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Photogrammetry Image Processing for Mapping by UAV

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***Abstract*—Basic goal of this project is to image processing for the surveillance area in the low cost by using UAV. The image processing generates the mapping for the particular area. For the purpose of surveillance in terrain surface here the mapping is implemented with the photogrammetric tool. UAV having the more efficient for flying in all-weather condition with most protective reinforcement composite material. UAV is designed with more efficient for long endurance and range. Here the high efficient perspective, depth camera is used to mapping the terrain surface. The depth camera is depends upon the wide lens and also with the integration program. The autopilot is used for automatic controls for the aerial vehicle and the microprocessor is used to guide the mission plan for mapping. The mapping process generates and gives the output in form of metric images. During mapping the lightning condition are automatically guided by the integration of the camera with GPS. The camera is purposefully integrated with the GPS for the locating a surface or land. The output is examined by the tool and it is finally evaluated with the metric images.**

Keywords*— Photogrammetry image, Autopilot system, Image Processing, Mapping.

I. INTRODUCTION

In photogrammetric application the image processing are too efficient for mapping process. The UAV are starting to represent a larger importance in the aerospace sector due to the fact that it can execute the wide range of the mission. The development of optic electronics, Nano technology and composite materials make UAV projects innovative. In mapping the images are in the form of 2d later the images are converted into 3d by using the phogrammetry tool. The mapping tool which gives the accurate and perfect outfit for the image in metric scale analyse. For the mapping process the photographic methods are to be followed to capture the images in the certain range with the shutter correction ratings. The multiple images are captured and later the tool will mosaic the images for the output process. The necessary steps for designing and executing an aerial image acquisition mission are far from being well defined. If we isolate the involved products one by one, we would see impressive specifications: High resolution DSLR or compact cameras, navigation systems with fast CPUs, reliable GPS units and radio receivers. The integration of autopilot with the camera, microcontroller, microprocessor and powerplant are placed in the fabricated UAV. The process started from the autopilot by triggering the camera to take images with the integrated GPS and the shutter timing is adjusted over triggering camera. To sustain the vibration in the integrated board the autopilot is fine-tuned and it supported with the magnetometer. The telemetry is used for processing by receiving and transmitting the data from board to GCS. By continuing the process the image processing data are collected and it is evaluate with the photogrammetry tool. Finally, found a very cheap and easy way to acquire aerial images. A good satellite imagery was too expensive with big temporarily resolution suffering by high percentage of cloudiness and the pure conventional aerial mission, was also expensive. But those UAVs, equipped with autopilots which allowed them to fly on a much predefined path, was looking very promising. Now, after many years of developing and improvement we have arrived to the view of acquiring aerial images using unmanned small robust and lightweight airplanes, UAV.

II. FLIGHT CONTROL SYSTEM FOR UAV

UAV autopilot system is a close loop control system, which comprises of two parts like observer and controller. The most common is observer the micro inertial guidance system including gyro, acceleration and magnetometer. The readings are combined with the GPS information can be passed to a filter to generates the estimates of the current states for controls. The control systems will guide the UAV with its observation. In FCS the input controls are calibrated from maximum to minimum with the PID controller. The PID controller will generates the values by the calibration process as well as prediction of controls. The telemetry system will collect the data by receiving and also sending the data by transferring from the FCS. FCS will guide by the GCS or calibrated PID values.

Figure 1. Mission control system

Figure 2. Calibrating the PID Controls

III. AUTO PILOT SYSTEM

The result of flight planning was a carefully defined flight path. As input for the UAV navigation software GCS a text file was generated containing the status, image acquisition point numbers and coordinate system as well as parameter for flying velocity. Here the calibration remains constant until the flight control system end the process. From the FCS the mission got started to fly against the wind and the mission setup in RTL method.

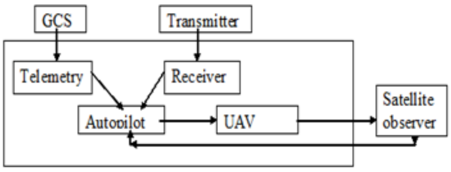

Figure 3. Flight control system for UAV

The APM board is the autopilot for the UAV mission, in this mission the multitasking information are proceed according the priority of the datum. The board which having the connector pin for telemetry, transmitter channel as input and output as servo control. In this the servo will govern over the autopilot system. An autopilot is a MEMS system used to guide the UAV without assistance from human operators, consisting of both hardware and its supporting software. Autopilot systems are now widely used in modern aircrafts and ships. The objective of UAV autopilot systems is to consistently guide UAVs to follow reference paths, or navigate through some waypoints. A powerful UAV autopilot system can guide UAVs in all stages including take-off, ascent, descent, trajectory following, and landing. The autopilot needs to communicate with ground station for control mode switch, receive broadcast from GPS satellite for position updates and send out control inputs to the servo motors on UAVs. There are also other attitude determination devices available like infrared or vision based ones.

The sensor readings combined with GPS information can be passed to a filter to generate the estimates of the current states for later control uses. Based on different control strategies, the UAV autopilots can be categorized to PID based autopilots, NN based autopilots and other robust autopilot. The calibrating controls are manipulated with the system and it integrated according to the system. The camera also integrated over the autopilot by the gimbal setting to hold the camera in stability factor. The autopilot will guide along with the waypoint navigation for image processing. For image processing mission planner will create the waypoints in the orthophoto method r oblique method. In orthophoto the parallel waypoints are plotted to guide the mission. Open source autopilot will helpful in the correction of the board to replace the some corrective control for detection. In open source the storage control are also corrected and calibrated for the mission process

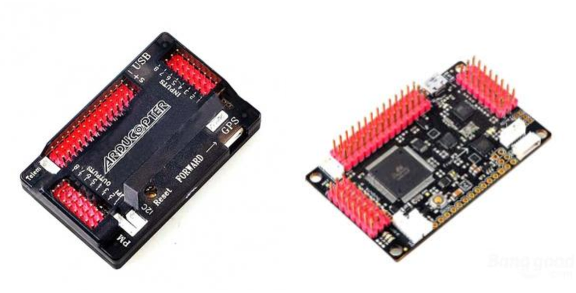

Figure 4. Ardu pilot (autopilot)

IV. CAMERA INTEGRATION WITH GPS

Here the camera integration states that the camera integrated with the GPS for triggering and communication purposes. The integrated camera is connected with the autopilot system and also the gimbal panel. Gimbal panel keeps the camera in the stability manner. This stability adjustment will give the images in efficient and depth clarity. Shutter timing is adjusted here for the process of taking frequent images. The frequent images [1] are more accurate for mosaic process in photogrammetry tool. Wider lens will give the more depth and clarity images according to the latitude and longitude correction. In this camera the wider angle is more than 24mm. CMOS and TFT are occurred in this camera for depth purposes. The shutter timing is adjusted for the frequent images, here the program explained that the progress of camera in wider, stowed and snapped. The adjustment of camera specification will give the continue proceeding of images. Overall the camera is integrated and pinned with the autopilot.

Figure 5. Cannon powershoot s100

```
@param o Zoom-Wide
@default o 100
@param i Zoom-frequent
@default i 30
@param s Zoom-snap
@default s 10

while 1
do
k = get_usb_power
until k>0
if k < 5 then gosub "ch1up"
if k > 4 and k < 8 then gosub "ch1mid"
if k > 7 and k < 11 then gosub "ch1down"
if k > 10 and k < 14 then gosub "ch2up"
if k > 13 and k < 17 then gosub "ch2mid"
if k > 16 and k < 20 then gosub "ch2down"
if k > 19 then print "error"
wend
end
```

```
:ch1up
print "Ch1Up-snap"; k
set_zoom s
shoot
sleep 1000
return

:ch1mid
print "Ch1Mid-frequent"; k
set_zoom i
sleep 1000
return

:ch1down
print "Ch1Down-Wide"; k
set_zoom o
sleep 1000
return

:ch2up
return

:ch2mid
return
   :ch2down
return
```

CHDK script integrated with camera for GPS synchronization and it gives the settings to integrate with lat and long, here the script is tuned along with the position vector and also with corrected angle. Then in mission planner along with the GPS integration the waypoints are listed out with the lat and long correction. The waypoints are pointed along with the home point in polygon plotting manner. In this plotting the continuous waypoints are given in the RTL mode. Mission startup from the initial stage and it ends up with the same point because of the mode plan. Here the script will track the image along with directory of images are been followed. Then the camera is corrected for image processing.

Each image having the set of steps, they are tracking of image-Directory of image-Satellite Timing-Camera time.

- The tracking of image is along with the mission plan and it corrected with lat and long correction.
- Directory of image is along with the kind of surface, how to be concerned and relevant with the processing.
- Satellite timing gives the correction of the image processing.
- Camera timing meant by the shutter timing and camera inclination.

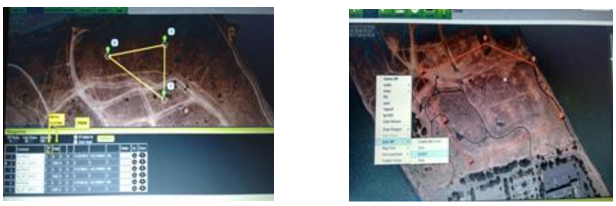

Figure 6. Waypoints for land surface.

V. IMAGE PROCESSING

Image processing for 3d images have upto now only been used in addition to taken images from the ground. The marked land surface is fully image processed by the fabricated UAV. In this the aerial image is the input and it process along with the parameters. Then the manual measurement and automatic generation of images are executed. Then the generation of image is bundled along with the tool and it implemented for the 3d processing.

Certain procedures for following image processing are,

- Multiple image matching
- Image matching primitives
- Image matching parameters
- Redundancy image matching
- Image surface modeling
- Image mosaicking [3]

The processing of image in the orthophoto pattern in this pattern the several amount of the point is marked in the pattern orientation. The pattern having the parallel waypoint pattern in this the images are captured multiple variation in the fraction of shutter timing. The shutter timing is depends upon the frame per rate. The frames are to be calculated for each and every image. The frames are depend upon the ground resolution with the 4cm with each respective image. The images are taken frequently by the camera with the help of the mission as well as the UAV. The images are snapped and saved in the memory devices and also the GCS. The GCS guide the system upto it reach the destination. The waypoint navigation guide the mission along with the system.

Using mapping software the following version of orthophotos of UAV is produced for data analysis:

- An orthophoto covering the marked site with the ground resolution of the 4cm and the 24cm grid size.
- Multiple orthophoto of the marked site with the ground resolution of the 2cm and the 20cm grid size.
- One orthophoto of the best preserved the marked site with the ground resolution of 4cm and the 10cm grid size.

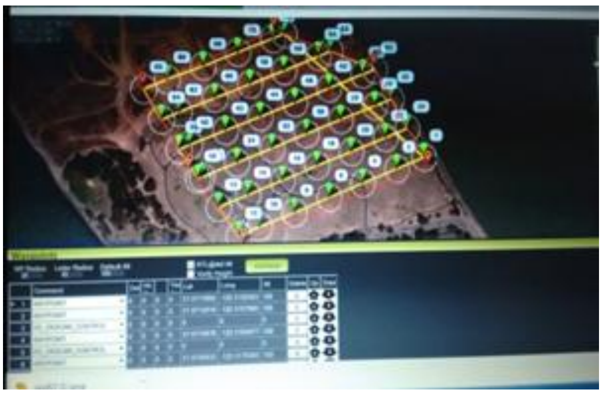

Figure 7. Orthophoto pattern

In this pattern the waypoint shows the multiple parallel lines to grap the images. The multiple lines gives the multiple images with the inclination of the 45deg for each image in the frame per rate. This images are captured along with the ground resolution and also with the factor of the surface mapping. This image are to be implemented in the mapper tool to be estimated in the 3d resolution. The 2d images are converted to 3d by using the mapper tool. The tool which is able to convert the image in the high resolution factor.

VI. TOOL SIMULATION

Here the tool is simulated with the captured image, this images are implemented to the tool for the conversion. The conversion is followed to be in different steps, they are captured image-Scanning of multiple image-Rectification of image-stitching and mosaic of images-conversion of images.

- Captured images-this images are in the 2d platform with the correction of the [2] lat and long errors. In this the images are been in multiple mode, that itself select the clear image for the rectification.
- Scanning of multiple image- scanning in the sense the images are in the mode of scanning to select the clear image from the multiple images. This scanning itself eliminates the blurred images and it is thoroughly verified.
- Rectification of images- In this the images are rectified along with the clear image. The inclination images are matching with one another and it corresponds to the original image. Likewise entire marked area is evaluated and rectified under this process.
- Stitching and mosaic- the aerial images are scanned and verified with the pattern rectification. Now the images are to be stitched and mosaic by the merging process. It meant that the entire marked area is to be mosaic and the stitched image is evalued.
- Conversion of image- The images are converted by stitching and mosaic process. Now the image are in 3d mapping image.

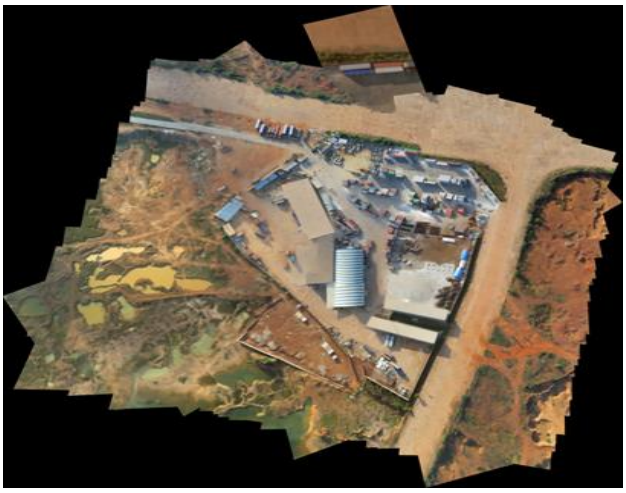

Figure 8. Stitched and mosaic image

From the tool simulation the exact output is verified and rectified. This are the process of the conversion of image by using the tool.

Figure 9. Stitched image converted in 3d

VII. CONCLUSION

The autonomous UAV system is used for this terrain land surface with high expectations. It is too comfort in taking images and generated the images according to the way points. In this particular system the autopilot is corrected by placing the magnetometer needle for the purpose of direction indication. So it absorbs the vibration and it gives excellent mission throughout the mission completed. In low cost this mission achieved high endurance and range, the endurance depends on how long it flies and range depends on how much distance covered. So both the statements are achieved in it. Then the system is worked fast, efficient and accurate for the needed mission. In this image processing also achieved in expected manner. The 3d images are much opted output for this mapping project, the kind of output delivery is achieved. The image processing done in restricted area due to some regulation in flying UAVs. The restricted area is put on mission surveillance for mapping a marked land surface. In this mission the certain pattern are allowed to follow up the process to be completed with the expected mission.

Further this surveillance mission will be used for large land surface to get the mission mapping for particular arena. In this the depth mapping is important concern to be noted because the certain terrain surface is even in all the sides it may have some uneven surface. For this inconvenience the depth image processing are to be taken for investigation and over this the project mission is extended. For this case the hardware component are improved by changing the zooming lens and increasing the shutter timing [5]. Then other improvements are orthophoto image pattern will be change and also the wider inclination in zooming camera. Meanwhile the GPS correction and observer also taken care for this mission progress. Normally, the software tool taking its own time for stitching and mosaic process.So the software tool is to be updated by automatically rectified the scanning process and also the improvement in stitching and mosaic process. So the time consumption is less for this stitching process. This is the improvement which is followed to be under this project. Highly complex terrain land surface is difficult to access, was recorded in just a day of field work by two new systems that exceed surveying method by accuracy, density and acquisition time. Image processing allowed the elaboration and visualization of the 3d mapping. The UAV system, the flight planning and the image processing method presented here are therefore powerful tool for recording and mapping other land surface.

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I' m Nagendra Prasad R, pursuing M.Tech - Avionics Engineering in Hindustan University. I know that in future UAVs are one of those who will rule the world. So, I decided to work in to this.

GOKULAKRISHNAN G

I'm Gokulakrishnan G, pursuing M.Tech - in Hindustan University with the specialization of Avionics Engineering. This paper shows that how much I'm crazy about drones. Also I have designed and fabricated many of fixed wing aircrafts as a hobbyist.

NIJANDAN S

I'm Nijandan S, studying Master Degree in Avionics engineering from Hindustan University. I did my Under Graduate in Electrical so I have special interest in dealing with avionic system of drones.