Human health is an especially important subject of research for scientists. Increasingly, in this context, the issue of allergies is being addressed, particularly airborne allergies. A special role in triggering allergies is played by pollen grains present in the air, which are produced by trees during their flowering period. Pollen grains are microscopic in size, so they can easily penetrate our bodies. Pollen grains contain proteins that, once recognized by our immune system, trigger an immune response, manifesting as negative symptoms for us. This mainly includes allergic rhinitis, breathing problems, coughing, tearing, and itching of the eyes. In Poland, the pollen grains of alder, hazel, birch, grasses, and ragweed are particularly allergenic. Analyses indicate that the problem of allergies is increasing nowadays. This is particularly influenced by global warming. There is a noticeable trend of increased production of pollen grains and an extension of the pollen seasons. The growing issue of pollen-related allergies makes research on this topic exceptionally important.

To determine the allergic threat, it is necessary to establish the amount of pollen grains present in the air at any given time. Proportionally, the higher the concentration, the stronger the symptoms we experience. There are several methods to determine the amount of pollen in the air, but most are manual methods, where the determination of concentration occurs with a time delay. Automatic methods are becoming increasingly popular, but they still require improvement. Therefore, a significant challenge for science is the development of real-time detection capabilities. The use of machine learning, an algorithm that, after being fed certain information, can appropriately perform tasks assigned by us, such as recognizing pollen grains, is crucial here. One of the devices that use this algorithm is the Swisens Poleno Jupiter, which is planned to be used in the project and is located at the Department of Climatology and Atmosphere Protection in Wrocław. The operation principle of the detector is simple: air, along with particles such as pollen grains, is sucked into the device. As the pollen grain passes through the device, it is analyzed in several stages. Based on previously obtained information, the algorithm can recognize the pollen grain and count subsequent ones, providing the concentration in a specified unit of time. One of the three objectives of the project is to improve the device's performance by incorporating data on Polish pollen grains into the algorithm. This will concern the two most allergenic plant families, namely Birch and Grass. It is also planned to increase detection precision by developing the recognition method.

For allergy sufferers, the variability of pollen grain concentration in space is also a crucial issue. Research indicates that concentrations can vary significantly even over small distances. To determine the dynamics of these changes, spatial modeling is commonly used. In science, modeling techniques are popular for accurately representing real-world conditions. The ADMS-urban model, which is dedicated to calculating the dispersion of pollutants in urban areas, is planned to be used for modeling. The second objective of the project is to adapt this model for use with plant pollen and to determine the variability of pollen grain quantities in Wrocław. Pollen grains from the Birch and Grass families will be analyzed to see how the model performs during two different flowering periods and with the varied characteristics of both taxa.

The final goal concerns using pollen concentration data from the Swisens Poleno Jupiter detector to generate concentration maps for Wrocław in real-time using the ADMS-urban model. These maps would be an invaluable source of information on the current allergic threat for all people dealing with this problem.

The expected outcomes of the project include improving the algorithm for recognizing pollen grains in the Swisens Poleno Jupiter device. Numerous scientific studies indicate that working with new data enhances detection efficiency. Research shows that it is possible to adapt the ADMS-urban model to determine the spatial variability of concentrations of various types of particles. Articles demonstrate the high effectiveness of the model, suggesting that the project can achieve results close to actual conditions. The results will allow for determining the dynamics of pollen grain concentrations in the urban area. The use of real-time data for spatial modeling is also beginning to appear in scientific literature, indicating that this approach is feasible. However, this is still a relatively new topic, emphasizing the significance of the project's goal.