It is estimated that approx. 45 million people in the world are blind. In Poland the number of persons registered in the Polish Association of the Blind is approx. 80 thousand. It should also be noted that 90% of the blind are unemployed. Braille and speech synthesizers allow the blind persons to access to textual information. It is much more difficult to present to a blind person spatial information about their surroundings or graphical information such as: images, videos, photos, graphs, maps, plans, diagrams etc. One of the solutions used for presenting visual information is audio description, i.e. a verbal description of visual content recorded or synthesized basing on text. A disadvantage is the lack of the audio description's interactivity – the blind person usually has little or no control over the delivered verbal content.

The project will develop methods and software for interactive perception of graphical information through the sense of touch and hearing. The idea of the research is to enable a blind person to touch visual content displayed on the monitor screen, which will be continously transformed into sounds. Such a non-verbal transmission of information is called sonification. With the addition of interaction with the touch screen displaying the graphical information a blind person will be able to customize the way he/she perceives images according to individual needs and interests. For example, while tactilely studying a painting one person may mainly analyze the shapes of objects, while another may focus on their spatial composition.

An indirect objective of the project is to develop ways of sonifying visual information basing on control via touch gestures. The creation of an original way of communicating with a computer that can be called a touch-sonic interface. Such an interface will be the basis of the research project's main objective, which is to develop methods of synthesizing a non-verbal auditory description of visual information in which the user will be able to control the speed and method of delivery of the audio content through tactile interaction. Interactive sonification will be able to transform an area indicated by a gesture on the touch screen to sounds, which we call the sonic space. This means a geometric space (two- or three-dimensional) will be transformed into a multi-dimensional sound space. The sound space will consist of sound parameters such as: volume, fundamental frequencies, timbre, periodic variations of the amplitude and frequency of sounds. The developed methods will enable the selection of sound parameters for both local mapping of image features (brightness, color, texture) and spatial characteristics (shape, size and spatial relations).

Tests will be conducted with the participation of blind volunteers, which will enable the evaluation and improvement of the developed methods for sonifying visual information. The mapping of local image features into sounds will take into account the properties of human auditory senses, such as the varying strength (dominance) of individual parameters of sound. Tests will consist of comparing different algorithms for determining the individual limits of perception of sounds by blind users. The tests will also use letterpress printed boards with reference embossed graphics. These studies will lead to determining which methods of converting visual content into sounds enable the most efficient way of perceiving images.

The project results will form the methodological and technical basis for designing a new class of interfaces, which in turn will enable the development of new techniques for teaching blind children and increase their chances of finding employment in adulthood.