Project Title: Shaded Router Planning With Dynamic Sun Shade

Team members:

Full name	ASU ID
Mithun Shivakoti	1233250098
Phaneendra Gavara	1233447984
Yoshita Yajjapurapu	1233541467
Naveen Kumar Manokaran	1232482864

Problem statement:
The health risks associated with heatwaves are significant, particularly for pedestrians and cyclists who are exposed to direct sunlight during these periods. There is a growing demand for a route planning system that takes into account the availability of covered walkways in order to limit the amount of time spent in the sun. This demand is a direct result of the increasing frequency of hot days that are caused by global warming. The goal of this project is to introduce a shaded route planning system that will provide users with the most optimal routes based on distance and shade cover, thereby reducing the risks associated with heat-related hazards.

Related work:
1. **Dostal, P., Katzschner, A., Bruse, M., Huttner, S. (2009).** Quantifying human thermal-heat-stress in European cities with BOTWorld and ENVImet microclimate simulations. *Proceedings of the 7th International Conference on Urban Climate.*
2. **Ma, K. (2018).** Parasol. Navigation: Optimizing Walking Routes to Keep You in the Sun or Shade. *Journal of Navigation and Heat Mitigation Systems.*

Initial hypothesis:
In order to improve the comfort of pedestrians and cyclists during hot weather, the research question that needs to be answered is whether or not shaded paths can be successfully plotted using satellite data. We believe that directing people toward shade will lessen the amount of harmful heat they are exposed to, hence boosting their level of comfort and safety.

Dataset(s):

Dataset source (link and reference)	Own Dataset
Number of instances	2925 for a part of Tempe city
Number of features	Shaded Area %

Class distribution (# instances in each class, if applicable)	Continuous distribution in shade
Dataset splits	Training/Test
Preprocessing steps	Image segmentation, OSM alignment, chromatic analysis etc

This dataset with 2925 images is a 3D model of the Tempe city map(partial city). It consists of images of various buildings with the shade during different times of the day starting 6 am in the morning till 6 pm in the evening, marking shades of each building for 13 different hours per week. Then during the phase of creating the model, the satellite image of the building and the time of the day would go as input and the output of the dataset is the image of this 3D model, and this is how the model would be trained for further predictions.

Method(s):

For the purpose of identifying shaded regions, we will make use of satellite photos and a model. The novelty lies in the fact that this foundation model is utilized to extract shadow data from satellite images. We will develop tailored travel recommendations by including shade ratios into a road graph and applying Dijkstra algorithm. Through the provision of real-time dynamic shading maps that are applicable to any metropolitan setting, the technique expands upon the work that has been done in the past. Users will have access to a more convenient route as a result of the implementation of dynamic shade altering. This is because the percentage of shade that is present on roads or footpaths will continue to change depending on the time of day.

Evaluation:

In order to evaluate the effectiveness of the solution, a combination of distance metrics and shade covering percentage should be utilized. In addition to establishing which route will take the least amount of time, we will study the levels of exposure along the several routes. During the evaluation, the user preference weights for shade versus distance will be the primary focus. The reduction of heat exposure and thermal comfort will be the primary areas of focus for our qualitative comfort improvement evaluation, which will be conducted through user surveys and comments.

Management plan:

Each team member will be responsible for a distinct component of the project: one will handle image processing and segmentation, another will integrate the data into a route planning system, and the rest will work on algorithm optimization, presentation and documentation. Weekly meetings will be held to monitor progress. Team members will interact over WhatsApp and hold one another responsible by posting weekly updates.