

## 1. Introduction

Traveling is a combination of travel, accommodation, travel time, and other aspects that most people tend to experience in their lives[1]. Yogyakarta is one of Indonesia's regions with a variety of well-known tourist attractions. Malioboro and Borobudur Temple are the most frequently visited tourist attractions [2]. Because Yogyakarta has a wide variety of tourist attractions [3], many tourists want to plan a trip to travel in Yogyakarta for several days. Usually, tourists need a travel agent to plan their travel itinerary.

In this digital era, there have been many studies that can replace travel agents in planning travel itineraries. Uhryn et al. [4] developed a travel system with bee colonies and used combinatorial problems on the graph, Mao [5] developed a tourist route recommender system with ant colony optimization for one-day tours in Beijing by analyzing tourist traffic lanes. However, the research only developed a tourist route system for one-day travel and only considered a few criteria. Meanwhile, in real life, tourists may want to travel for several days and consider criteria such as cost, time, and rating of tourist attractions. Therefore, we built a multi-day travel recommender system in this study by considering user preferences such as cost, time, and tourist spot ratings.

Traveling scheduling problems is often analogous to TSP. In TSP each location can only be visited once, after optimizing visits to several places, the trip will return to the starting location [6]. Some algorithms that can solve TSP i.e., Ant Colony Optimization [7], Genetic Algorithm [8], Firefly Algorithm [9], Artificial Bee Colony Algorithm [10], Cuckoo Search Algorithm [11], etc.

WOA is one of the Swarm Intelligence (SI) algorithms inspired by the hunting behavior of humpback whales [12]. Mirjalili and Lewis [13], developed WOA to solve optimization problems. WOA has the advantage over other algorithms in handling complex optimization problems. In addition, it can solve 29 mathematical optimization problems and six structural design problems, resulting in WOA being superior to other meta-heuristics.

Therefore, we built a system that recommended traveling for several days in Yogyakarta using WOA combined with MAUT. MAUT is a popular method to evaluate products based on the weight value obtained from the user's Degree of Interest (DOI) [14]. When traveling, tourists usually consider many criteria when visiting tourist attractions. So, we built a tourist route recommender system using WOA to find the optimal tourist route and MAUT to meet the needs of user preferences such as cost, time, and tourist attractions rating.