An Intelligent Tutoring System for Learning Python

Omankwu, Obinnaya Chinecherem;
Osodeke Efe Charles;
Onwuzo, Chioma Julia;
And
Okoro, Ugochukwu Bethel

Department of Computer Science
College of Physical and Applied Sciences
Michael Okpara University of Agriculture,
Umudike, Umuahia, Abia State

Abstract: Python is an easy to learn, powerful programming language. It has efficient high-level data structures and a simple but effective approach to object-oriented programming. Python's elegant syntax and dynamic typing, together with its interpreted nature, make it an ideal language for scripting and rapid application development in many areas on most platforms It is the most widely used languages in Desktop developing, Web Development and Mobile Development, so there are many lessons that explain its basics, so it should be an intelligent tutoring system that offers lessons and exercises for this language. Why tutoring system? Simply because it is one-one teacher, adapts with all the individual differences of students, begins gradually with students from easier to harder level, save time for teacher and student, the student is not ashamed to make mistakes, and more .In this paper, we describe the design of an Intelligent Tutoring System for teaching Python to help students learn Python easily and smoothly. Tutor provides beginner level in Python. Finally, we evaluated our tutor and the results were excellent by students and teachers.

Keywords: Python; Intelligent Tutoring System (ITS); Tutor

1. INTRODUCTION

Intelligent Tutoring Systems (ITS) are, in many respects, very similar to human tutors. Based on cognitive science and Artificial Intelligence (AI), ITS have proven their worth in multiple ways in multiple domains in Education [1, 2]. Currently, ITS can be found in core Mathematics, Physics, and Language courses

in many schools various countries world. ITS are growing in acceptance and popularity for reasons including:

   i)   Increased student performance,

   ii)   Deepened cognitive development,

   iii)   Reduced time for the student to acquire skills and knowledge [1, 2, 3].

Intelligent Tutoring Systems that tutor and monitor programming have been developed and evaluated for many years in the field of Artificial Intelligence in Education. In many ways, programming has been a very productive domain in the evolution of most aspects of the field including student modeling, knowledge representation, and the application of sound pedagogical principles. Effective programming requires a range of problem-solving and diagnostic strategies. The manner in which a student writes code provides rich insight into the reasoning processes of the student.

As a result, programming provides an interesting domain for studying learning and cognitive processes.

The goal of this current research is to bring together recent developments in the fields of Intelligent Tutoring Systems, Cognitive Science, and AI to construct an effective intelligent tutor help students learn to program in Python. In addition to contributing to understanding the learning process in general, it is hoped that this research will have a positive impact on supporting instructors teaching Python programming in their institution. More than ever, this is an important area for institutions where there are more students wishing to learn to program, and where it is difficult to provide personalized instruction that they need [4]. Additionally, since there are a growing number of institutions investing in distance learning, this research will play a significant role to provide appropriate methods of teaching this key subject to students learning remotely.

2.   LITERATURE REVIEW

The subject of the intelligent tutoring system has been addressed in many papers because of its importance in the field of education in addition to its positive result, such as An Intelligent Tutoring System Authoring Tool designed by Abu Naser teaches how to use Python program [4], SQL-Tutor, teaches and explains to students the way of writing queries in relational database through several lessons in the basics of writing query [6], ITS for Health problems related to addiction of video game playing [7], TS for C# Language [8], effectiveness of

the CPP-Tutor [9], teaching AI searching algorithms [10], teaching database [11], and ITS for Teaching the 7 Characteristics for Living Things [17], ITS for teaching the right letter pronunciation in reciting the Holy Quran [12], ITS for teaching advanced topics in information security [13], Oracle Intelligent Tutoring System (OITS) [14], ITS for learning Computer Theory[15], e-learning system [16], ADO-Tutor: Intelligent Tutoring System for leaning ADO.NET [18], ITS for Parameter Passing in Python Programming [22], and Predicting learners performance using NT and ITS [19], CPP-Tutor for C++ Programming Language [20], a comparative study between Animated Intelligent Tutoring Systems (AITS) and Video-based Intelligent Tutoring Systems (VITS) [21], ITS for stomach disease Intelligent Tutoring System [23], ITS for diabetes [24], Computer Networks [25], DSE Tutor for Teaching DES Information Security Algorithm [26].

3. ITS SYSTEM ARCHITECTURE

In this research we used a tool to build a intelligent tutoring system to learning Python language, in this tool allows the administrator to add lessons, examples and questions and many general settings that control the form of the program, this intelligent tutoring system consists of four main components: Domain Unit, Teaching Unit, Student MODEL and User Interface MODEL.
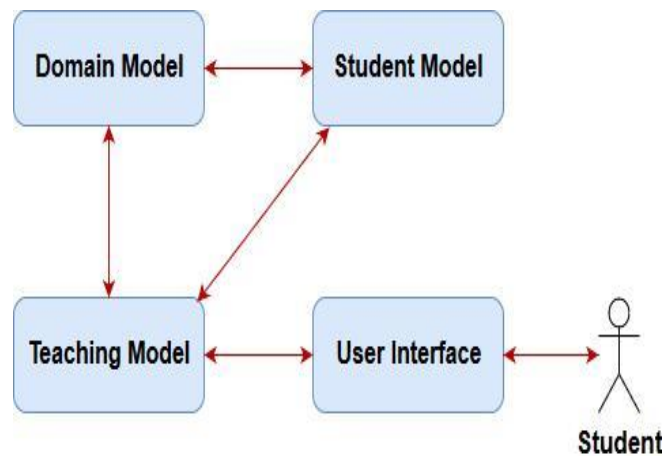

Figure 1: Architecture of an Intelligent Tutoring System.

2.1 DOMAIN MODEL

In this section we will discuss the topics covered by this system:
- Overview of Python language.
- Environment Setup.

- Basic Syntax.
- Datatypes and Variable.
- Print Statement by use Console.
- Print Statement by use GUI.
- Operators.
- Input Statement by use Scanner.
- Input Statement by use GUI.
- Decision Making.
- Loop Control.
- Method.
- Array.
- Class & Object.
- Composition.
- Inheritance.
- Polymorphism.
- Abstraction.
- Interface.

2.2 STUDENT MODEL

Each student can use this program through his or her own account, and log on to the system through the student's number to learn the lessons and solve the specific exercises in each lesson. Exercises for students in successive grades will be very easy. If you fail the exercises you will return to the lesson again.

Each student will also have a final mark, when learning the lessons and solving the exercises.

2.3 TEACHING MODEL

This MODEL as controller that controls operations in ITS, the student can answer questions if has good degree or more he can move to next level, but if he fails he back to exercises of the same level.

The degree of difficulty increases as the student moves from a lower level to a higher level and if the student obtains a higher degree than good.

2.4 USER INTERFACE

The user interface is divided into two sections for the teacher to add lessons, examples, exercises, modification and deletion, in addition to adding new users to

the color adjustment and many settings. The student interface is the one through which lessons are reviewed, exercises are solved and the student's degree is determined.

3 ITS EVALUATION

We tested some students interested in the language of Python using the intelligent tutoring system and the results were excellent and all of them showed a desire to use the system because it is the work of the human teacher to the fullest.

4. CONCLUSION

ITSs are seen as future's mentoring framework and many examinations fulfilled around there. When they are contrasted with customary classroom climate, ITSs are very effective and moderately having instructors' spot, they go up against supporting obligation for understudies. In customary showing condition, understudies' contrasts aren't considered. In this paper, we have designed intelligent tutoring system for student learning Python. The system was created for students who need to think about Python or increment their knowledge in this field easily. The evaluations of the system have been done by teachers and students.

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