

University of Latvia  
Department of Optometry and Vision Science

**COMPUTERIZED VISION SCREENING  
AND TRAINING DEVICE  
FOR CHILDREN**

WHITE PAPER

Riga, March 2021



**UNIVERSITY  
OF LATVIA**



## Summary

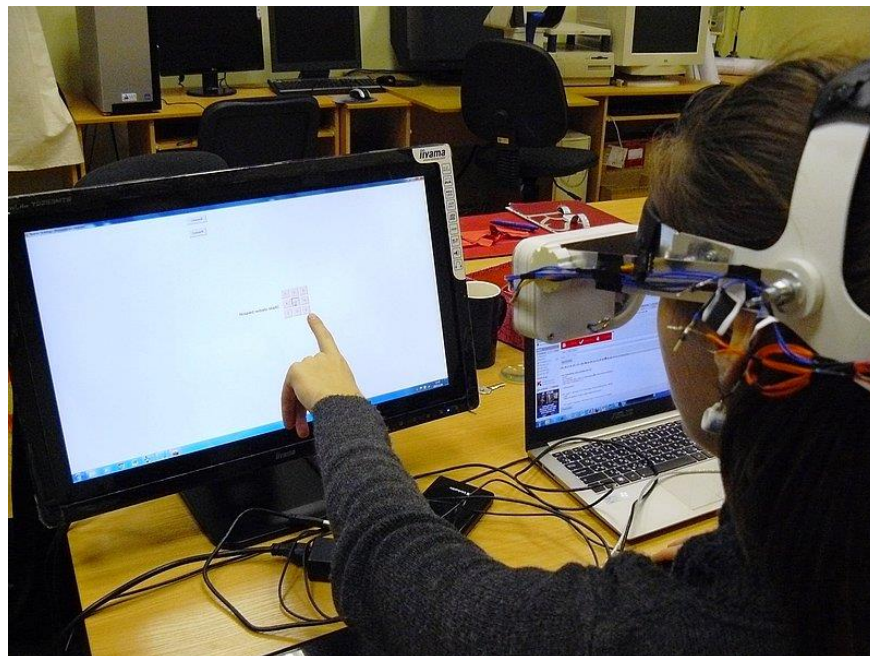
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We are a spin-off from the Department of Optometry and Vision Science at the University of Latvia, developing unique methodology for computerized vision screening.

Our method allows to detect a variety of vision functions with a simple head-mounted device in one set:

- visual acuity at far and near
- colour vision
- accommodation facility
- binocular vision test
- phoria
- stereoacuity
- vergence facility
- fusional reserve tests

This approach opens a possibility to have detailed vision screening tests in cases when visiting an optometrist or ophthalmologist is not obvious or unavailable, e.g., for school-aged children in a wide list of countries. Unlike head-mounted devices currently available on the market, our solution allows to test much more vision functions at once. It means that different types of vision problems can be detected and treated timely, which is particularly important for younger children.



## Problem

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Nowadays there is a significant increase of vision problems among young people due to increasing proximity load, which is associated not only with the learning process, but also with changes in leisure activities, i.e., children now spend a considerable amount of their time using smart devices.

Our study found that 20-30% of school-aged children in Latvia have visual problems. The most tragical consequences come from that young children and their parents very often may not recognize some specific vision disfunctions, therefore they are not visiting an optometrist, if only a patient does not have myopia, hypermetropia, or astigmatism.



Such symptoms like problems with reading, regular headaches, rapid fatigability during the educational process etc. usually are not considered as vision-related problems. In a wide list of countries regular visits to optometrists are not mandatory for schoolchildren, but vision testing equipment available on site is limited to a simple visual acuity test.

Studies confirm that unresolved visual problems of school-age children significantly affect their academic performance and have a strong impact on their future growth and well-being.

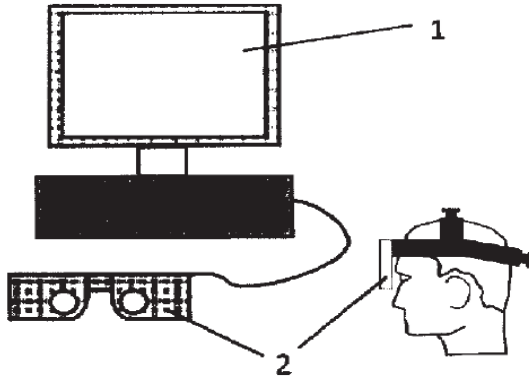
## Solution

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Our proposed solution is based on our own developed algorithms and a simple set of filters and lenses. It can be easily operated even by a non-specialist. The methodology is tested on more than 11 000 children in Latvian schools. Proven specificity and sensitivity of our screening method is 87% and 77% respectively.

Our vision screening methodology provides near distance monocular and binocular visual acuity assessment, hypermetropia test, binocular vision test, accommodation and convergence function assessment, stereovision and colour vision tests.

We have developed a prototype of the vision screening device, which is based on our vision screening methodology. This is a wearable head-mounted equipment, designed to be used by non-professionals to assess the visual function. It includes optical lenses and filters that are automatically placed in front of the patient's eyes during the vision function examination. The device in its current technical configuration has capability to also provide accommodation and vergence training in addition to vision screening.



The vision screening prototype in its current configuration consists of a computer unit and visual display (1), a microcontroller and device containing lenses and filters (2). Test stimuli that are necessary to assess visual functions are presented on the computer monitor. Computer provides four functions – generates test stimuli, records patient responses, analyses the responses and provides communication with the microcontroller, which drives lenses and filter device driver during visual function examination.

Comparing to other portative devices for vision screening, our main advantage is the unique methodology, which allows to detect a higher variety of vision diseases with a relatively simple construction. Another very important advantage is the simplicity in operation, so our proposed solution is suitable for a wide use by non-professional staff, which schools can provide onsite.

Our methodology will not substitute both ophthalmologists and optometrists, since the device will only indicate if a patient has any vision-related problems, but the complete diagnosis and the treatment shall be prescribed by certified medical personnel.

The device we offer contains all the necessary components to provide not only vision screening but also vision training. The set of various vision training exercises will be developed and offered along with the device software. An optometrist will be able to compose an individual training program for each patient, according to the test results.

The plenty of studies show that timely detection and treatment of the visual function in early age can lead to significant amelioration of signs for the patient, which is an important factor for the quality of life and for the society in general.

# Team



**GUNTA KRŪMIŅA**

**Project Leader**

Senior Researcher,  
Professor,  
Dr.Phys.

**Experience:**

project management, development of tests for diagnostics of visual disorders, vision screening program for school-aged children, clinical optometry



**RENĀRS TRUKŠA**

**Project Engineer**

Research Assistant,  
Lecturer,  
Prof.Mag. (Clinical Optometry)

**Experience:**

design and manufacture of electromechanical devices, prototyping, development of visual stimuli un tests



**SERGEJS FOMINS**

**Project Engineer**

Guest Researcher,  
Assistant Professor,  
Dr.Phys.

**Experience:**

development of visual stimuli and programs for the assessment of visual function, electronic engineering, prototypes in vision science



**ALEKSEJS KORABOVSKIS**

**Bisusiness Developer**

Senior Expert  
M.Sc. (Economics)

**Experience:**

technology commercialization and management of deep-tech start-ups, entrepreneurship, and business consulting



**KAROLA PANKE**

**Project Optometrist**

Research Assistant,  
Dr.Phys.

**Experience:**

testing of visual function methods, study of eye accommodation physiology, optometrist



**JEĻENA SLABČOVA**

**Project Optometrist**

Research Assistant,  
Prof.Mag. (Clinical Optometry)

**Experience:**

clinical optometrist, testing of visual function methods and vision screenings



**AIGA ŠVEĶE**

**Project Optometrist**

Vadošā pētniece,  
Asocētā profesore,  
Dr.phys.

**Experience:**

clinical optometrist, orthoptist, development and testing of new vision training methods to improve visual functions



**EVITA KASSALIETE**

**Project Optometrist**

Pētniece,  
Docente,  
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**Experience:**

testing of visual function methods, vision screening, vision problems and learning difficulties in school-aged children



**KRISTĪNE KALNIČA-  
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**Project Optometrist**

Research Assistant,  
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**Experience:**

full eye examination in  
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**ZANE JANSONE-  
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**Project Optometrist**

Research Assistant,  
Prof.Mag. (Clinical Opto-  
metry)

**Experience:**

full eye examination,  
development of colour  
vision tests



## Brief history & Current status

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- During the Vision Screening project (2011–2013) 11 000 children were tested in Latvian schools within 2 years.  
Specific aim of the project: development of diagnostic methodologies for visual and visual perception disorders, adapted for the preventive assessment of specific near-sighted vision functions in school-age children and representative visual screening of Latvian school-age children (epidemiological study).
- The results of the Vision Screening project resulted in the patent “APPARATUS FOR ASSESSMENT OF VISUAL FUNCTIONS”.
- Further development and commercialization of the technology was supported by the Investment and Development Agency of Latvia (LIAA) in 2020.
- Prototyping of the portable computerised device for vision screening and training started in the beginning of 2021.

Currently we are looking for business partners and industry experts for further technology development, customer validation and industry facilitation process.

You are very welcome to share your opinion on our proposed solution for vision screening and training!

Please contact us:

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