

# Reconstructing Bird's Eye View using Unmanned Aerial Vehicle Data

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## Introduction

Unmanned aerial vehicle (UAV) has a multitude of applications, including high-resolution surveying and mapping, coordinating humanitarian aid, cooperative environment monitoring, forest fire detection, surveillance, search & rescue missions and many more. UAV can provide clear and high-resolution video and image that are required for fast response to time-critical events at low cost (Guoqing Zhou & Deyan Zang, 2007).

The application of this technology can be made optimal if there is a user-friendly platform to access processed images and videos captured by UAV which can be used by the administrator, decision-makers and other users. The major aim of the study was to integrate video captured by UAV in a web map and make functionality to interact between 360<sup>0</sup> videos and the map.

## Method

An area covering part of river Aa and surrounding agricultural land and grassland of Münster, Germany was selected for the study. Image and 360<sup>0</sup> videos of the study area were captured using UAV.

MapBox is an open-source javascript API for making interactive online maps (Mapbox, 2019). Map box also supports geojson layers. Mapbox also has a built-in function to overlay video over the map. But this functionality works only when the position of the camera is fixed. This was not the case for our project. Thus only web Map was prepared using the MapBox API and Mapbox built-in function to overlay video could not be used for our study. iFrame player API was used to display 360<sup>0</sup> videos on the map. The iFrame player API (Youtube, 2019) has the functionality to embed a YouTube video player on the application. It also provides functionality to play, pause, seek to a certain time in a video, set the volume, mute the player, and other useful functions. This API also provides functionalities and events to control the behaviour of the video.

The data containing the position and time of the aircraft was downloaded from UAV. This data was in excel format. All the unnecessary details except longitude, latitude, elevation, and timestamp were removed from this data. Then this data was converted to Geojson and stored in a file.

The Geojson point data of the track was converted into geojson line string using loop in javascript. This linestring was displayed in the map using Mapbox Gl library. For this, we first add this data as a source in the map, then from this source, we created layer. We

specified the desired colour and width of the route. We also connected this route to video to control its visibility. Thus route is only displayed when the video is on and disappears when the video is switched off.

After displaying route developed functionality to display a marker on the map and change its position based on the position of video. The first marker source was created with an arbitrary location. Then it was overlaid on the map with its visibility turned off. Then we wrote an equation to convert time in the video to the corresponding location on the route. As soon as the video is played, the marker's visibility is turned on and the marker's position is set to the corresponding location on the route. When there is no change in the current time of the video that is when the video is paused marker also stops.

A circle was created to represent the coverage of the video. The radius of the circle is dynamic and change based on the height of the aircraft. The coverage formula is as follows:

$$\text{radius} = \text{height of aircraft} * \tan(\text{field of view angle} * \text{PI}/180)$$

The coverage feature was also linked with video events. So the coverage was displayed only when the video is on.

## **Results**

The result of the study was a web map application, integrated with 360<sup>0</sup> videos. The video can be rotated in all directions to see the surrounding. The video can be dragged forward and backward. When the video is played track of the video is overlaid on the map and a marker is also displayed showing the position of the camera. As the video is playing the position of marker also changes representing location from where the video was taken. We can also pause the video and rotate the view at a specific point to have a better understanding of what is around that place. A transparent area representing the field of view is also overlaid on the map.

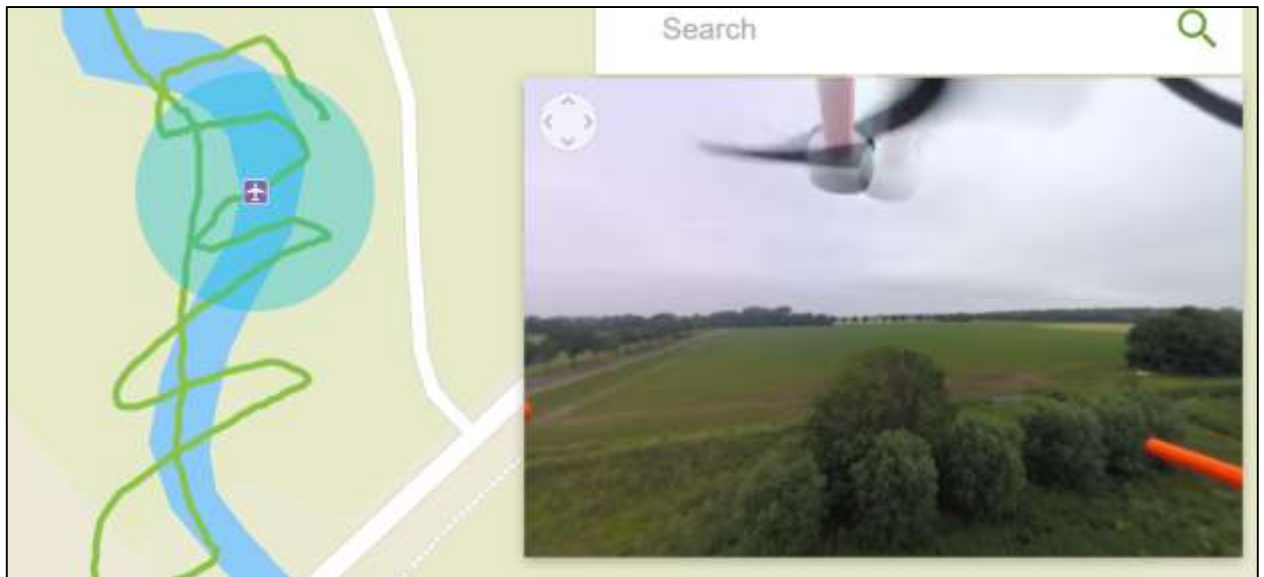


Figure 1 Interface of Video and Route

## Conclusion

UAVs are a fast, easy, flexible and efficient way of collecting data. These capabilities made them a useful tool for various research. This tool reconstructs a bird's eye view of the study area. This gives planners and decision-makers detailed information not only of the river but also its surrounding. They can look at features, land cover, etc. at a particular location. Without this functionality, they would have to go to the field every time. Moreover, it also gives an idea about the alignment of the route and speed of aircraft during the time of data collection. This tool can be easily replicated in other similar projects.

## References

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