

DODO: Multiplayer Educational Game for the Visually Impaired

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Motivation:

- According to WHO, “School-age children with vision impairment can also experience lower levels of educational achievement.”¹
 - This is due to the difficulty of acquiring information through visual means; often many subjects require visuals/graphics to better explain the applications and spatial awareness, especially in STEAM
- DODO is a tactile coding block that supports visually impaired students in learning computer programming
- Series of paper modules with unique texture and shapes to represent a different function or value in code
 - By using AI and computer recognition, the AI will provide feedback to the student in real time
- This project will aim to further optimize and increase the effectiveness of DODO by applying gamification to the system and creating a multiplayer version of DODO

Research Problem:

- Gamification: Process of enhancing systems by applying video game characteristics to motivate/engage users²
 - Can increase learning efficiency, learning motivation and engagement, increasing information retaining ability etc.
- Gamification is effective when a cycle of struggle and reward is applied to the user³
 - Evokes “pleasure” within the user
 - Incentives the user to continue playing the game
- Due to DODO being a program for the visually impaired; gamification will be applied through aspects like:
 - Assigning mission objectives
 - Sound effects
 - Narrator/storyline
 - Badges
- The multiplayer game will use a competitive gamemode, where individuals compete to complete each mission objective the quickest

DODO: Gamification for the Visually Impaired

- AI Object Detection is modified, instead of real-time detection — webcam captures image when a button is pressed
 - Image captured is then analyzed — allows for faster processing and supports this gamemode
 - Timer for each script will time how fast each player is — this will determine which player is faster
- Level ideas:**
- #1: Show a variable module
 - #2: Show an if statement
 - #3: Show a module that will print a variable
 - #4: Show a variable that has the value “x = 2”
 - #5: Show a module that will print “x = 2”

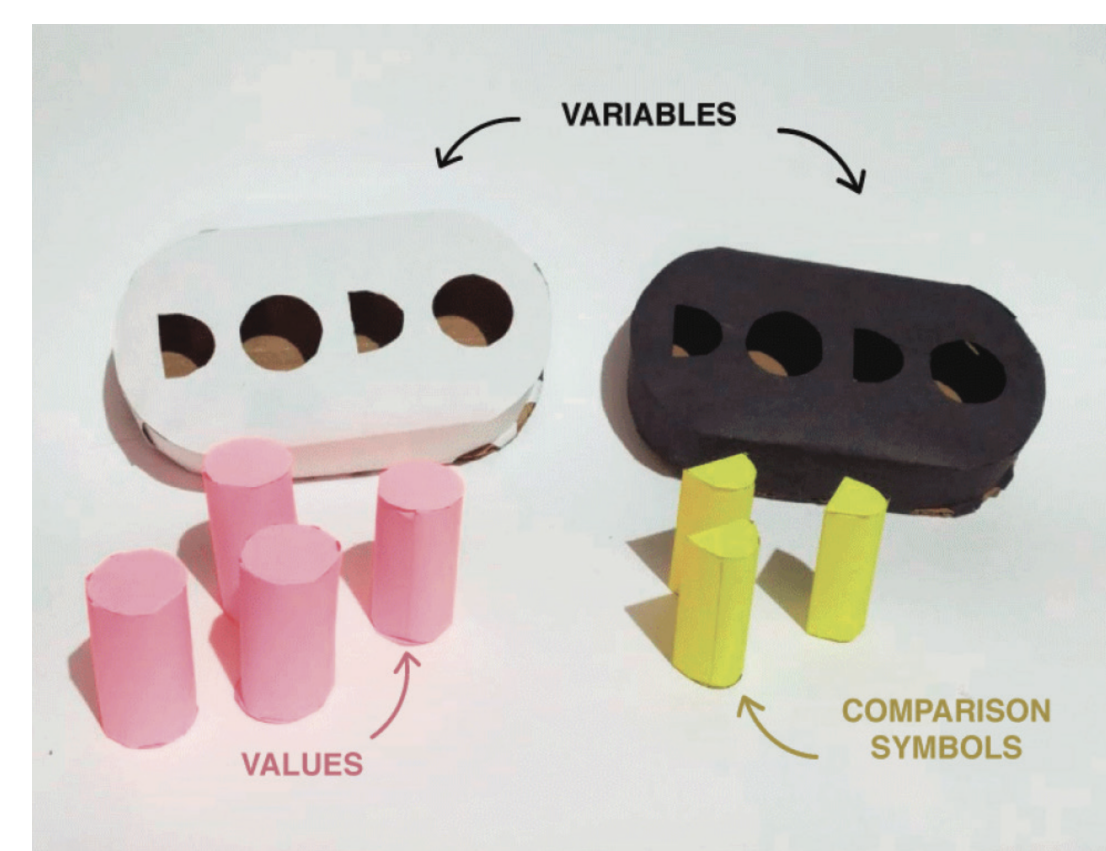


Figure 1: The paper modules used in DODO

Methodology:

- 1 Brainstorming — Identify user requirements and limitations due to visual impairment
- 2 Mapping out a flowchart of the code — Develop logistics of the program
- 3 Writing pseudocode — Apply in coding format

- This software program will use two cameras & two buttons to host the game on one computer
- For the sake of simplicity and to promote playing the game beside each other and in person

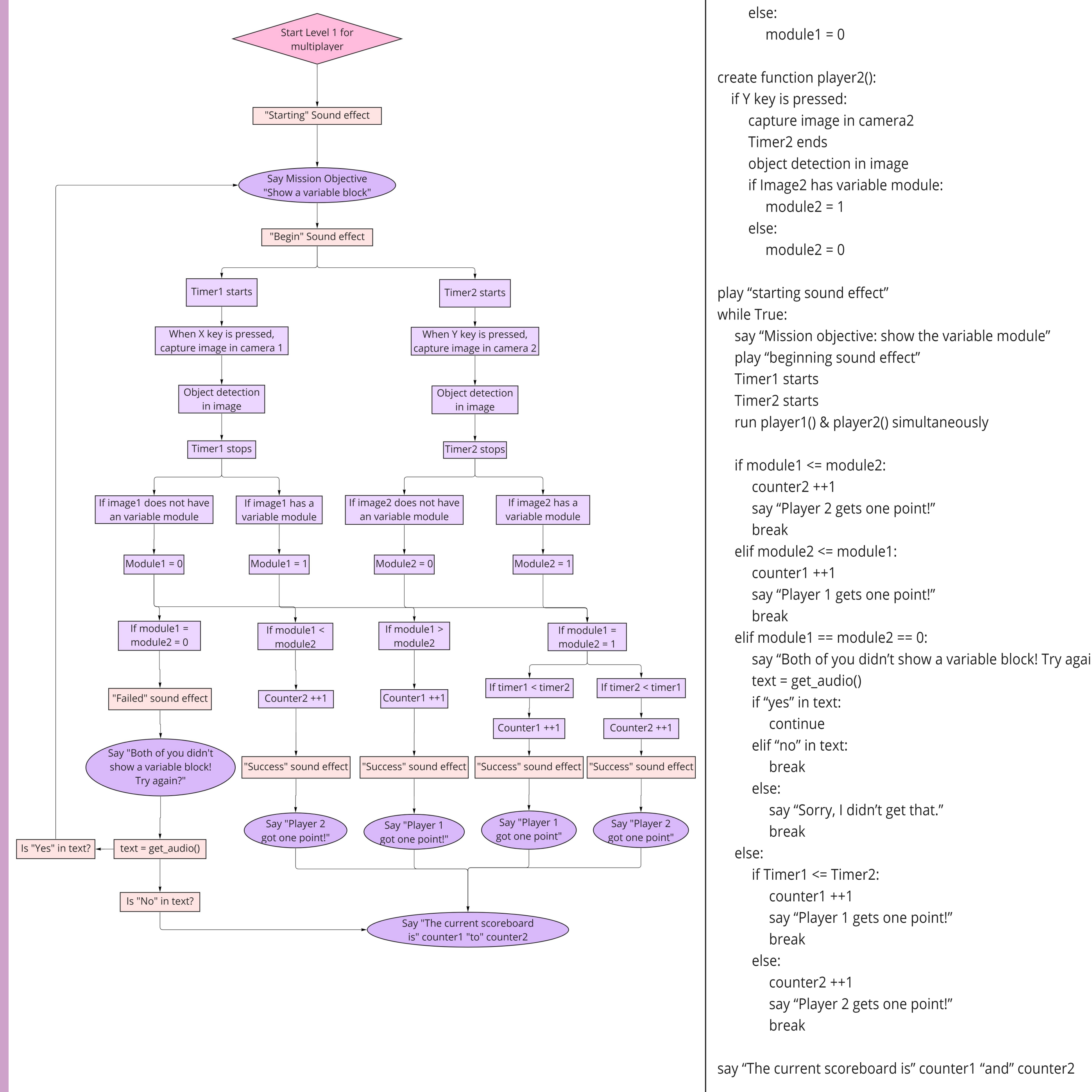


Figure 2: Flow chart depicting how the code for the first level will function

```
create function get_audio() input voice from user
create function object_detection

#level 1
create function player1():
  if X key is pressed:
    capture image in camera 1
    Timer 1 ends
    object detection in image
    if Image1 has variable module:
      module1 = 1
    else:
      module1 = 0

create function player2():
  if Y key is pressed:
    capture image in camera2
    Timer2 ends
    object detection in image
    if Image2 has variable module:
      module2 = 1
    else:
      module2 = 0

play "starting sound effect"
while True:
  say "Mission objective: show the variable module"
  play "beginning sound effect"
  Timer1 starts
  Timer2 starts
  run player1() & player2() simultaneously

if module1 <= module2:
  counter2 ++
  say "Player 2 gets one point!"
  break
elif module2 <= module1:
  counter1 ++
  say "Player 1 gets one point!"
  break
elif module1 == module2 == 0:
  say "Both of you didn't show a variable block! Try again?"
  text = get_audio()
  if "yes" in text:
    continue
  elif "no" in text:
    break
  else:
    say "Sorry, I didn't get that."
    break
else:
  if Timer1 <= Timer2:
    counter1 ++
    say "Player 1 gets one point!"
    break
  else:
    counter2 ++
    say "Player 2 gets one point!"
    break
say "The current scoreboard is counter1 and counter2"
```

Figure 3: Pseudocode depicting how the code for the first level will be written

Future Work:

- Following these plans, the next step would be to program the code in Python and create a working game
 - This would include the listed sound effects, narration, audio instructions, feedback, badges etc.
 - Adding more levels
 - Using the actual paper modules and AI object detection
- Further work could include different multiplayer modes (eg. A collaborative mode)

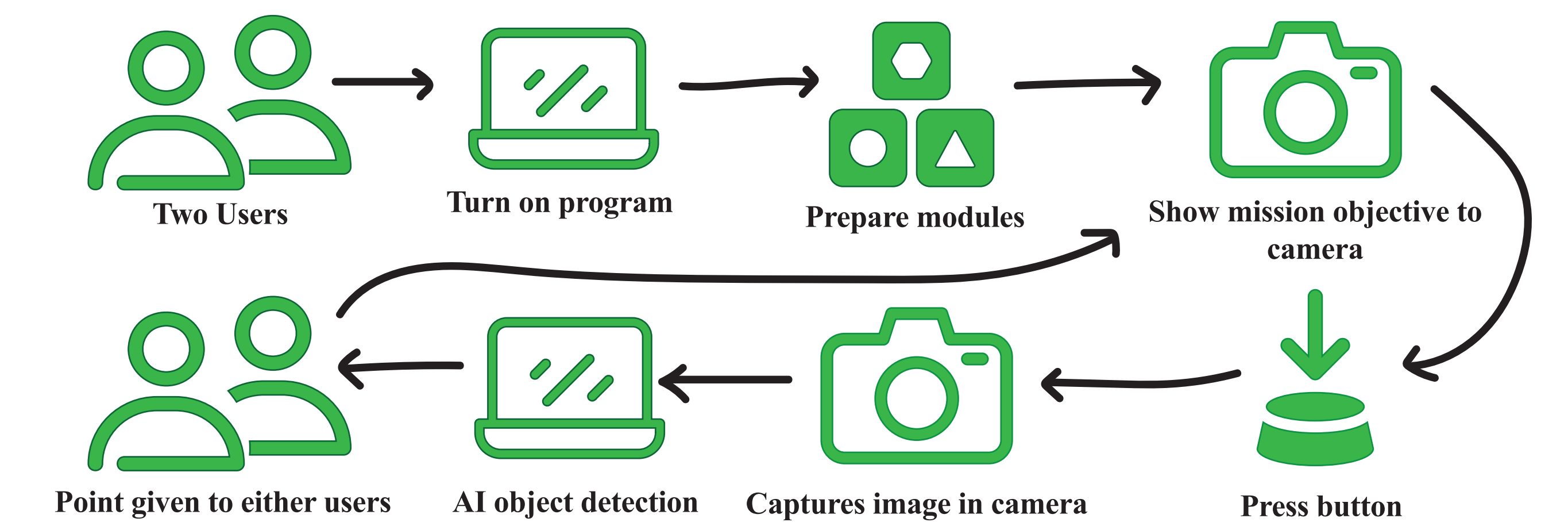


Figure 4: Diagram depicting how the program will function

Literature Cited:

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