介绍

在这个阶段的课题中，Group 11通过对米兰某地城市森林中树木信息和地理信息的数据分析。对数据中所涉及的地区进行地理建模和实体制作，并且将同一抽样地的多种树木抽象为一棵树，将树木数据进行可视化设计。希望能够通过制作实体地理模型的方式，展现数据所在地的城市森林和周边区域的空间场地关系，来让该区域居民更好的认识其长期生活的周边环境。

数据概览和目标。

我们选择的数据主题是urban forest. 我们从我们的data host处得到了在意大利米兰XXX处所种植的树木信息和其相关数据的报告，data host 在该地区25个抽样地点的位置信息（经纬度）以及每个地点的树木种类信息和生长情况的统计。我们借助这部分数据完成了之前A2部分数据分析的工作。

在A2的数据分析中，我们通过所给地块种植树木的相关信息，在一个数据集中找到了树木的高度，胸高直径等信息，这是树木生长情况的数据表现。同时我们发现所给的多个数据集是由data host 所选取的plot，不同的抽样调查的位置，进行串联的。我们希望，通过位置数据，将这一区域的Urban forest 在城市中的位置标明，同时结合在这一地块中的树木信息，让居住在周围的居民能够更好的认识他们周边的urban forest 和其中的自然环境。所以我们在这一阶段设定的目标，是通过一种合适的方式，同时将该处不同点位的Urban forest 和周围的空间场地关系，以及Forest中的树木生长相关情况，展示给周边的居民。

方案设计：

我们希望用一种直观可见的实体物，可触摸的形式，而不是虚拟的平面图像，来增强地理位置信息和其中树木情况的可视化，同时强化展示森林和周边的空间场地关系。但在我们进一步处理我们所拥有的数据时，我们发现关于每个plot的地理信息，我们只得到了经纬度，只能够将每个点在平面地图上的位置表现出来，而要展示其场地关系则还需要该地区相应的地形/海拔数据，以展示其空间上的状态和位置。

所以我们在地理信息呈现的方案上选择了，借助所提供的经纬度信息和我们能够查到的所在地的地形信息，来制作实体的等高线地块模型，同时在每个plot的位置上添加树木模型，以此来展现这个区域的Urban Forest和周围区域的空间场地关系和树木生长情况。

在每个plot的树木数据信息集中，并没有每颗树木的具体位置信息。这意味着我们只能够在一个位置点上表示一个plot中的全部树木信息。而我们在一个plot中要同时表现树种，每种树木的数量，高度和粗度状态。所以我们将一个plot中的全部树木抽象为一棵树，用不同的颜色代表不同的树种，不同高度的分叉代表不同树种的平均高度，不同颜色的叶片簇大小/叶片数量来表示不同树种在该plot中的数量。而关于表示树木粗度的胸高直径，则用不同直径的同心圆底座来体现。

所以我们再一次对数据进行了细分。根据不同的plot将树木信息分类，对我们需要的数据进行了统计，并将不同的树种匹配了不同的颜色，作为我们实体模型制作的参照。

为了能够给更多的展现Urban Forest对周边居民生活的影响，我们在想能否将其对环境或空气的影响和改善也作为我们讲述给居民观察的内容。在阅读data host 提供的对应数据报告之后，我们找到了其中有树木对于二氧化碳吸收能力的统计。该部分可以作为我们向居民展示的‘实际的影响’，即树木‘减少’的二氧化碳。由于空气并不是直观可见的形式，只能用其他的方式来代替，我们选择了用灯光的强弱来表现不同树种吸收二氧化碳能力的强弱，而因为树木减少二氧化碳的光合作用正如同人的呼吸一般，所以我们选择了用呼吸的灯效来作为体现二氧化碳吸收的表现形式。

成果与发现

至此是我们全部实体模型方案的推导和设计过程，而我们实际的模型正如下图以及最终模型所展示的样子：（插照片）

在完成实体模型的制作之后，我们可以在体现实际空间场地关系的模型中观察到以下发现：首先，被调查的plot主要集中在场地的东北部和北部，南部西南部则基本没有被取样调查。其次，Black Locus and European Hackberry 在绝大多数的plot中都有生长，并且都长势良好，他们普遍都比同一个plot中的其他树木要更高大，胸高直径也更大（树木更粗）。

第三，在我们实体的树模型上，可以看到紫色的圆要比其他圆都大，这意味着 black poplar这种树总是有着比其他树更粗壮的树干。

第四，我们通过实体树的模型总结发现，更高的树往往伴随着更粗的树干（胸高直径更大）。这个规律能够在plot18 的模型得到验证。

最后，结合数据持有人给予我们的调查报告和我们的验证计算，我们发现在该地区并不是所有种类的树木都对碳的吸收有所贡献。能够对当地碳吸收产生正效应的只有4种树，剩下的树木甚至还在向环境中释放碳（我们在灯效上用红灯表示）

总结：

我们从数据持有人处获得的数据内容，生成我们城市森林数据可视化方案的设计过程，以及我们在其中的部分发现。我们希望通过我们的实践，以及观众对模型和观察和进一步的了解，能够让我们预设的受众，当地的居民，能够充分的了解和认识他们周围的自然环境，发掘更多我们所没有读到的数据和发现，以帮助他们在更好的环境中生活。

Introduction

In this phase, Our group analyses tree data and geographic information in an urban forest in one part of Milan. The tree data was visualized through geographical modeling of the areas involved and by abstracting multiple trees from the plot site into a single tree. We hope to create the physical model of the spatial site relationship between the urban forest and the surrounding area in the data, and the trees model for every plot to give the inhabitants a better understanding of their permanent surroundings.

Data overview and targets

The topic of our data is the urban forest. We obtained information about the trees planted a place in Milan, Italy, and a report on their data from our data holder. They include the location (latitude and longitude) of the 25 sampled sites (called plot) in the region, which is chosen by the data holder, and information on tree species and growth statistics for each site. We have used this data to complete the previous analysis of Assignment 2.

In Assignment 2, we found information on tree height, diameter at breast height, which represents the situation of tree growth. At the same time, we found that the multiple datasets given were strung together from the plots, which are the different sampling locations selected by the data holder. We hope that the location data will allow the urban forest in this area to be located in the city and, together with the information on the trees in the plot, allow the people living in the surrounding area to become more aware of the urban forest and the natural environment around them. This phase aims to present the urban forest and the surrounding spatial-site relationship, as well as the growth of the trees in the forest, in an appropriate way to the residents of the area.

Visualization design

We wanted to enhance the visualization of the geographic information and the condition of the trees within it with an intuitively visible physical object, in a palpable form, rather than a virtual flat image, while enhancing the display of the spatial site relationships between the forest and its surroundings. However, as we further processed the data we had, we found that we only had the latitude and longitude for each plot. They are only allowed us to represent the location of each point on a flat map, whereas to show the site relationships, we needed the appropriate topographic/elevation data for the area to show its spatial state and location.

Therefore, we chose to use the latitude and longitude information provided and the topographical information we could find for the location to create a physical contour plot model and add tree models at each plot location to show the spatial site relationship and tree growth of Urban Forest and the surrounding area.

There is no specific location information for each tree in the tree data set for each plot. We can only represent all the tree information in a plot at a single location point. In contrast, we want to represent both tree species, the number of trees of each species, their height and thickness status in a single plot. So, we abstract all the trees in a plot as one tree, using different colors to represent different species, different height forks to represent the average height of different species. Moreover, we also use different colored leaf cluster sizes(number of leaves) to represent the number of different species in the plot. The diameter at breast height, which indicates the thickness of the tree, is represented by concentric bases of different diameters.

Once again, we have subdivided the data. The tree information was classified according to the different plots, the data we needed was counted, and the different tree species were matched with different colors as a reference for our solid model making.

To give the impact of urban forest on people living around it, we wondered whether we could also include its impact on the environment or air as part of our observations to the residents. After reading the corresponding data reports provided by the data holder, we found a section with statistics on the CO2 absorption capacity of the trees. This section can be used as the 'real impact' that we can show to the residents, that is, the 'reduction' of CO2 by the trees. As air is not a visible form and can only be replaced by other means, we chose to use the intensity of the light to show how well different tree species absorb carbon dioxide. As trees reduce carbon dioxide by photosynthesis in the same way that people breathe, we chose to use the light effect of breathing to show carbon dioxide absorption.

Results and findings:

Our actual model is as shown below and, in our video,

Once the physical model was completed, the following observations were made in the model that represented the actual spatial site relationships:

Firstly, the surveyed plots were concentrated in the northeast and north of the site, with the southwest being largely unsampled.

Secondly, Black Locus and European Hackberry were present and growing well in most plots. They were generally taller and had larger diameters at breast height (thicker trees) than other trees in the same plot.

Thirdly, on our solid tree model, we can see that the purple circle is bigger than all the other circles, which means that the black poplar always has a thicker trunk than the other trees.

Fourthly, our solid tree model concludes that taller trees have thicker trunks (larger diameter at breast height). This pattern can be verified in the model of plot 18.

Finally, combining the survey report given to us by the data holder with our validation calculations, we found that not all trees in the area contribute to carbon sequestration. Only four species of trees can contribute positively to local carbon uptake, and the rest are even releasing carbon into the environment (which we have indicated by red lights on the light effect).