# RAYS: PROGRAMMING LANGUAGE FOR VISUALLY IMPAIRED STUDENTS

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# Abstract

The fourth Sustainable Development Goal of the United Nations (UN) 2030 agenda is to ensure equitable and inclusive quality education and encourage learning opportunities for everyone. Even though different curricula and approaches are exercised to provide education effectively to students, there are a lot of shortcomings when it comes to teaching specially abled students. Visually impaired (VI) students face significant challenges in learning subjects. One such challenge is learning programming, which is a key skill in the computer science field. VI Students lose motivation and drop the subject due to inaccessibility in existing programming languages and inefficient curriculums. This research aims to explore the issues faced by VI students in learning programming and develop an accessible programming language which can be used by the students to learn programming efficiently.

Based on the literature review in this context, interviews were conducted with VI programmers working in leading companies, accessibility lecturers, and VI students to identify the challenges they face. In addition, observation on existing accessibility tools and technologies and brainstorming was conducted. Analysis of the gathered information proved that the inaccessibility in programming languages affected the progress and attitude of VI students towards programming. On this basis, programming language was developed to overcome the inaccessibility. The programming language syntax was deigned to be comprehensive with screen readers. An accessible IDE was developed to write programs. The programming language was evaluated among novice VI students using counterbalancing evaluation methodology. Evaluation results indicated that the participants felt positive and motivated towards programming. They felt the language syntax to be more comprehensive with screen readers than in other languages.

The language was scoped to the Sri Lankan O/Level ICT syllabus which includes iteration, selection, sequence, getting input and type casting. The recommended future enhancements are object-oriented approach, data structures and accessible debugger.

**Keywords**: Visually Impaired, Blind, programming language, Accessibility, compiler, Accessibility technologies