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TOWARD MONITORING THE ENVIRONMENT WITH SUSTAINABILITY USING CARDBOARD  
BASED FIXED-WING UAV

**Abstract**

Over the past several decades, the impacts of climate change on the Earth's environment have become widely recognized as significant risks. Consequently, the importance of monitoring the state of the global environment has increased. In recent years, methodologies have been proposed to integrate the comprehensive overview provided by satellites with the detailed information from Unmanned Aerial Vehicles (UAVs) flying at higher altitudes to construct precise climate change models.

However, it is undesirable for the platforms used for environmental monitoring to themselves impose a burden on the environment. To avoid such unwanted consequences, we propose an innovative approach using a cardboard-based fixed-wing UAV to mitigate environmental impact and achieve efficient environmental monitoring.

Our UAV is constructed mainly from recyclable cardboard, with a high recycling rate for all components excluding the electronic systems. In comparison to conventional UAVs composed of materials such as Fiber Reinforced Plastics (FRP), our cardboard-based UAV can reduce environmental impact. Additionally, the minimal joints between components in this aircraft contribute to noise reduction, thereby minimizing potential adverse effects on ecosystems.

From the perspective of aerodynamic performance and energy consumption efficiency, fixed-wing UAVs offer longer endurance and extended flight times compared to multirotor UAVs. This allows for more efficient environmental monitoring, covering a larger area in a single flight.

Taking these considerations into account, we demonstrate that our cardboard-based UAV is a useful platform for performing environmental monitoring tasks (e.g., Normalized Difference Vegetation Index (NDVI), environmental DNA (eDNA)) efficiently while considering environmental impact. We plan to introduce our cardboard UAV into real-world applications, including environmental monitoring in the future.