Inventory Management with an LLM Bot and Camera

Ozobot Editor Challenge—Teacher's Guide

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Introduction

If you haven't already done so, you should read the two-page student guide that accompanies this lesson. It provides all of the information needed by you and the student to thoroughly understand the challenge.

Challenge Summary

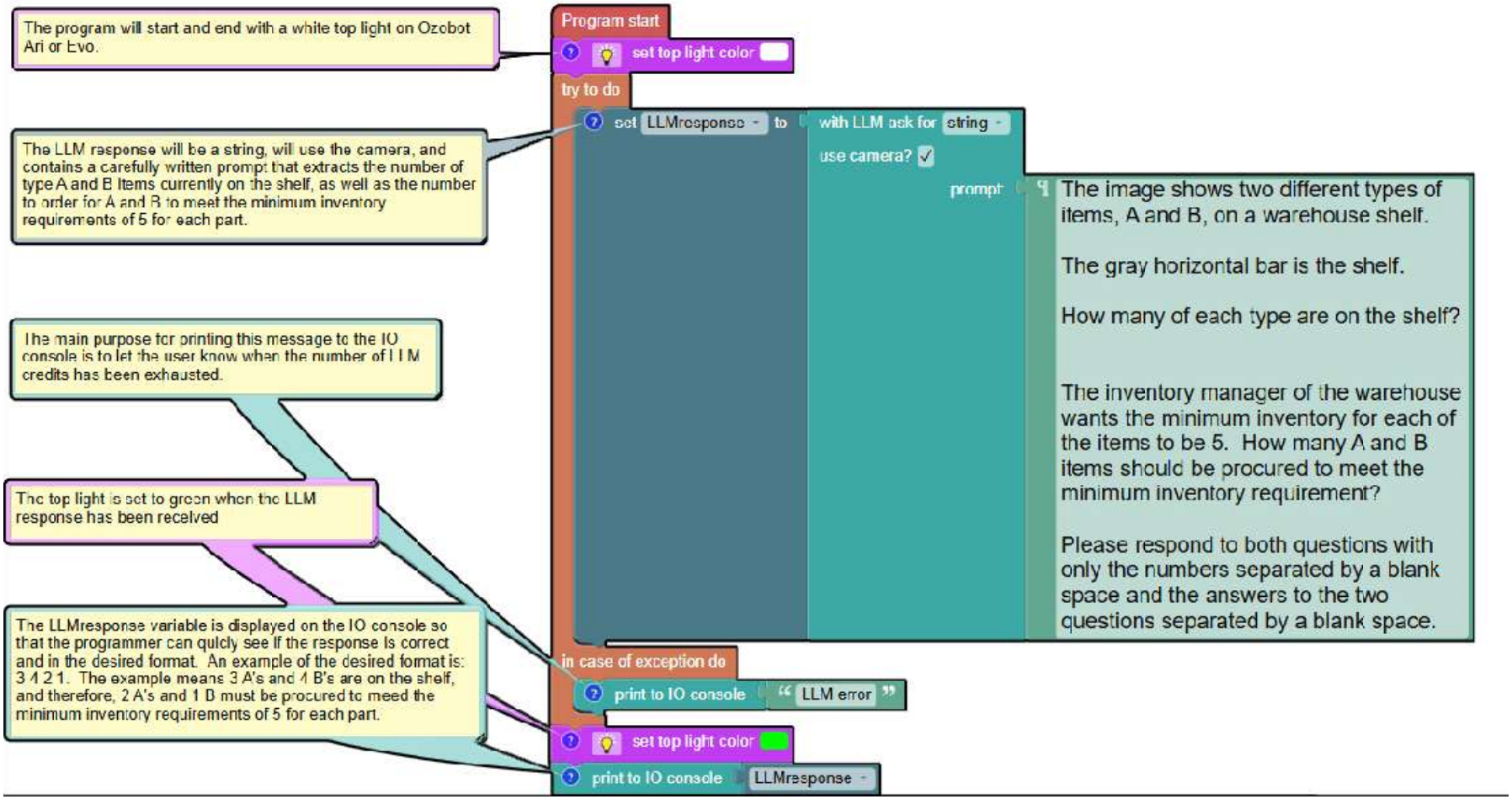
This challenge involves using camera-based AI to manage warehouse inventory by analyzing images of shelf items, specifically two types labeled A and B, to determine the number of each item needed to meet a minimum inventory threshold of 5. The process includes capturing pictures of the shelf, using AI to assess current quantities, and calculating the procurement requirements. An Ozobot (Ari or Evo) will then move to a specified grid location corresponding to the calculated order quantities, and display or output a message indicating how many items of each type should be ordered to reach the minimum stock level. The task combines visual analysis, strategic movement, and communication to optimize inventory management.

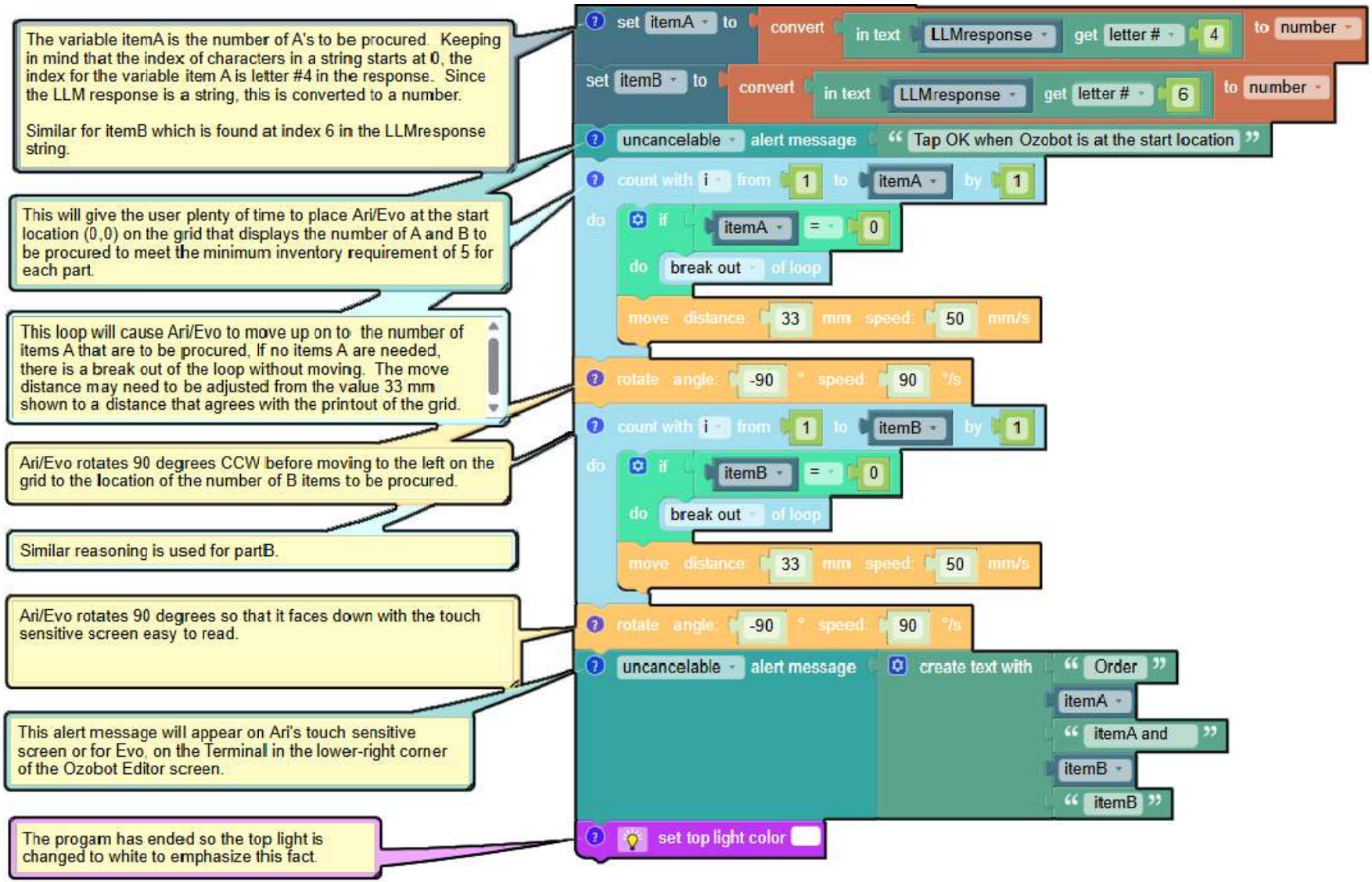
Computer Science Programming Concepts in This Lesson

- The use of variables to hold the values of program constants
- The use of loops to handle tasks that must be repeated several times
- The use of conditionals, as needed, to control the flow of logic
- Variable names that support self-documentation
- Extracting information from a string by parsing
- The use of LLM (Large Language Models) with a camera

Complete Program with Comments

On the next two pages, you will find the complete Ozobot Editor solution to the challenge as prepared by the author. The wording of the LLM prompt is a key factor in achieving success in the challenge. The prompt may require several iterations before the students get the desired response from the LLM. The solution also involves parsing the response to obtain the number of A and B items that need to be ordered to meet the minimum inventory requirements of 5 for each part. These two numbers come from the LLM response, which is a string. Therefore, conversion to a number is required for each. It should also be noted that the prompt must be general enough so that it can handle all of the example shelves without changing the prompt.


The program will start and end with a white top light on Ozobot Ari or Evo.
The LLM response will be a string, will use the camera, and contains a carefully written prompt that extracts the number of type A and B items currently on the shelf, as well as the number to order for A and B to meet the minimum inventory requirements of 5 for each part.
The main purpose for printing this message to the IO console is to let the user know when the number of LLM credits has been exhausted.
The top light is set to green when the LLM response has been received
The LLMresponse variable is displayed on the IO console so that the programmer can quicly see if the response is correct and in the desired format. An example of the desired format is: 3 1 2 1. The example means 3 A's and 1 B's are on the shelf, and therefore, 2 A's and 1 B must be procured to meed the minimum inventory requirements of 5 for each part.
Program start
set top light color
try to do
set LLMresponse to
with LLM ask for string
use camera?
prompt
The image shows two different types of items, A and B, on a warehouse shelf.
The gray horizontal bar is the shelf.
How many of each type are on the shelf?
The inventory manager of the warehouse wants the minimum inventory for each of the items to be 5. How many A and B items should be procured to meet the minimum inventory requirement?
Please respond to both questions with only the numbers separated by a blank space and the answers to the two questions separated by a blank space.
in case of exception do
print to IO console
" LLM error "
set top light color
print to IO console
LLMresponse


The variable itemA is the number of A's to be procured. Keeping in mind that the index of characters in a string starts at 0, the index for the variable item A is letter #4 in the response. Since the LLM response is a string, this is converted to a number.
Similar for itemB which is found at index 6 in the LLMresponse string.
This will give the user plenty of time to place Ari/Evo at the start location (0,0) on the grid that displays the number of A and B to be procured to meet the minimum inventory requirement of 5 for each part.
This loop will cause Ari/Evo to move up on to the number of items A that are to be procured, If no items A are needed, there is a break out of the loop without moving. The move distance may need to be adjusted from the value 33 mm shown to a distance that agrees with the printout of the grid.
Ari/Evo rotates 90 degrees CCW before moving to the left on the grid to the location of the number of B items to be procured.
Similar reasoning is used for partB.
Ari/Evo rotates 90 degrees so that it faces down with the touch sensitive screen easy to read.
This alert message will appear on Ari's touch sensitive screen or for Evo, on the Terminal in the lower-right corner of the Ozobot Editor screen.
The progam has ended so the top light is changed to white to emphasize this fact.
set itemA to convert in text LLMresponse get letter # 4 to number
set itemB to convert in text LLMresponse get letter # 6 to number
uncancelable alert message "Tap OK when Ozobot is at the start location"
count with i from 1 to itemA by 1
do if itemA = 0
do break out of loop
move distance 33 mm speed 50 mm/s
rotate angle -90 ° speed 90 °/s
count with i from 1 to itemB by 1
do if itemB = 0
do break out of loop
move distance 33 mm speed 50 mm/s
rotate angle -90 ° speed 90 °/s
uncancelable alert message create text with "Order" itemA "itemA and" itemB "itemB"
set top light color

Share Codes

- Without comments: **7ctnxcu**
- With comments: **xaypdps**

Alternative Ways to Use this Challenge

Instead of using this lesson as a challenge, the teacher may elect to present the solution to students after they have read the Student Guide. A teacher walkthrough of the program with comments, allowing student interaction and questions from students, may be more appropriate in some situations. Following the walkthrough, students could then work with the program using the accompanying diagrams of shelves containing various combination of parts A and B. See the file *Seven Example Shelfs for the Inventory Progtram.pdf*. These examples can be cut apart on the dotted lines and used by students to test their inventory challenge program solution.

Example Inventory Video

Accompanying this lesson is a video entitled *Example Inventory Video.m4v*. You may find it useful to show this short video to your students before they begin the challenge. It shows Ari moving on the grid for a shelf containing 3 A and 4 B items, stopping at (x,y)=(1,2) to indicate that 2 A items and 1 B item need to be ordered to satisfy the minimum inventory requirement of 5 for each item.

Applicable CSTA (Computer Science Teachers Association) Standards

2-CS-02	Design projects that combine hardware and software components to collect and exchange data.
2-AP-11	Create clearly named variables that represent different data types and perform operations on their values.
2-AP-19	Document programs in order to make them easier to follow, test, and debug.
3A-DA-11	Create interactive data visualizations using software tools to help others better understand real-world phenomena.
3B-CS-02	Illustrate ways computing systems implement logic, input, and output through hardware components.
3B-AP-08	Describe how artificial intelligence drives many software and physical systems