the traced way of UAV. The sensor checks for obstacles in the way of UAV within distance of 2 meter. If any obstacle is detected in the way then tries to avoid that obstacle and moves the drone in opposite direction. In case of autonomous flight if there is latency or range issue then drone returns back to its home location.



**Fig -3:** Waypoint Selection for Autonomous Flight

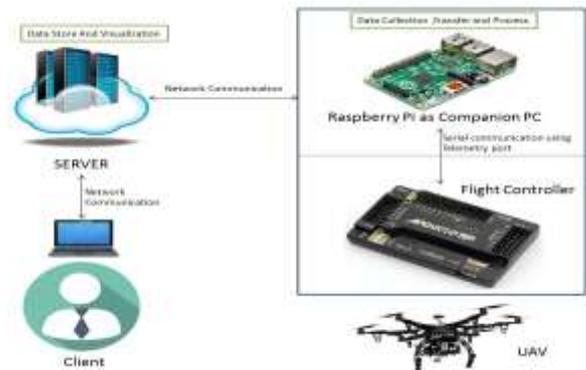
### 1.2 UAV CONTROLLING THROUGH INTERNET

For the time being the UAV's are controlled usually by transmitter and receivers which gave limited range for operation. In this system the UAV we controlled through internet using 4G dongle or using Wi-Fi. This ideology consists of a Raspberry Pi module and laptop or computer. The Raspberry Pi module works as a receiver for system which takes data from user and sends it to flight controller used.

To configure this network architecture we have done interfacing between Raspberry Pi and flight controller "Arducopter" by connecting telemetry port of Raspberry Pi to Arducopter. This is connection establish a serial communication between client and UAV using telemetry port.[2]

After worth once connection is established between Raspberry Pi and flight controller the raspberry Pi reads data from the user which can be given by either using a specifically designed webpage or developed application for handling of UAV. The Raspberry pi decodes that data and sends it to the flight controller i.e. Arducopter and UAV can be controlled over the internet. This facility provides the range problem of transmitter and receiver occurred in normal UAVs. By using internet or Wi-Fi connection user can

easily control UAV by his/her laptop, PC or even smart phone. [3]



**Fig -4:** Network Architecture for Internet Controlling

### 1.3 VIDEO STREAMING THROUGH INTERNET

The webpage display provides live video streaming and show information about latitude, longitude and presence of enemy in warfare conditions or people in disaster situations. The host server sends information to client server and user can see it on screen on webpage this the way the network architecture and designing of webpage is done.[4]

To design this system we firstly install the Raspberry Pi OS in computer and connect the Raspberry Pi to internet by using Raspbian and by entering correct username and password. This connects Raspberry Pi to internet. To get live video streaming we use following steps:

1. Open the web browser and enter the IP address of device.
2. Set default username and password
3. To start installation use "sudo apt-get install motion"
4. After installation use "sudo nano etc/motion/motion.conf"
5. Set frame rate in between 1000-1500
6. Set 'quality' to 100
7. Set 'width' and 'Height' to 640 and 480 respectively
8. Set "start\_motion\_daemon"
9. Write command "sudo motion" to start the server.



**Fig -5:** Webpage Design for live video streaming

### 1.4 PICK AND DROP FUNCTION

UAV are nowadays can be used for multipurpose applications such as surveillance, rescue, monitoring events etc. In this system we are adding a new function pick and drop in UAV which can be used in rescue operations such as disaster conditions, warfare etc. In this system we are using two separate modules one for pick and drop and another for only drop function.

This function can pick any object of maximum load of 400 grams and can drop it wherever it is desired. In disaster conditions this function can be used for drop facility by using a separate module which can lift any payload such as food and health packets, radio devices up to 750 grams.



**Fig -6:** Module for Drop Function



**Fig -7:** Mantis Claw

### 1.5 WATER LANDING AND TAKEOFF CAPACITY

During disaster situations like flood, tsunami where human help cannot reach at such conditions UAV can provide help for people in those conditions. During such situations UAV may have to land on water surface. In our system we are designed a UAV which can land on water safely and also can takeoff from water surface.

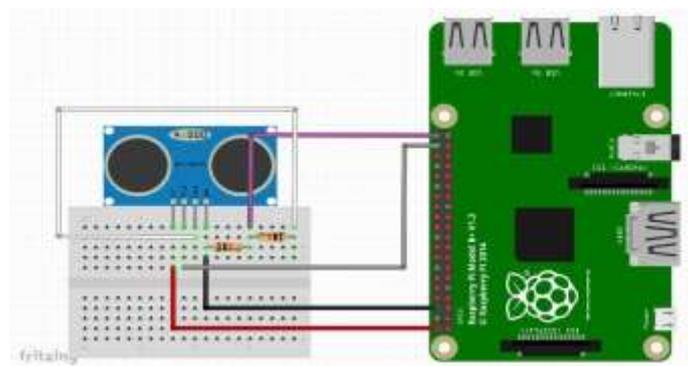
### 1.6 COLLISION AVOIDANCE SYSTEM

The system consists of four ultrasonic sensors which work as radar system. The four sensors are placed in four directions which detects objects coming in path within range of 2 meter. The sensors are interfaced with Raspberry Pi.[5]

The ultrasonic sensor consist of one or more ultrasonic transmitter, receiver and control circuit which emits a high frequency ultrasonic sound which bounce off any nearby solid objects and objects gets detected. The HC-SR04 Ultrasonic sensor we are using in this system for

Raspberry Pi has four pins; ground, Vcc, ECHO and TRIG. We use Raspberry Pi to send an input signal to TRIG which triggers the sensor to send an ultrasonic pulse. These pulse waves bounce off any nearby objects and some of the waves are reflected back to sensor. The sensor detects those waves and measures time between the triggered and returned pulse and then sends 5V signal to ECHO pin.

ECHO will be “low” until sensor is triggered when it receives the echo pulse. Once a return pulse has been located ECHO is set “high” for duration of that pulse. The python script therefore measures the pulse duration and then calculate distance from this. In this way distance of object from UAV is calculated.

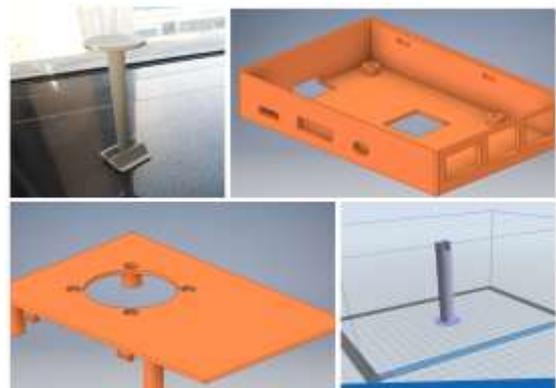


**Fig -8:** Interfacing of Raspberry Pi with ultrasonic sensor

### 1.7 3D PRINTED DESIGNS

In this system we use some 3D printed designs for various purposes such as for UAV stands, GPS stands, and Raspberry Pi case to reduce the weight of UAV because of which it can use minimum battery and helps motors to produce maximum thrust.

To make 3D designs we use “Inventor” software and after designing to 3D print those models we have used “Flashprint” software which is designed for 3D printer. After models are ready they are printed in 3D printer. Such objects help to minimize weight and helps UAV to produce maximum thrust



**Fig -9:** 3D Printed Designs

## 2. CONCLUSIONS

This paper presents a highly polished and tested user interface and control server software package enabling autonomous control of a UAV. This software was applied to an UAV which was modified to enable control through a Raspberry Pi computer. This software package allows a user to interface with a UAV through a variety of input devices, such as smart phones, tablets, and personal computers. The functionality to specify waypoints for UAV to traverse and regions for the UAV to scan over utilizing a camera is provided through the interface.

The interface was developed utilizing existing web technologies for a uniform experience across a multitude of devices and browsers. Capable of working online, the interface provides online mapping data and live video feeds from a connected UAV. UAVs may be connected to the interface through a Wi-Fi network, or through 4G LTE, allowing for control at great distances.

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