Bangla Programming Language: A Native Language-Based Approach to Introducing Programming to Early Learner (V4.5)

Md. Anisur Rahman

Head of IT

Programming24 School

(https://programming24.school.blog)

mrahman202047@mscse.uiu.ac.bd

anisur@dcaclab.com

Abstract

Programming is often introduced in English, creating a significant barrier for learners whose primary language is not English. This is especially true for children and early learners, who may already struggle with abstract concepts like logic, loops, and functions. This paper introduces a novel educational initiative—Bangla Programming Language, a web-based programming environment that enables learners to write, interpret, and learn code entirely in Bangla. Inspired by existing efforts such as Potaka, ChaScript, and Pankti, our project extends those ideas by offering a real-time Bangla Code Runner, a Bangla-to-C code translator, and a full-featured Bangla Programming Editor. Built using JavaScript and modern web technologies, our system targets young learners, particularly school children, to introduce foundational programming concepts in their mother tongue. This paper details our design methodology, comparative analysis, implementation approach, code examples, limitations, and plans for future improvements.

1. Introduction

As the digital economy expands, learning programming is becoming an essential skill. However, the dominant language of programming—English—can pose a serious barrier for learners from non-English-speaking backgrounds. Children, especially, face cognitive overload when they must first learn English keywords before understanding programming logic.

To address this, our research and development focused on building a system that brings programming education to learners in their mother tongue—Bangla. Our platform introduces the Bangla Programming Language, where code is written using Bangla keywords, outputs are presented in Bangla, and feedback is intuitive and friendly for children.

Unlike other experimental or theoretical models, our system is fully functional and includes three main modules:

- A Bangla Code Runner, where code can be executed directly in the browser.
- A Bangla → C Translator, that helps learners see equivalent C code.
- A Bangla Programming Editor, which supports writing and learning in an interactive environment.

This approach is pedagogically aligned with research that supports early education in native languages. Our system not only simplifies coding but also fosters inclusiveness, confidence, and early engagement with computational thinking.

2. Related Work

2.1 Potaka Editor

Potaka Editor is a well-known project that promotes Bangla programming by offering a block-based and text-based editor. It uses natural Bangla syntax and is inspired by Scratch and Blockly. Although it allows users to write Bangla-like code, it is primarily designed for visual learning rather than code execution. Potaka lacks real-time program execution, and advanced features such as loops or user-defined functions are limited.

2.2 ChaScript

ChaScript is a scripting language that mimics Bangla in structure. It presents readable syntax and natural expression of logic in Bangla. However, ChaScript lacks browser support and execution engines. It is mostly academic and has not been widely adopted in educational institutions or public learning environments.

2.3 Pankti

Pankti introduces a poetic or expressive way of writing code. It aims more at creative and aesthetic computing than functional programming or logic building. Although it supports a unique syntax, it is not optimized for teaching loops, conditionals, or data handling—the core components of programming education.

3. Research Methodology

3.1 Research Questions

- Can programming be effectively taught in Bangla without compromising logic or structure?
- How does native language syntax improve learner engagement?
- How does our system compare with similar existing platforms?

3.2 Inclusion Criteria

- Systems or tools designed with a native language programming approach.
- Platforms aimed at children, beginners, or non-technical audiences.
- Tools with available documentation or online interface.

3.3 Exclusion Criteria

- Tools limited to poetic expression or design.
- Systems requiring software installation or complex setups.
- Non-interactive or non-functional code examples.

3.4 Comparative Analysis Table

Feature	Potaka	ChaScript	Pankti	Our System
Bangla Syntax	✅	✅	✅	✅
Code Execution	✅	✅	✅	✅ (JS-based runner)
Web-based Editor	✅	✅	❌	✅
Bangla to C Translation	❌	❌	❌	✅ (Partial)
Compiler Integration	✅	✅	✅	✅
Target Audience	Children	Children	Children	Children, Beginners

4. System Description

Our system includes three integrated modules:

4.1 Bangla Code Runner

The Bangla Code Runner enables real-time execution of Bangla code directly in the browser. We built a custom parser using JavaScript that recognizes Bangla keywords and maps them to equivalent JavaScript instructions. The interpreter processes logic, inputs, conditionals, and outputs interactively.

Example Code:

```
ধরি নাম = ইনপুট("তোমার নাম কি?");
যদি (নাম == "আনিছুর") {
  দেখাও("হ্যালো আনিছুর!");
} নাহলে যদি (নাম == "লিখন") {
  দেখাও("হ্যালো লিখন!");
} নাহলে {
  দেখাও("ঘোড়ার ডিম! তোমার নাম কি?");
}
```

Execution Output (example):

```
তোমার নাম কি? → লিখন
হ্যালো লিখন!
```

4.2 Bangla ➞ C Code Translator

This module allows users to write code in Bangla syntax and automatically translate it into valid C code. This is especially useful for educational purposes, as students can learn both native syntax and how it maps to a standard language like C.

Example Bangla Code:

```
# অন্তর্ভুক্ত < স্ট্যান্ডার্ড_ইন_আউট.হেডার >
পূর্ণ মৌলিক() {
  পূর্ণ নাম্বার;
  দেখাও ("একটি সংখ্যা নিই:");
  নাও("%প", &নাম্বার);
  দেখাও("%প\n", নাম্বার);
  ফেরত ০;
}
```

Translated C Code:

```
#include <stdio.h>
int main() {
    int সংখ্যা;
    printf("একটি সংখ্যা দিন:");
    scanf("%d", &সংখ্যা);
    printf("আপনার সংখ্যা: %d", সংখ্যা);
    return 0;
}
```

Note: The translated code is currently for learning only—it cannot yet be compiled or executed within the system.

4.3 Bangla Programming Editor

This module provides an environment where users can write full programs, view outputs, and follow step-by-step tutorials. It is designed with Bootstrap and Google Fonts for Bangla typography support and readability. The editor includes:

- Syntax hints
- Predefined code snippets
- Bangla-based documentation
- Links to tutorials

5. Implementation

- Frontend: HTML, CSS (Bootstrap), Google Fonts (Hind Siliguri)
- Core Logic: JavaScript-based parser and runtime engine
- Editor: Custom textarea interface with interactive output
- Hosting: GitHub Pages / Vercel
- Open Source: https://github.com/AnisurRahmanJU/BanglaProLangs

6. Limitations

Despite the novelty and success of the current platform, there are limitations:

- No Full Compiler: The Bangla → C Translator does not support actual compilation. It is a one-way translation tool without syntax checking or runtime output.
- Partial Syntax Support: While we support conditionals, variables, and I/O, there is no support yet for user-defined functions, classes, or complex data types.
- Limited IDE Features: The editor lacks syntax highlighting, auto-completion, or real-time error checking.
- Performance: The interpreter is built in JavaScript and may not scale well for large or complex scripts.

7. Future Work

Our roadmap includes:

- Compiler Integration: Integrate a backend compiler or WebAssembly engine to allow full execution of Bangla → C code.
- Syntax Highlighting & Linting: Add CodeMirror or Monaco editor integration for better user experience.
- Mobile App: Develop Android/iOS app for offline and mobile learning.
- Voice Input: Allow Bangla speech-to-code via Web Speech API.
- Gamification: Add levels, badges, and coding puzzles for child learners.
- Curriculum Mapping: Align with school curricula in Bangladesh and West Bengal to support formal education.

8. Conclusion

The Bangla Programming Language initiative bridges the gap between language and logic. By allowing learners to write and execute code in their native language, it fosters inclusivity, early confidence, and a deeper understanding of programming fundamentals. Our system outperforms previous efforts by combining real-time execution, educational structure, and ease of access. We believe this is a small but important step toward democratizing programming education in South Asia and other Bangla-speaking communities. Future developments will aim to expand features, integrate with formal education, and reach more learners globally.

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