Robot ON!

A Serious Game for Improving Programming Comprehension

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Motivation

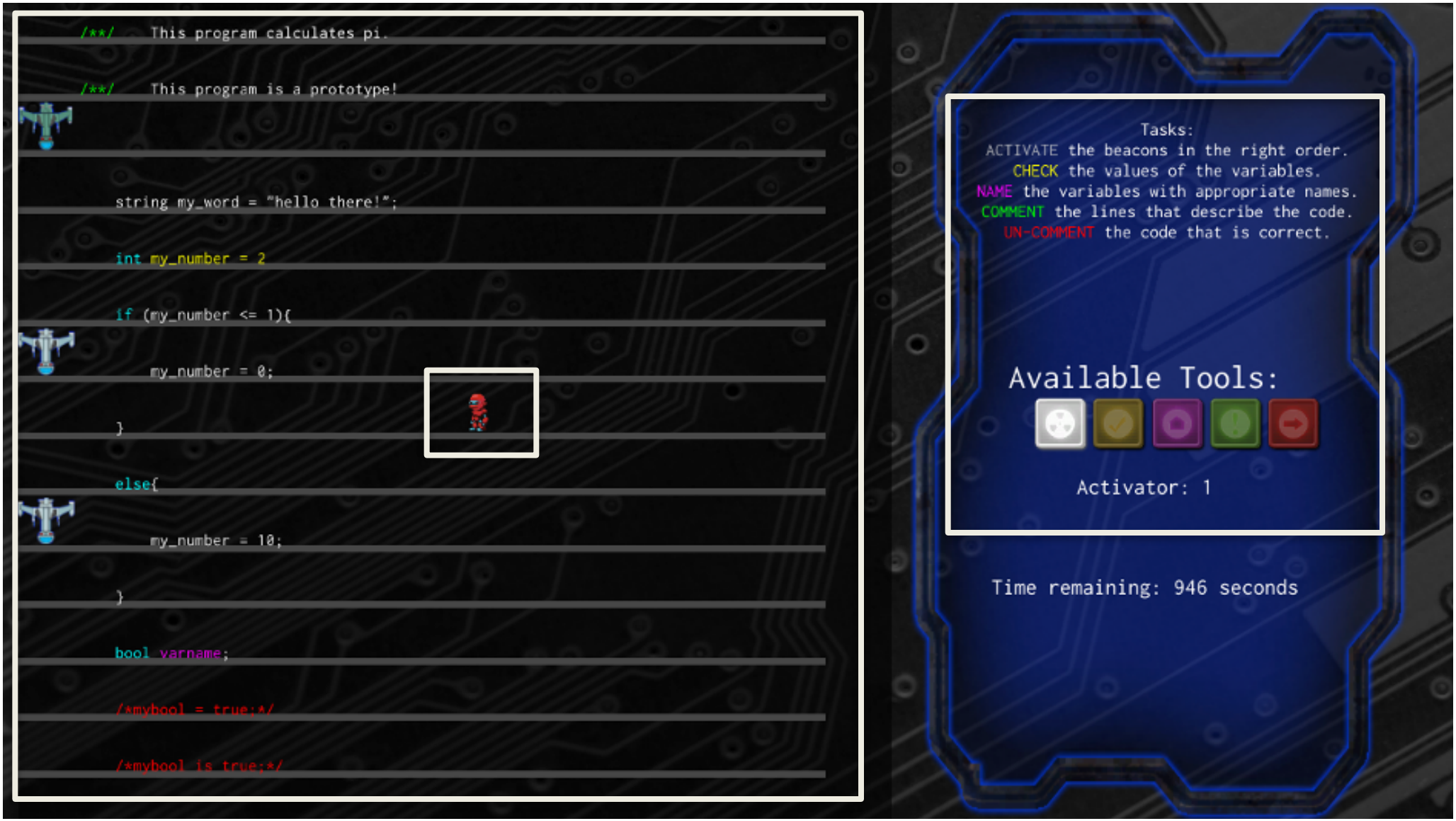
- Many students struggle in **introductory computer programming** courses
- Students especially struggle to **understand** code they did not write themselves
- Most serious games about programming involve players **writing** their own code
  - Students lack programming comprehension skills

Robot ON!

- Players take the role of a programmer trying to activate a series of 'Mech' systems
- Controlling a robotic avatar, the player must complete **puzzle tasks** to finish each level
  - Each puzzle is based on understanding existing code

Robot ON!

- Two dimensional
  - The player can run, climb, or fall through lines of code
  - Mimics a **real code environment** by allowing navigation similar to a word processor cursor
- Tools provided to the player allow them to interact with different **puzzle tasks**
  - Each line of code may have any number of puzzle tasks



Robot ON! Puzzle Tasks

- Puzzle tasks focus on understanding key programming concepts:
  - **Variable values**
  - Data type identification
  - Program statements
  - Control flow

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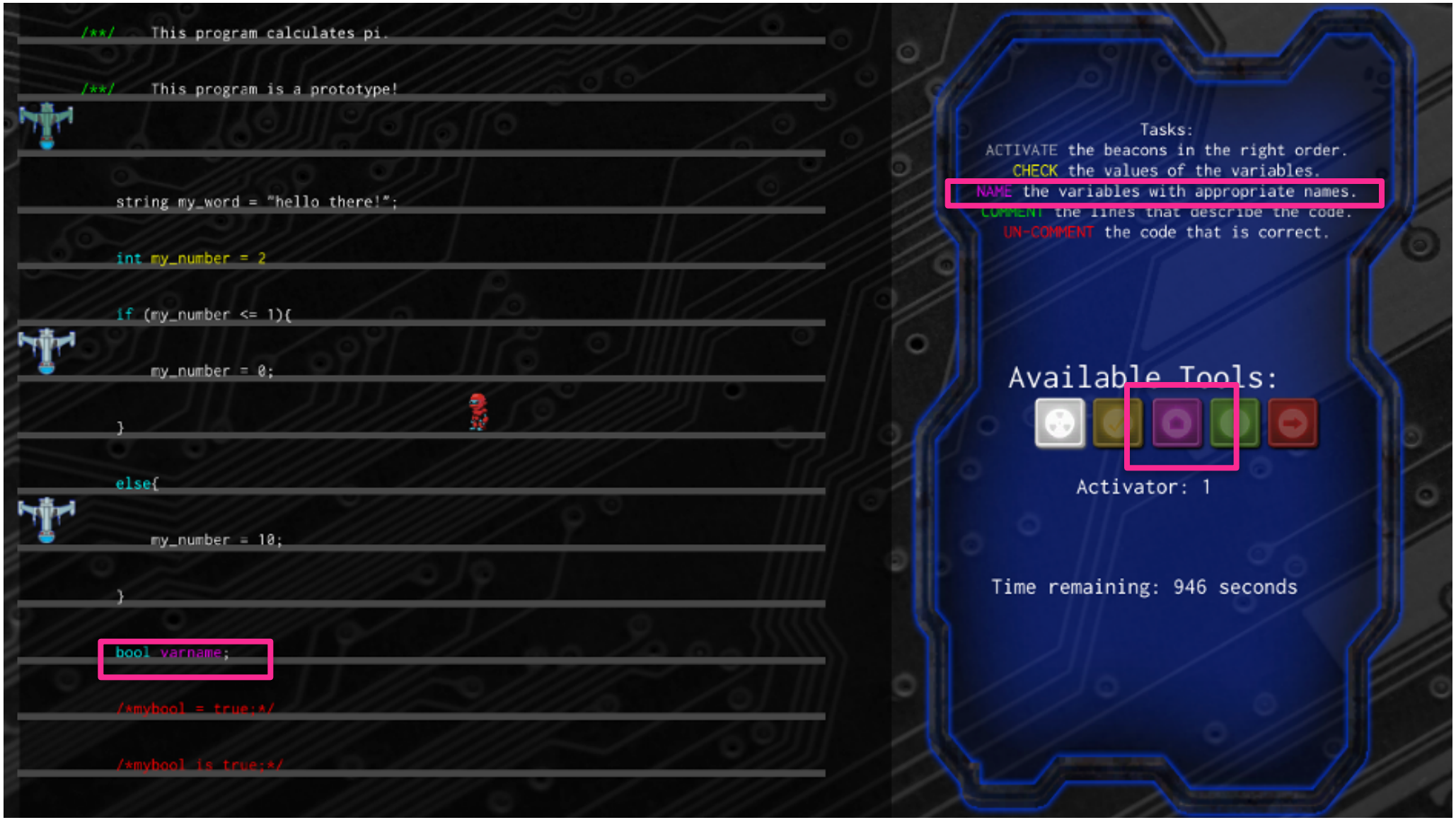

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Customizing Robot ON!

- Robot ON! was designed to be customizable and extendible by course instructors
  - Levels can be created for **different programming languages**
  - Puzzle tasks can be created to target specific students and learning materials
  - Creating puzzle tasks provides students a chance to learn through **failure**!

Customizing Robot ON! - XML

```
13  <code>
14  <badcomment size="1" righttext = "This program counts from
    1 to 10!">    This program counts from 10 to 1.
15  </badcomment>
16  <oncomment size="1">    "This program counts from 1 to 10!"
17  </oncomment>void main(){
18      for(int i = 1;i &lt;=10; i++){
19          cout &lt;&lt; i &lt;&lt; endl;
20          if (i % 5 == 0){
21              cout &lt;&lt; "div by 5!" &lt;&lt; endl;
22              <beacon actnums="0,1"></beacon>
23          }
24      }
25  }
26  </code>
```

Evaluating Robot ON!

- Is the Robot ON! game **playable** by undergraduate students?
- Does Robot ON! give players sufficient **skills** to work with a new programming language (i.e., achieve learning outcomes)?
- Do students **enjoy** playing the Robot ON! game?

Future Work

- **Planned Evaluation**
  - Two part study of usability and learning outcomes
- **Incorporation into introductory courses**
  - Robot ON! is intended to supplement existing courses
- **Open-source**
  - Robot ON! is available to other institutions for community improvement on Github
- **Wider application of CS game-based learning**
  - Robot ON! game could be adapted to include other software concepts (e.g. parallelization)

Summary

- Robot ON! is a **learning supplement** for introductory programming courses to aid students in developing programming comprehension skills
- Robot ON! can be a starting point for the creation of an **improved** game for teaching debugging or other concepts
- Robot ON! can be **customized and extended** by instructors in accordance with their learning materials

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ROBOT ON! IS AVAILABLE AT:
https://github.com/sqrlab/RobotON