

(bomb, first aid, guns, bullets etc), reconnaissance, target tracking and recognition etc [5].

UAVs are the bird-shaped fixed wing drones and generally preferred over rotor or multi rotor drones due to their longer range, larger endurance time and less acoustic and infrared signatures which are boost for hiding from the satellite. Small UAVs which comes under 2-25 kg weight class are easier to carry and most popular among the surveillance activities around the globe [6]. Although these UAVs lack to deliver high quality image and video data due to lower data transfer rates over longer distances with limited bandwidth. Most of the international defense organizations still face problem in developing a robust data link service for long range video transmission.

This paper majorly concentrates on the integration aspects of video and data telemetry system for a general purpose UAV. Drone communications can be classified into four main types, Drone-to-Drone (D2D), Drone-to-Ground Station (D2GS), Drone-to-Network (D2N), and Drone-to-Satellite (D2S). In this experiment, our objective to test the long range video and data transmission system was carried using Drone-to-Ground Station communication [7]. A dedicated video telemetry system consists of three major components: Airborne Camera, Airborne and ground Transceiver along with associated antenna and a ground control software. In Fig. 1 for down-link transmission, the system should be capable of transmitting video signal from UAV to GCS and for up-link transmission, the system should be capable of transmitting command (data) signal from Ground GCS to UAV.

Rest of the paper is arranged as follows: Section II describes the components of the telemetry system and detailed description of their important parameters. It also explains the integration aspects of the experimental setup and interfaces of the telemetry system in Section III. There are experimental results and comparison of desired versus available parameters of the components that affects 20-30km range of video and data transmission in Section IV followed by Section V that concludes the paper.

II. COMPONENTS OF TELEMETRY SYSTEM

A data and video telemetry system may be divided into three main components- Transceiver, Antenna & Camera

There is the detailed analysis of the main parameters of these components that affects long range transmission of data and video.

A. Camera

Camera is the main sensor used in a video telemetry system. Digital cameras are generally used for recording video and capturing images of terrain from UAV so that further image processing is possible.

Many military operations are preferred at night, therefore, dual sensor Electro-optical/ Infrared (EO/IR) cameras are used which allows thermal imaging at night.

Since UAVs comes in various sizes, the suitable camera should be chosen accordingly.

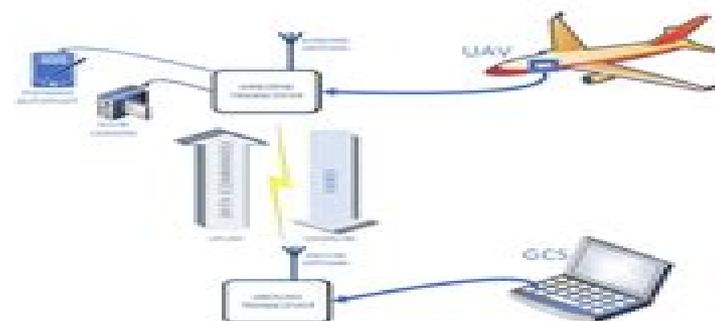


Fig. 1. Video and Data Link System for UAV

Main requirement of camera is based on the following parameters:

1) **PTZ**: The camera should be capable of PTZ for capturing a larger aerial view of the target from a higher altitude. For this 3-axis gimbals are preferred over 2-axis ones due to higher stability. Accurate 3-axis (x, y, z) gimbal is required for the proper aerial video recording since they have three motors for the stabilization in all the 3-axis. Zoom is considered when the UAV is desired to perform a surveillance mission for International territories.

2) **Night vision**: Generally infrared (IR) sensors are used for night vision which detect infrared energy through the lens which is intercepted by camera. Lens focuses IR light into an IR sensor array and thousand of sensor arrays convert the energy into image. Night vision cameras are mandatory for carrying night missions especially in military forces, to keep an eye on the movement in sensitive areas.

3) **SD card**: SD card slot allows the on-board video recording so that the camera is able to record large size video for longer duration that is capable of recording the raw video data in desired format.

4) **FPS**: FPS is usually in NTSC and PAL colour standard depending upon the geographical location. NTSC format is used in 24, 30 and 60 fps whereas PAL format is used in 25 and 50 fps. 60 fps is used for sports or drones in order to see slow motion; 30 fps in television, news, industrial videos; 24 fps in cinematography whereas 25 fps is generally used for the broadcast. [18]

5) **Shutter speed**: Shutter speed is the amount of time shutter takes to open and it is preferable to be always higher than the fps to avoid the frame duplicity. [19] This parameter plays a major role in deciding the number of pictures UAV can capture for a given speed and altitude maintaining a safe overlap distance among subsequent images, later processed for creating digital elevation model, surface model, terrain models etc for a land survey.

Lowpower Wireleb Optical Transmibion Systems For Communications Telemetry And Control

Yijin Wang



Lowpower Wireleb Optical Transmibion Systems For Communications Telemetry And Control:

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In a digital era where connections and knowledge reign supreme, the enchanting power of language has be apparent than ever. Its ability to stir emotions, provoke thought, and instigate transformation is truly remarkable. This extraordinary book, aptly titled "**Lowpower Wireleb Optical Transmibion Systems For Communications Telemetry And Control**," published by a very acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound impact on our existence. Throughout this critique, we will delve to the book is central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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