First Person View on Flying Robot For Real Time Monitoring

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Abstract— **Radio control nowadays not only control the car but can control the copter. First Person View is a way to change the viewpoint of the controller looks like in the copter. By using radio telemetry communication that sends video data from the camera on the copter and will be shown on a display on ground station. Radio telemetry communication will use wideband modulation techniques to transmit video at high speed until the video is shown to be a real time video. The transmitter has been designed which is able to transmit video data up to 1 kilometers. Good quality video data can be sent about 500 meters below. measurement of Peak Signal to Noise Ratio (PSNR) that distance and wall are greatly affect the quality of the video. Deficiencies in the delivery of video communication can be minimized by increasing the gain and transmission power of the radio frequency telemetry and matching between the video telemetry radio and radio control copter.**

Keywords— Hexacopter, Remote Control, Telemetry, Receiver, Transmitter, FPV, PSNR

I. INTRODUCTION

Hexacopter controllers often only done at close distances, due to the limitations of the controller to see hexacopter. To overcome it, then do the monitoring on the area around the copter can make controlling hexacopter at longer distances. Monitoring is monitoring carried out to collect data and make measurements progress toward an object. One way to do air monitoring at the hexacopter using First person view (FPV). FPV makes the controller has a point of view seems to be inside the hexacopter. To do perancagan it takes some additional data communication with the device at high speed. Some of these devices such as mini-cameras, video sender and display.

II. MATERIALS AND METHOD

A. Hexacopter

Among world Aeromodeling may already be familiar with the term Multirotor or Multicopter. Multicopter is the spacecraft flown by the rotor, which amounted to more than one, is divided into several types that are widely used for beginners which include twincopter (2 rotor), tricopter (3 rotor), quadcopter (4 rotors) and for the more advance for Arial Video or photography where benefits have a bigger lift making it capable of raising professional camera/video i.e., hexacopter (6 rotors) and octocopter (8 rotors) [1]. Hexacopter using three pairs of propeller CCW CW with into 6 propeller. Where each pair of opposite motor rotates in the opposite direction. This allows the copter to turn (yaw) right or left by speeding up and slowing down one pair and another pair of rotors. Horizontal movement is done by accelerating the rotor (increasing thrust) on one side and decrease it. [1]

There are 2 Configuration synchronization motor brushless commonly used at the hexacopter, namely configuration frame plus (+) and the frame X (x).

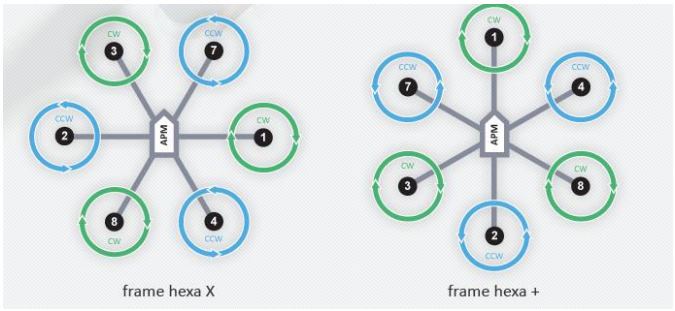

Fig. 1 Frame Hexacopter

B. Monitoring system

The monitoring system is a process of collecting data about themselves and perform analysis of these data with the aim to maximize all of its resources. Where is the data that has been collected real-time data, whether the data is obtained from the hard real-time systems and systems soft real-time. Processes that occur in the monitoring system generally has a 3 processes, namely data collection, data analysis, and show result data. Source of data to be retrieved may include information about the hardware, experiments on the system, or other sources to be obtained about the system itself. The process of data analysis is the selection of the data that has been obtained or can also be a manipulation of the data thus obtained the expected information. And featuring result data to be information from the previous process which is useful for taking decisions on the running system and can be a curve, images, tables or animation.

C. First Person View

First Person View or FPV is a system that change the way pilots (vehicle control) becomes as if it were on the bicycle itself. Vehicle radio control (RC) which is controlled from the pilot viewpoint originated from an onboard camera and transmitted via wireless to a display, using either the LCD monitor or goggles porteble. FPV involves installing a small video camera and video transmitter analog RC plane and flew via live video, usually displayed on a video glasses (goggles) or a portable LCD screen. As a result, FPV aircraft can be flown well beyond visual range which is limited only by the reach of the eye while flying vehicle. [3]

D. Peak Signal to Noise Ratio (PSNR)

Video quality measurement method is the calculation of widespread Peak signal to noise ratio (PSNR) image after image. PSNR is a derivative of the signal to noise ratio (SNR) that compares the error signal energy with energy. PSNR is the basis of the quality metrics used in the framework to test the results of video quality. PSNR comparing the maximum possible signal energy to the energy error, which has been shown to result in a higher correlation with subjective quality perception with conventional SNR.

$$PSNR(n)_{db} = 20\log_{10}\left(\frac{V_{peak}}{\sqrt{\frac{1}{N_{col}\,N_{row}}\sum_{i=0}^{N_{col}}\sum_{i=0}^{N_{row}}[\,Y_S(n,i,j) - Y_D(n,i,j)]^{\,2}}}\right) \quad (1)$$

E. Transmitter

Data transmission from the camera to the display using medium frequency radio with a high frequency is 5.8 GHz. transmitter has some electronic circuit to modulate the input signal into an analog signal to be transmitted as a VCO (Voltage Controlled Oscillator), PLL (Phase-Locked Loop), amplifiers, and digital control circuits.

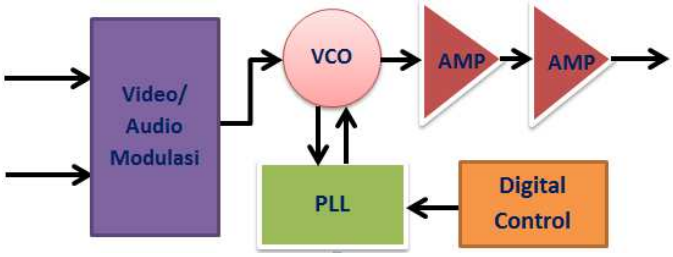

Fig. 2 Block Diagram of The Transmitter

F. Receiver

Receiver is also a combination of some of the same series as the transmitter, such as a VCO (Voltage Controlled Oscillator), PLL (Phase-Locked Loop), amplifiers, and digital control circuits. But the difference between the transmitter and receiver are on the receiver there is also a series of LNA (low noise amplifier) as the received signal amplifier, then there is a low pass filter (LTF) and SAW filters for filtering the received signal from the noise, and mixer circuits to separate between data signal and the carrier signal.

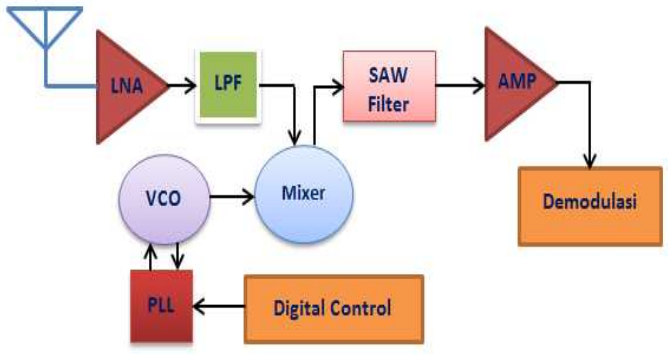

Fig. 3 Block Diagram Of The Receiver

III. DESIGN AND IMPLEMENTATION SYSTEM

FPV system starts from a video capture performed by the camera and the camera will send the data to the telemetry. In the video data telemetry will be superimposed on the carrier signal is sent over the air to the receiver. Receiver will separate the information signal and the carrier signal. Then the signal information will be sent via Audio Video output to the display. Display will featuring video data so the area around the copter can be monitored.

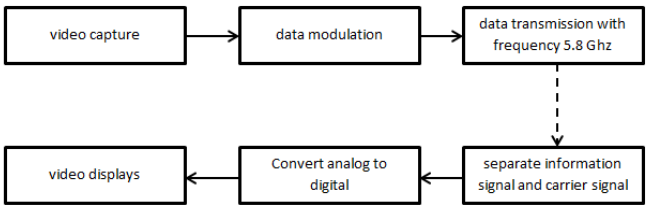

Fig. 4 Comunication Block

A. Hardware design

Mini camera will be mounted on the gimbal frame hexacopter used as video data retrieval module. TX TS832 is a telemetry transmitter used to send the data have been taken from the mini camera. Data received from the camera will TX TS832 modulated and converted into an analog signal that is modulated. Analog signal that has been modulated spread in the air and then propagate that can be received by the RX RC805. RX RC805 is a telemetry receiver which will demodulate analog signals into analog data captured. Analog data which is output from the RX RC805 actually can be displayed on the display but in this study the data must be processed and analyzed, the data will dimasuk to analog converter. In the analog data converter is converted into digital data and entered into the display or PC to be processed and displayed.

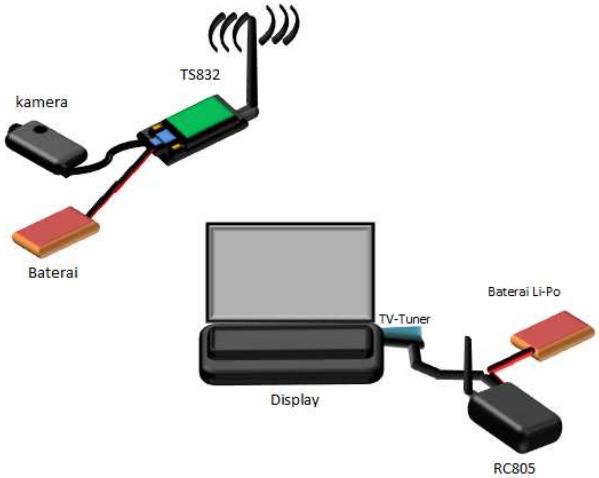

Fig. 5 Hardware Design

IV. TEST RESULTS AND ANALYSIS

Tests carried out to analyze the farthest distance to monitor use hexacopter. Testing is done from a distance of 1 meter to 1 kilometer where the distance is the distance between transmitter and receiver. The result will be a comparison

between the data before it is sent and the data is sent after, to get the value of PSNR.

FPV system has been designed and can work well. Each component of the system can work well and the communication of data from the system is running as expected.

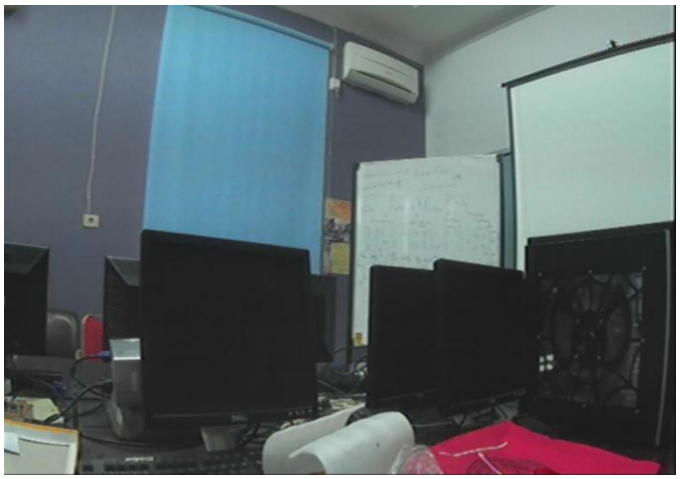

Fig. 6 Views On Display At Performance Testing System

In the first experimental results while the second condition has been met, but in close proximity. Maximum distance that can be on a video monitoring only 500 meters in the absence of obstacles between the transmitter and receiver. At a distance of more than 500 meters with the video quality will decrease PSNR below 30 db, thus proving that the distance affects the delivery of video data as well as lower transmission power so affects the video quality obtained.

Fig. 7 Results Video on Distance 500 Meter

V. CONCLUSIONS

FPV systems can work well, but the initial design of the device only uses the standard video transmission cannot be performed with optimal distance. This can be achieved by adding a power gain of the antenna used transmitter and receiver. With the addition of making quality video with low noise ratio at a distance of over 500 meters. but at a distance of 500 meters with good video quality monitoring is sufficient to perform the air video. Time delay that occurs is in the category can be tolerated because of the time delay is less than 1 second.

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