Improving App Inventor Usability via Conversion Between Blocks and Text

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Problem

MIT App Inventor 2 (AI2), a popular online environment for Android app development, democratizes programming through its easy-to-use blocks language. While simple blocks programs are easy to read and write, complex ones become overwhelming. Creating and navigating nontrivial blocks programs is tedious, and AI2's current inability to copy blocks between projects inhibits reusing code between projects and programmers.

Solution

TAIL (Textual App Inventor Language)

To address these issues, we have created a new textual language, TAIL, that is isomorphic to AI2's blocks language and provided a means for converting between regular blocks and code blocks that contain TAIL. This project aims to (1) increase AI2's usability by providing an efficient means for reading, constructing, and reusing programs, and (2) ease users' transitions from blocks programming to text programming.

TAIL Language Design

Conversion Between Blocks and TAIL: The Details

ANTLR Lexer Grammar Rules

ANTLR Parser Grammar Rules

ANTLR Parser Actions

in Javascript Target

<block type="math_multiply" inline="true">
  <mutation items="2"></mutation>
  <value name="NUM0">
    <block type="math_add" inline="true">
      <mutation items="2"></mutation>
      <value name="NUM0">
        <block type="math_number">
          <title name="NUM">12</title>
        </block>
      </value>
      <value name="NUM1">
        <block type="math_number">
          <title name="NUM">3</title>
        </block>
      </value>
    </block>
    <value name="NUM1">
      <block type="math_number">
        <title name="NUM">4</title>
      </block>
    </value>
  </value>
</block>

Blocks <--- Text Conversion

Blocks to TAIL

JavaScript Blocks to Text Converter

Tail Code Blocks (in JavaScript)

ANTLR

Parser

ANTLR Lexer Grammar Rules

ANTLR Parser Grammar Rules

ANTLR Parser Actions

Tree Translation

ANTLR Parser Actions in Javascript Target

<block type="math_multiply" inline="true">
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  <value name="NUM0">
    <block type="math_add" inline="true">
      <mutation items="2"></mutation>
      <value name="NUM0">
        <block type="math_number">
          <title name="NUM">12</title>
        </block>
      </value>
      <value name="NUM1">
        <block type="math_number">
          <title name="NUM">3</title>
        </block>
      </value>
    </block>
    <value name="NUM1">
      <block type="math_number">
        <title name="NUM">4</title>
      </block>
    </value>
  </value>
</block>

Empty Sockets

[while test: {call pred a: {} b: {42}}
  do: {
    call dump a; b;
  }]

[when Button1.Click
do: {
  initialize_global <num> to: {42}
  when Button1.Click
do: {
    initialize_local <avg>
to: {call average
      x: {TextBox1.Text}
y: {get global num}
in: {if {{get avg} < {get global num}}
        then: {{set global num to: {{get avg} / {2}}}
        else: {set TextBox1.Text to: {get avg}}}}})
    (to <average> <x> <y>
result: {{{get x} + {get y}} / {2}})
  }
}]

<block type="math_multiply" inline="true">
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        </block>
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    </block>
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      <block type="math_number">
        <title name="NUM">4</title>
      </block>
    </value>
  </value>
</block>