

## **EXPERIMENTAL OF COMBINES DRONE TECHNIQUE AND RESISTIVITY MAGNETIC METHOD TO DETERMINE THE SUBSURFACE ARCHAEOLOGICAL ANOMALIES IN BUJANG VALLEY, KEDAH, MALAYSIA.**

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**Abstract :** This paper describes a technique of combined remote sensing drone photography data and resistivity magnetic of geophysical method for archaeological anomalies detection, which was employed in a pilot study survey at Sungai Batu (Batu River), National Archaeological sites of Bujang Valley, Kedah, Malaysia. Bujang Valley is also known as a Kedah Tua (old Kedah) which one of the significant national archaeological sites in Malaysia. Whereas the Bujang Valley emperor was previously predicted to have their glories around the 4th century CE, new dates of around 110 CE for Sungai Batu. The archaeologist has revealed iron smelting sites, jetty remains and clay brick monument in Sungai Batu which believed to be dated before 110AD. Moreover, the current trends show the integration of remote sensing medium with Unmanned Aerial Vehicles or drones' application in archaeology has upsurge the investigation and survey in a regional scale. Their abilities in capturing a large amount of imagery at a more detail and real-time image spatial resolutions that influences to their flexible designs, low costs, automated workflows, and minimal technical knowledge barriers has create an intention among archaeologists and expert in multidiscipline of knowledge. Indeed, the most exciting aspect of this technique is the ability to "remove" vegetation to visualize the ground surface beneath a tree canopy. However, the technique of UAV or drone application over archaeological area in Malaysia is still new and need an experimental to test the effectiveness of drone and the accuracy of data obtain in determine the subsurface archaeological anomalies in Bujang Valley. Hence, this experimental "challenge" the ability and the effectiveness of this technique to achieve the objective of the study especially in the context of Malaysia environment.

For the drone survey, DJI Phantom 4 Pro with modified camera to Infrared-RGB has been used to capture an aerial imagery over specific study area which were obtained in two imagery; infrared and RGB photos. Finally, a resistivity magnetic method has been used as a complement to the aerial technique. The survey conducted with an ABEM Terrameter LS2 resistivity meter for subsurface anomaly detection, which the data obtained were correlated with Digital Number from the drone data to generate the Normalized Difference Vegetation Index and a high precision Digital Surface Model result using the specific algorithm. Resistivity magnetic is used to corroborate the patterns found in a specific sub-area of the pilot study site. Then, the interpreted data from drone were incorporated with resistivity inversion model result to confirm the subsurface archaeological anomalies. Therefore, the results highlight the effectiveness and contribution of drone's technology applied for effective archaeological planning and investigation work especially in Malaysia archaeological context.

**Keywords:** Unmanned Aerial Vehicle; remote sensing; resistivity magnetic; archaeological detection; Malaysia context.