Deliverable G

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GNG1103

1. Abstract

This document outlines the 2nd Zone Restriction prototype from Group 12. It details the steps that have been taken from prototype 1 to get to where we are today. It details the numerous tests that were conducted on the respective prototypes and their respective findings. Further feedback from potential users was collected with a more advanced/specific direction. This feedback will once again be used in the future to further improve our final product. The Bill of Materials has been improved further including a major API addition to aid in our final product. The projected test plan for prototype 3 has also been created with are set to iterate on prototype 2 using the knowledge gained from past tests and user feedback.

2. Defining the prototype

Our second prototype is split into two separate sections that function independently from each other.

2.1. Alert SMS Test

The alert SMS system uses python code and a Twilio API to send an SMS message to a user. The goal of this prototype is for a message to be sent whenever the randomly generated variables in the function enter a “restricted area”. In the future this code will be implemented with the other systems and will send a text message (with the content varying with the level of the alert) to the user.

2.2. GUI Functionality

The prototype 2 GUI is finally a functioning GUI. The alerts have been organized with the ability to see all previous alerts until they are deleted. We are also working on implementing the live zone tracking however we are still troubleshooting. Additional buttons have also been added however we are still actively looking for functions for the buttons.

2.3. UE Position Graphics

Using JavaScript to script the functionality of an HTML webpage, the input coordinates of a boundary and UE are scaled in order to fit inside of a specified canvas, and are then displayed, updating according to a user specified refresh rate.

3. Prototype 2 Test Plan:

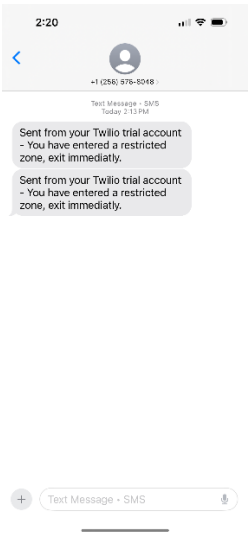
3.1. Alert SMS System

<table>
<tr><td>Test Descriptions</td><td>Python code will send an SMS message to a user once a randomly generated set of variables enters a restricted zone.</td></tr>
<tr><td>Reason for Prototype</td><td>Analyzing critical subsystems
---
Verifying feasibility</td></tr>
<tr><td>Evaluation Criteria</td><td>Proportion of successful emails
---
Delay between send and receive</td></tr>
<tr><td>Level of Prototype</td><td>Middle fidelity

Focused</td></tr>
<tr><td>Kind of Prototype</td><td>Analytical</td></tr>
<tr><td>Metrics</td><td>Proportion (%)

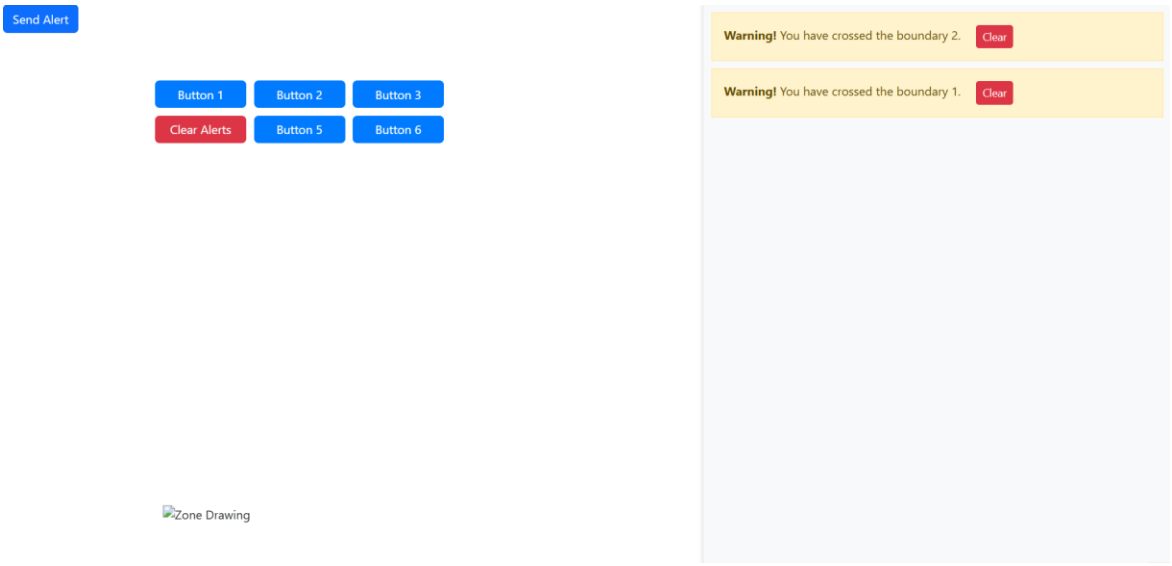
Delay (s)</td></tr>
<tr><td>Analysis Method</td><td>The recipients’ text messages will be checked to see if the correct message was sent at the correct time.</td></tr>
<tr><td>Stopping Criterion</td><td>Loop is ran 10 times, text message is sent each time the variable enters a restricted zone.</td></tr>
<tr><td>Results</td><td>(The restricted zone is set from 11>X>5 and 11>Y>5)
<table>
<tr><th>Location</th><th>Output</th><th>Text sent</th></tr>
<tr><td>X: 6 Y: 3</td><td>Safe</td><td>N/A</td></tr>
<tr><td>X: 6 Y: 9</td><td>You’ve entered a restricted zone</td><td>You have entered a restricted zone, exit immediately.</td></tr>
<tr><td>X: 7 Y: 2</td><td>Safe</td><td>N/A</td></tr>
<tr><td>X: 8 Y: 8</td><td>You’ve entered a restricted zone</td><td>You have entered a restricted zone, exit immediately.</td></tr>
<tr><td>X: 3 Y: 3</td><td>Safe</td><td>N/A</td></tr>
<tr><td>X: 7 Y: 4</td><td>Safe</td><td>N/A</td></tr>
<tr><td>X: 5 Y: 6</td><td>Safe</td><td>N/A</td></tr>
<tr><td>X: 2 Y: 6</td><td>Safe</td><td>N/A</td></tr>
<tr><td>X: 7 Y: 3</td><td>Safe</td><td>N/A</td></tr>
</table></td></tr>
<tr><td>Interpretation</td><td>Pass: Message was sent each time the variable entered the restricted zone</td></tr>
</table>

```
Lab4_GNG1103 > Prototype_P2 > Prototype.py > ...
import time
import random
from twilio.rest import Client

# Twilio credentials
account_sid = 'ACaefcdd8d722d46bc2cc4bffdb2631b7a'
auth_token = '327086962302d042a0f2e2ae8c789a05'
client = Client(account_sid, auth_token)

# Send a message

for i in range (10) :

    X = random.randint(1, 10)
    Y = random.randint(1, 10)

    if 11 > X > 5 and 11 > Y > 5 :
        message = client.messages.create(
            body="You have entered a restricted zone, exit immediatly.",
            from_='+12565768048',  # Your Twilio phone number
            to='+16139864044'      # Recipient's phone number
        )
        print("You've entered a restricted zone")
    else:
        print('Safe')
    print(X, Y)
    time.sleep(5)
```



3.2. Interactive GUI

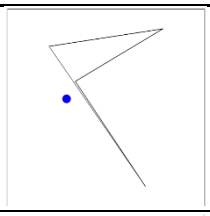
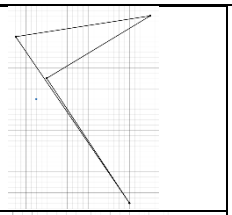
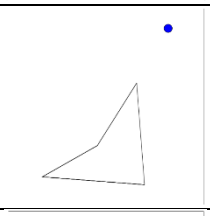
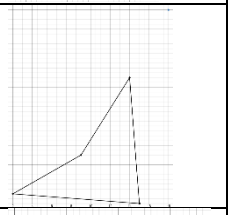
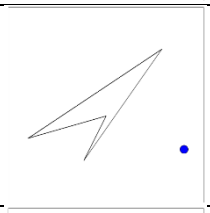
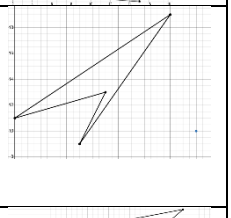
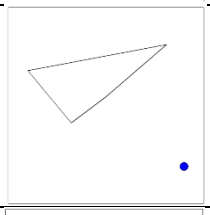
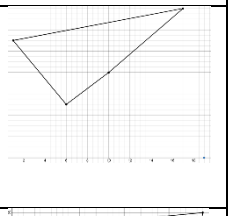
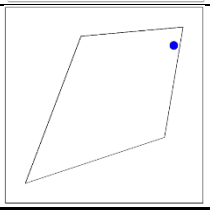
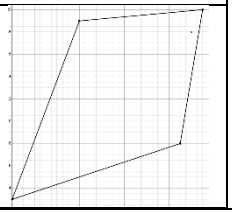
Test Descriptions	GUI code will send alerts when button is pressed and clear each alert with the specified button along with clearing multiple with the “Clear All” button
Reason for Prototype	Analyzing critical subsystems --- Verifying feasibility
Evaluation Criteria	Proportion of successful alert clears --- All buttons function optimally
Level of Prototype	High fidelity --- Focused
Kind of Prototype	Visual
Metrics	Proportion (%) --- Delay (s)
Analysis Method	Visual recognition of the alert disappearing off the screen
Stopping Criterion	5 alerts triggered and individually cleared then 5 alerts triggered and all cleared at once
Results	The first set of 5 alerts were triggered correctly and cleared with no issues. Same for the second set of 5
Interpretation	Pass



3.3. UE Position Graphics

Test Descriptions	JavaScript code will display specified boundaries and a point accurately and within its canvas
Reason for Prototype	Analyzing critical subsystems --- System integration
Evaluation Criteria	Proportion of points within canvas --- Accuracy to external comparison
Level of Prototype	High fidelity --- Focused
Kind of Prototype	Visual
Metrics	Proportion (%) --- Accuracy (%)
Analysis Method	The displayed graphics will be visually compared to the same points on Desmos
Stopping Criterion	5 randomly generated sets of 5 points are tested (1 of which is UE position)
Results	

Point	Vertices	Code	Desmos

	(5,11)	(3,17) (16,19) (6,13) (14,1)		
	(18,20)	(15,0) (2,1) (9,5) (14,13)		
	(14,10)	(12,19) (0,11) (7,13) (5,9)		
	(19,0)	(6,5) (10,8) (17,14) (1,11)		
	(16,18)	(0,3) (6,19) (17,20) (15,8)		
Interpretation	Pass: All 5 tests were visually identical to the same input points on Desmos, and all were centered in and scaled to the specified canvas			

4. Feedback Collection

From Client:

- The accuracy of the location tracking must be in the cm
- The location should be pulled more frequently depending on how close the UE gets to the zone

From other potential users:

- "It would be really helpful if the system could offer insights on how often boundary crossings happen, and with which vehicles or drivers. This could help us determine if we need to tighten access or adjust our workflows."

- “Zones may need to be adjusted frequently as we rearrange storage. Ideally, I’d appreciate a quick, user-friendly way to redefine or move zones on a map (a drag-and-drop setup). It would also be great if I could set rules for certain zones, like only triggering alerts if someone remains there for more than a minute."
- “Hierarchy of notifications”

5. BOM Update

Component	Quantity	Unit	Unit Cost	Total Cost	Link
Visual Studio Code	4	EA	0.00	0.00	https://code.visualstudio.com/
Arduino IDE	4	EA	0.00	0.00	https://www.arduino.cc/en/software
Shabodi Workshop	1	EA	0.00	0.00	
Python 3.13	4	EA	0.00	0.00	https://www.python.org/downloads/
Microsoft Excel	1	EA	0.00	0.00	
Twilio API	1	EA	0.00	0.00	https://www.twilio.com/console/projects/summary?_gl=1*1hql8zh*_gcl_au*NDI5MzMyMTg1LjE3MzEwMDI5NTg.*_ga*MTI1Nzc0MTczNy4xNzMxMDAyOTU4*_ga_RRP8K4M4F3*MTczMTExMDE2Ny4zLjEuMTczMTExMDIzNC4wLjAuMA..
				Total	
			Added Total	0.00	

			Final	0.00	

6. Prototype III Test plan

   Primary Goals:

   - To finalize and test the alert creation system responsible for creating appropriate alerts given a situation
   - Begin integration of critical subsystems to develop our first generalized prototype

Test Number	1	2
Test Description	Alert creation test: A set of random information (within reason) will be inputted into the code to test for the right output	First primary assembly: Assembly of all previous prototypes: Different sets of variables will be tested (Boundry coords, user coords)
Reason for Prototype	Analysing critical subsystems ----------Verifying feasibility	Analysing Program functionality ----------Verifying feasibility
Evaluation Criteria	Appropriate alert message created with given information	Alerts sent out properly and timely and graphics UI updated
Level of Prototype	Middle fidelity ---------- Focused	High fidelity ---------- Generalized
Kind of Prototype	Analytical	Analytical
Metrics	Success Rate	Success Rate
Analysis Method	The console with deliver an appropriate message upon execution	The GUI and SMS systems display the alert message and
Stopping Criterion	2 tests per condition change	20 tests

7. Conclusion

With prototype 2 completed there have been some major developments with respect to our final project. To start we have been informed that the Shabodi's APIs will not work as intended and should be omitted from the code. This means that the focus should be shifted from a functional product to a proof of concept. Due to this the codes have been

altered and most have been completed. This includes the location tracker, boundary system, and alert system with other sub codes being completed along the way. Continuing with our new goal of progressing slower a shift is now being made to the completion of the GUI. With the GUI now being functional and mostly completed the visual zone has proven to be a little harder than anticipated. Despite this new setback the team is confident it is possible by the deadline and will continue to strive for success in all areas of the final project.