Računarska grafika

O predmetu

Ciljevi

- Osnovni pojmovi i principi grafičkih sistema/paketa/biblioteka
  - primitive, atributi, animacija, interakcija, svetlo, kamera, tekstura,…
- Praktične veštine programiranja 2D i 3D računarske grafike
  - **JavaFX**

- Teoretski koncepti na kojima se zasniva računarska grafika
  - matematički koncepti: krive, transformacije, projekcija
  - fizički fenomeni: svetlost, boja
  - algoritmi: rasterizacija, popunjavanje, odsecanje, sakrivanje

- Pregled tehnologije uređaja koje koristi računarska grafika
  - grafički kontroleri, monitori, štampači, pokazivački uređaji
  - stereovizija

Metodologija

- Predavanja:
  - programiranje grafičkih aplikacija – biblioteka JavaFX (2D, 3D)
  - teoretski koncepti i tehnologije (1. deo)
- Auditorne vežbe:
  - zadaci programiranja računarske grafike
  - problemski zadaci vezani za teoretske koncepte
  - teoretski koncepti i tehnologije (2. deo)
- Domaći zadaci:
  - 2 domaća zadatka - projekta (2D i 3D), usmena odbrana
  - svaki po 25% ukupnog broja poena za ocenu
- Ispit:
  - u svakom ispitnom roku, samo test, nosi 50% ocene

Propozicije

- Sticanje poena:

P = 0.5*D + 0.5*I, uslov D>40 i I>40
D=(D1+D2)/2

P	P<=50	50<P P<=60	60<P P<=70	70<P P<=80	80<P P<=90	90<P
Ocena	5	6	7	8	9	10

Program

- Uvod
- 2D grafički sistem: primitive (oblici), atributi
- Crtanje krivih
- 2D transformacije, animacija, interakcija
- 3D transformacije i projekcija
- Prikazne transformacije, kamera
- Svetlost i senčenje
- 3D grafički sistem
- Svojstva materijala, teksture, 3D mreže
- Rasterizacija primitiva: prava linija i kružnica
- Popunjavanje
- Odsecanje
- Sakrivanje površina
- Sistemi boja
- Tehnologije U/I uređaja

Literatura

- Materijali za predavanja i vežbe:
  - Tartalja, I., *Materijali za predavanja* (http://rti.etf.bg.ac.rs/rti/ri5rg/#materijali)
  - Đurđević, Đ., Tartalja, I. *Materijali za vežbe* (http://rti.etf.bg.ac.rs/rti/ri5rg/#materijali)

- Literatura:
  - Hughes, J.F., van Dam, A., McGuire, M., Sklar, D.F., Foley, J.D., Feiner, S.K., Akeley, K. *Computer Graphics – Principles and Practice*, 3rd edition, Addison-Wesley Publishing Company, 2014.
  - Sharan, K., *Learn JavaFX 17: Building User Experience and Interfaces with Java*, 2nd edition, Apress, 2022
  - Watt, A., *3D Computer Graphics* (3rd edition), Addison-Wesley, 2000.
  - Oracle, *Java Platform, Standard Edition (Java SE) 8 – Client Technologies*, JavaFX (http://docs.oracle.com/javase/8/javase-clienttechnologies.htm)
  - OpenJFX, JavaFX (https://openjfx.io/index.html)

Primeri aplikacija

svi naredni primeri su iz projekata
koje su izradili studenti i bivši studenti ETF-a

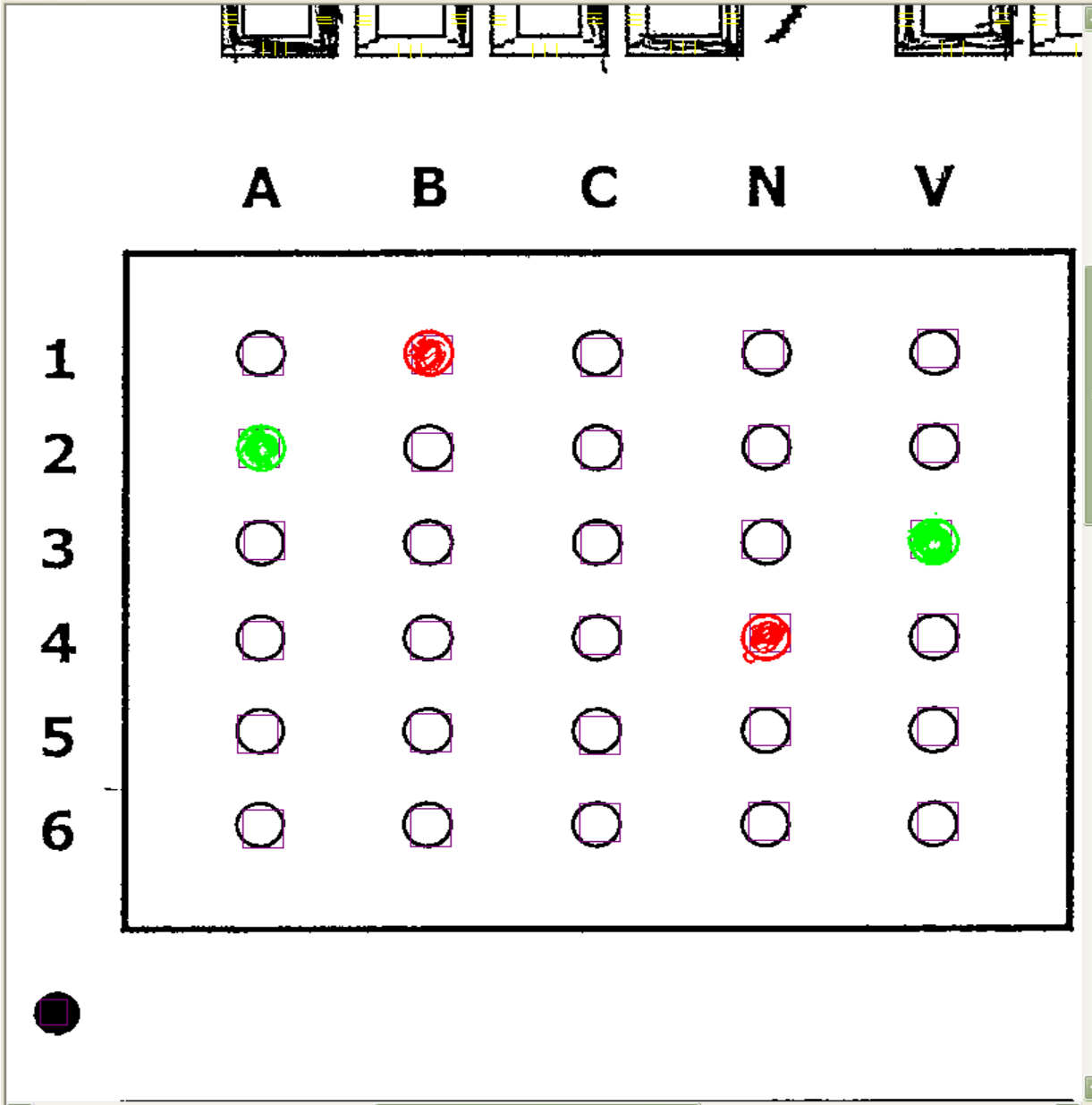
Test Answer Recognition & Scoring for Windows 3.0

Projekat Izgled Podešavanja Pomoc

Obrasci u projektu

[BMP] 113.bmp
[MulTIFF] D:\Igor\Istrazivanje\test\te
OBRAZAC 1
OBRAZAC 2
OBRAZAC 3
OBRAZAC 4
OBRAZAC 5
OBRAZAC 6
OBRAZAC 7
OBRAZAC 8
OBRAZAC 9
OBRAZAC 10
OBRAZAC 11
OBRAZAC 12
OBRAZAC 13
OBRAZAC 14
OBRAZAC 15
OBRAZAC 16
OBRAZAC 17
OBRAZAC 18
OBRAZAC 19
OBRAZAC 20
OBRAZAC 21

Analiza obrasca i rezultat



Snimi i obradi sledeci

Broj indeksa: *47*/**

neregularan indeks

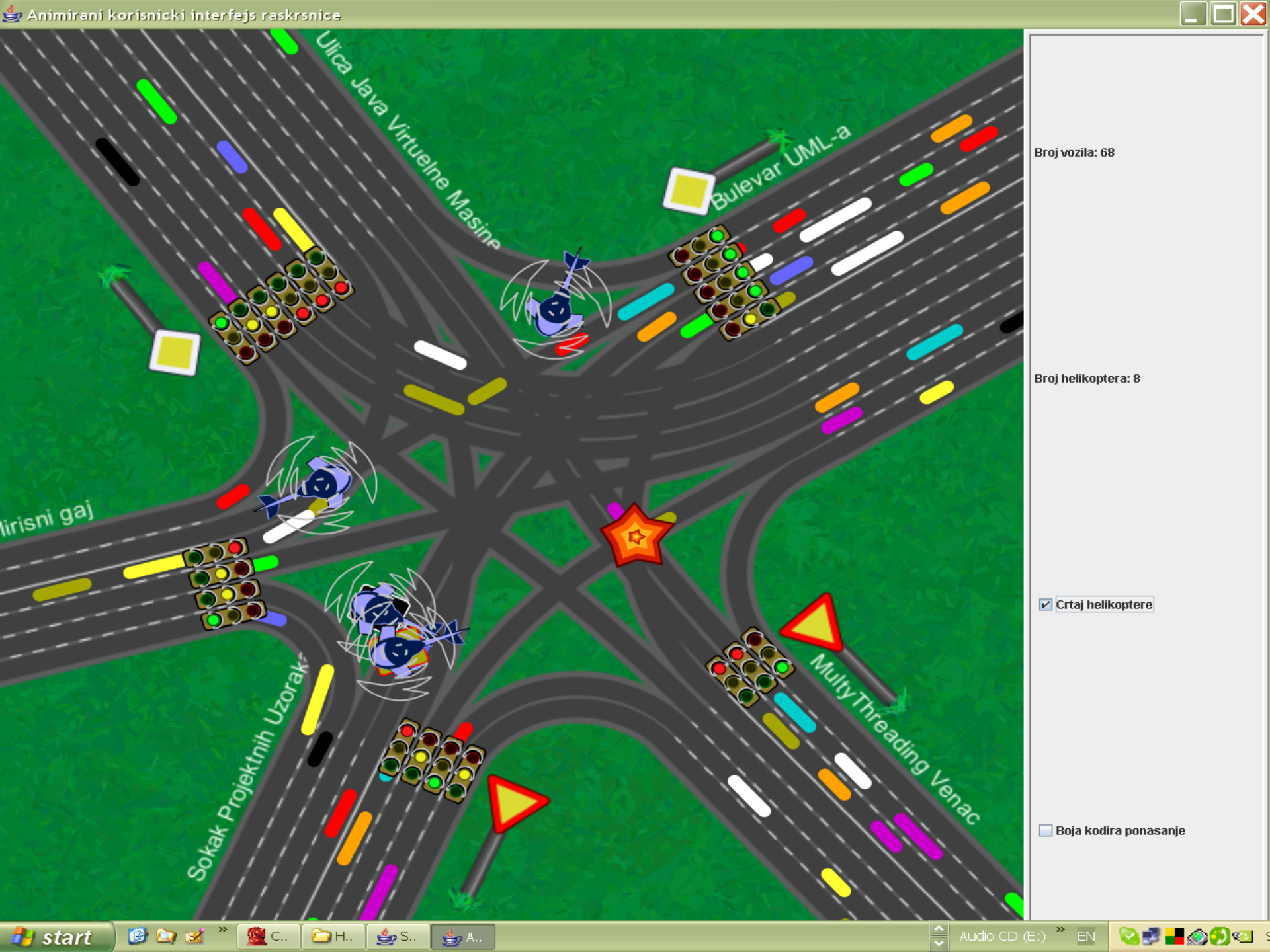
Varijanta testa: 1

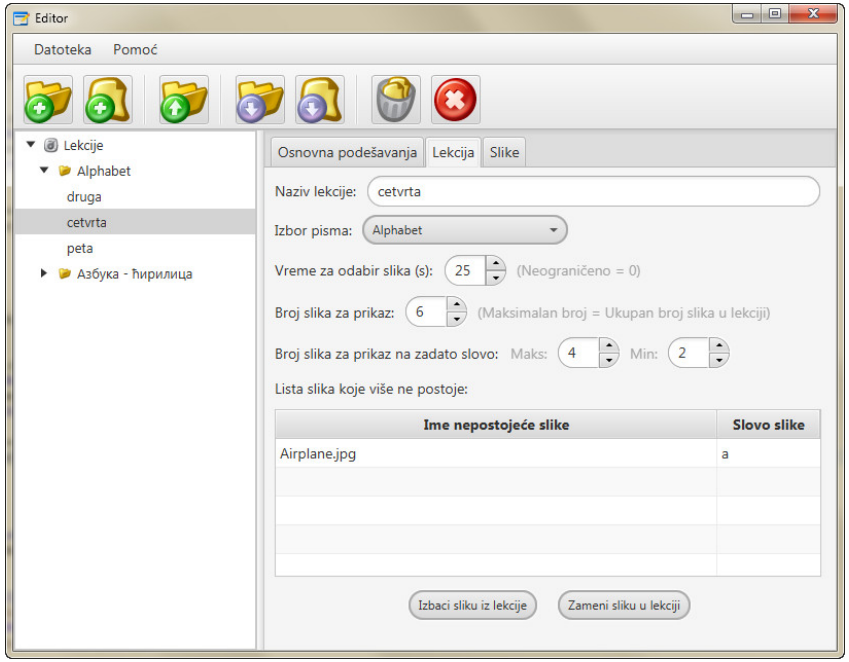
Odgovori: Σ = 15.00

1. [B] -2.50 p
2. [A] 10.00 p
3. [V] 10.00 p
4. [N] -2.50 p
5. [] 0.00 p
6. [] 0.00 p

Neprepoznat indeks.
Ocena u granicama normale.

Vreme obrade: 1.44 s


Animirani korisnicki interfejs raskrsnice
Ulica Java Virtuelne Masine
Bulevar UML-a
lirisni gaj
Sokak Projektnih Uzorak
MultyThreading Venac
Broj vozila: 68
Broj helikoptera: 8
Crtaj helikoptere
Boja kodira ponasanje
start
C..
H..
S..
A..
Audio CD (E:)
EN

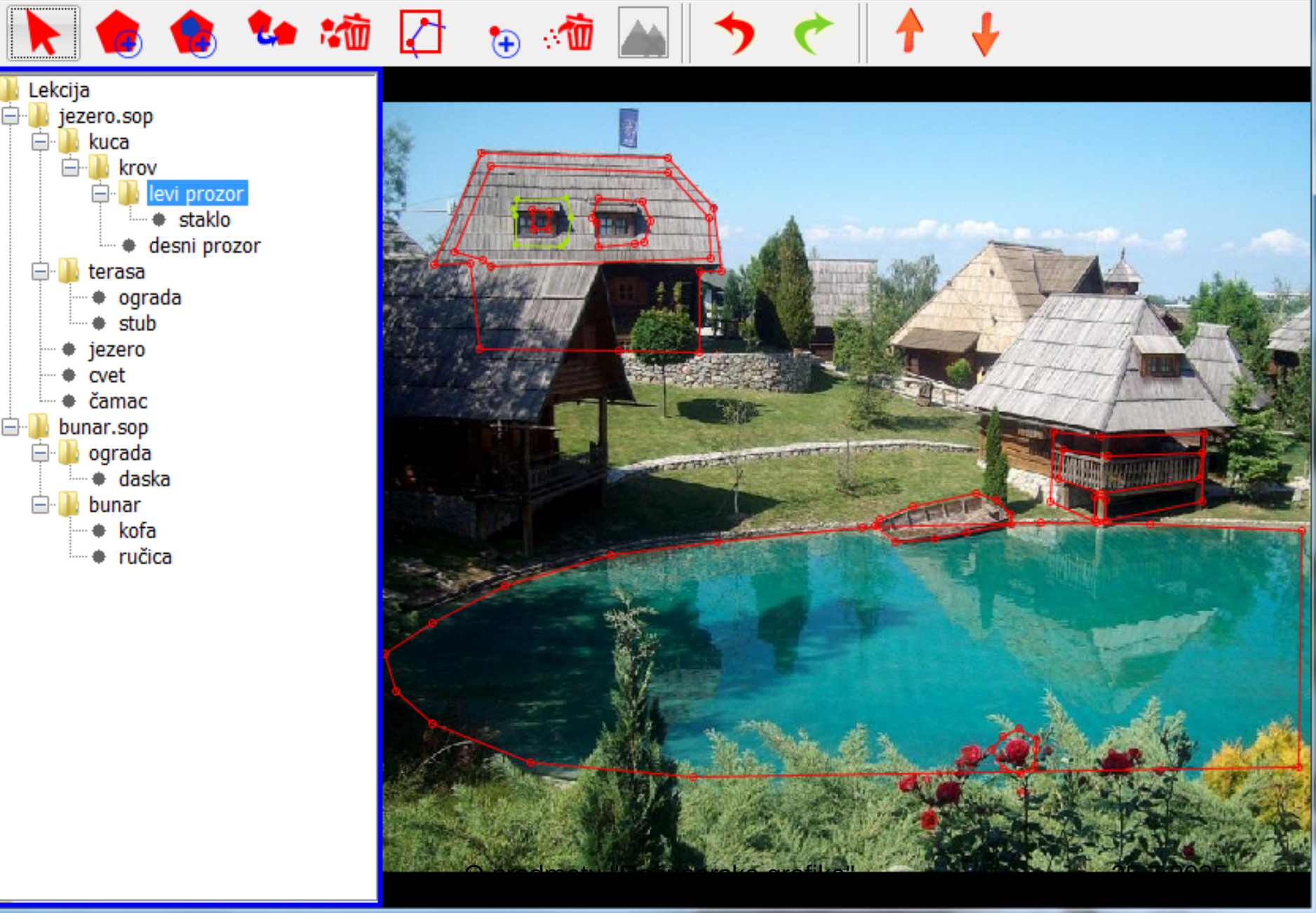

Editor
Datoteka
Pomoć
Lekcije
Alphabet
druga
cetvrta
peta
Азбука - ћирилица
Osnovna podešavanja
Lekcija
Slike
Naziv lekcije:
cetvrta
Izbor pisma:
Alphabet
Vreme za odabir slika (s):
25
(Neograničeno = 0)
Broj slika za prikaz:
6
(Maksimalan broj = Ukupan broj slika u lekciji)
Broj slika za prikaz na zadato slovo:
Maks:
4
Min:
2
Lista slika koje više ne postoje:
Ime nepostojeće slike
Slovo slike
Airplane.jpg
a
Izbaci sliku iz lekcije
Zameni sliku u lekciji

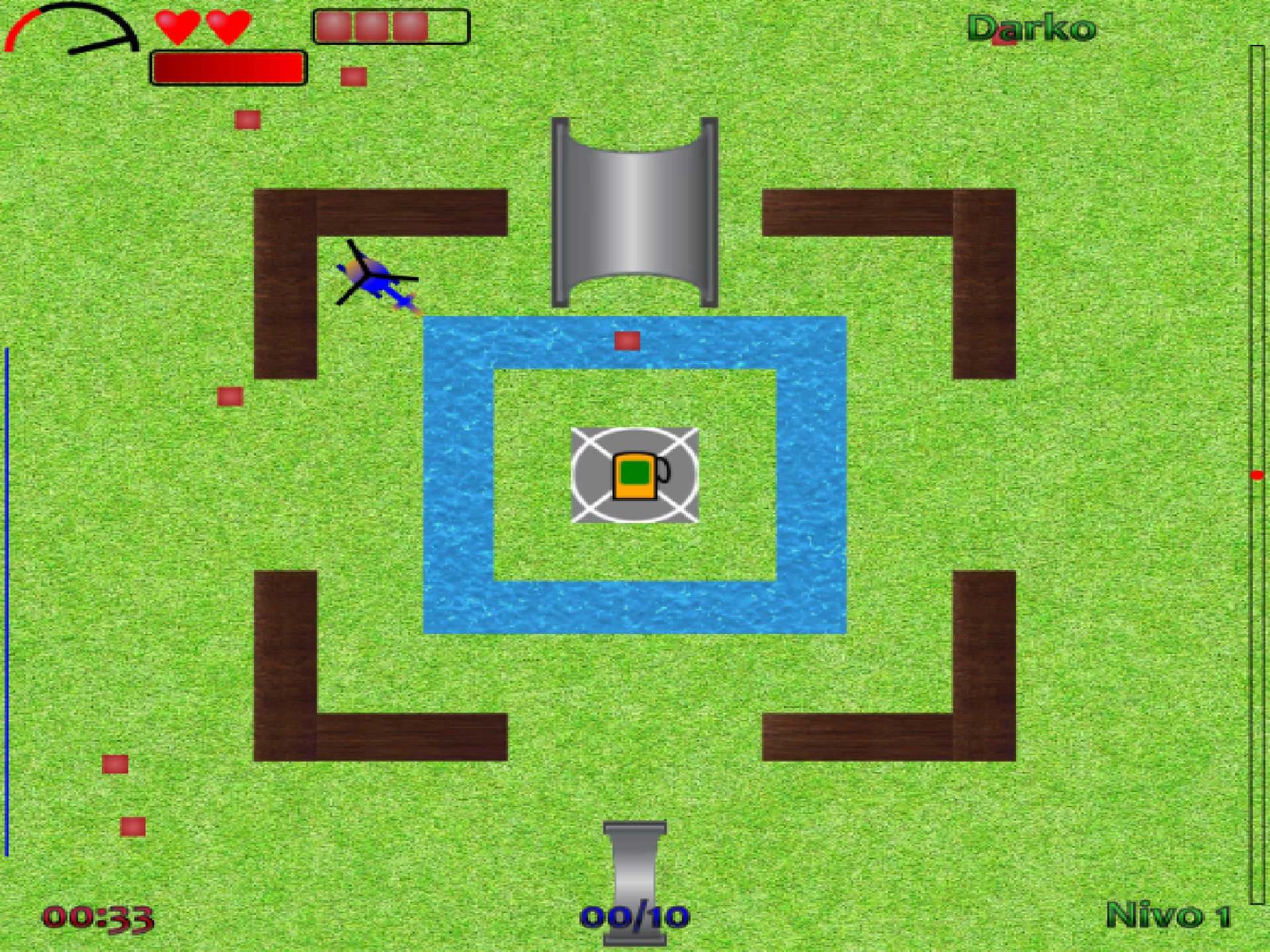

Editor
Datoteka
Pomoć
Lekcije
Alphabet
druga
cetvrta
peta
Азбука - ћирилица
Osnovna podešavanja
Lekcija
Slike
Izaberi sliku
Zameni sliku
Dodaj sliku
Obriši sliku


Мени
Време: 0 с
Ш
?
: 82
: 44
: 2
: 2
Даље

ZnamTo - Editor za definisanje lekcija

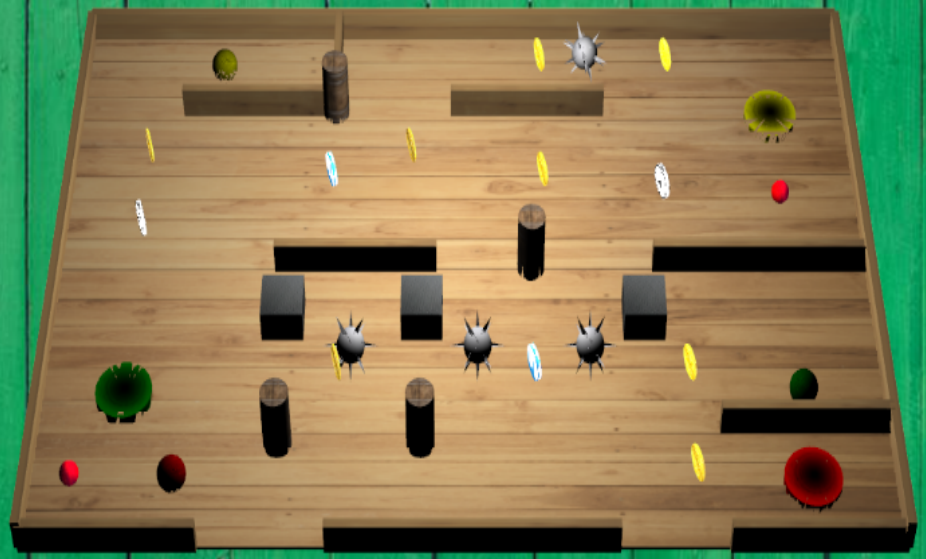
Fajl Uređivanje Slika Opcije O programu




Darko
00:33
00/10
Nivo 1


Izlaz
Sačuvaj
Teren demo
Pozadina


3
16
2



30
TIME REMAINING: 59


TERRAIN:
TEREN
GRID
1
ADD NEW LEVEL
CHANGE TERRAIN NAME
SAVE
DELETE TERRAIN
BACK
PALETTE
PICKED: WALL
POSITION X:
-25
POSITION Z:
817
WIDTH:
1000
DEPTH:
30
RADIUS:
ROTATE
DELETE
APPLY


00-06.0
P7 WRC
SUBARU
kmh


$150
2:03
#1
2
2
D
N
R

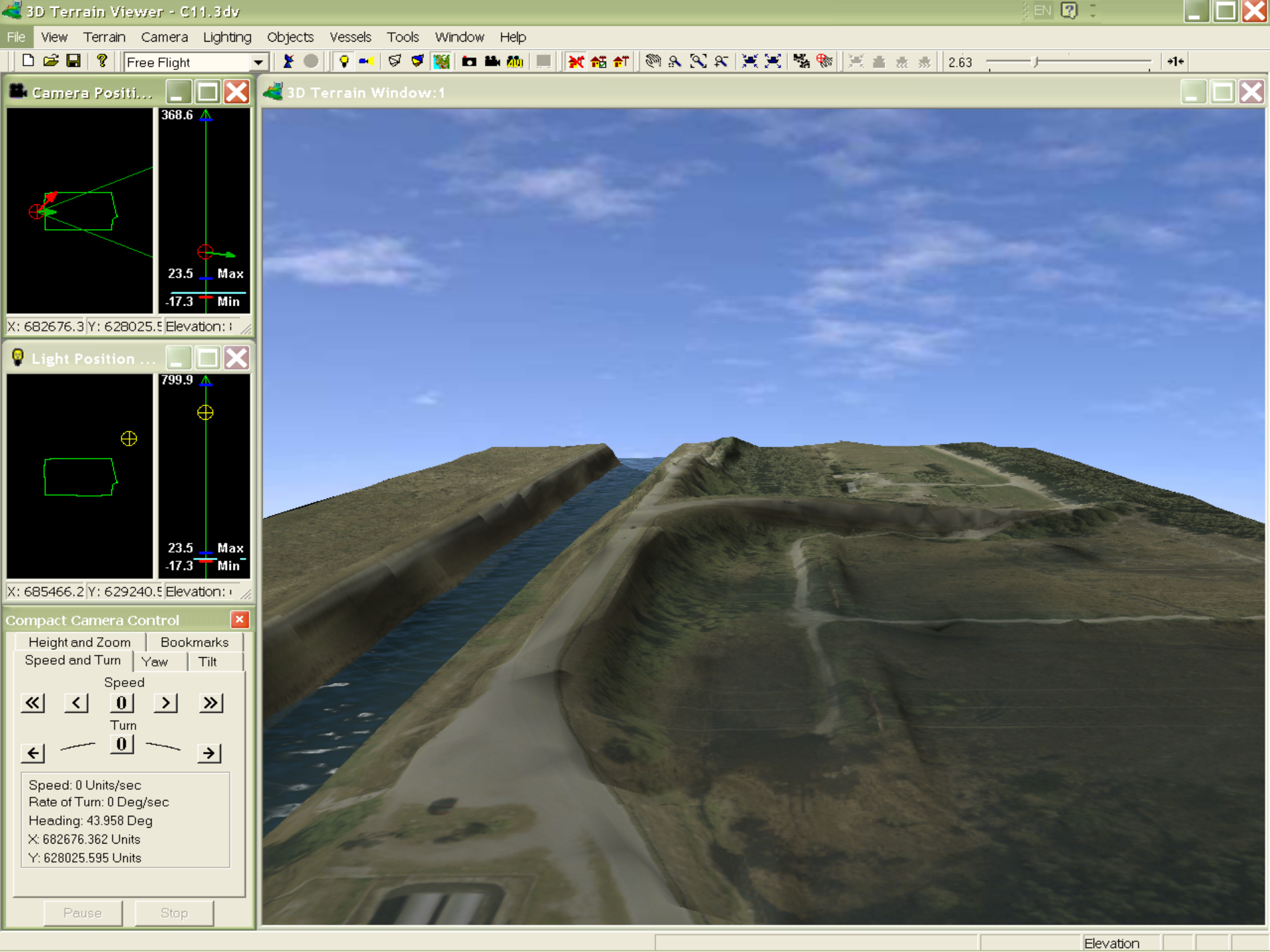

LITE St®eets - Editor Scene
Fajl
Edituj
Pomoć
Jezik
Mapa
Saobraćaj
Zadatak
Teren
Ulice
Ulica
skretanje
pesacki
raskrsnicaT
raskrsnica
Zgrade
Objekti
Vegetacija
Skaliraj Objekat
Klasični
Odozgo
LiteStreets4 - Paint
LITE St®eets - Edito...
4:40 PM

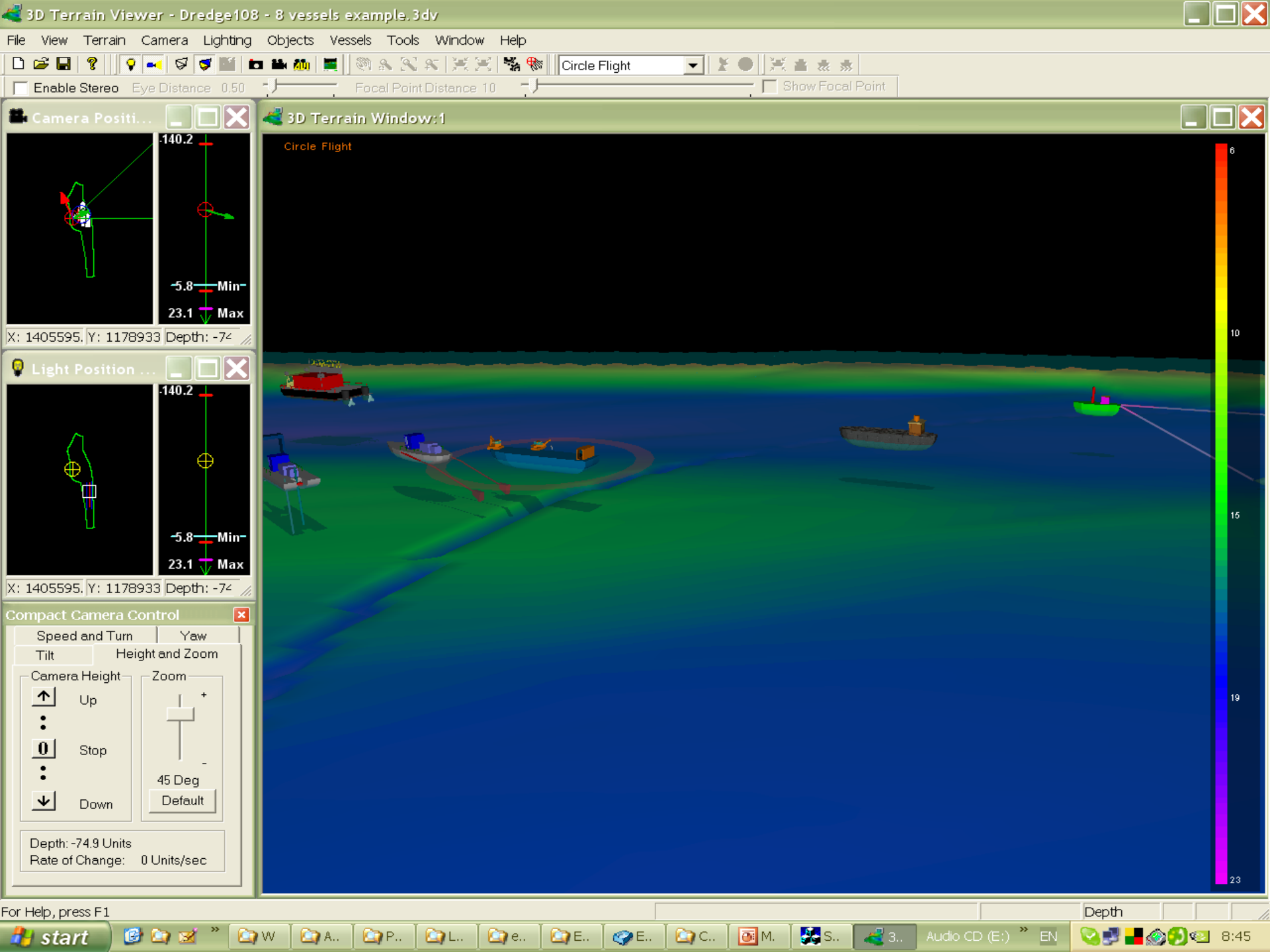

HouseSim2
Tekući:


HouseSim2
Tekući:


HouseSim2
Tekući:

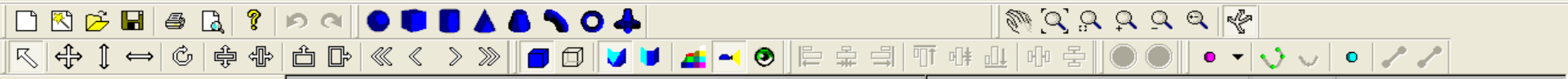

HouseSim2
Tekući:

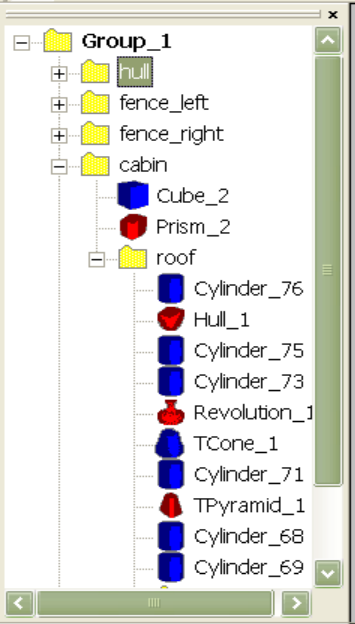

3D Terrain Viewer - C11.3dv
File View Terrain Camera Lighting Objects Vessels Tools Window Help
Free Flight
2.63
Camera Positi...
368.6
23.5 Max
-17.3 Min
X: 682676.3 Y: 628025.5 Elevation: 1
Light Position ...
799.9
23.5 Max
-17.3 Min
X: 685466.2 Y: 629240.5 Elevation: 1
Compact Camera Control
Height and Zoom
Bookmarks
Speed and Turn
Yaw
Tilt
Speed
0
Turn
0
Speed: 0 Units/sec
Rate of Turn: 0 Deg/sec
Heading: 43.958 Deg
X: 682676.362 Units
Y: 628025.595 Units
Pause
Stop
3D Terrain Window:1
Elevation

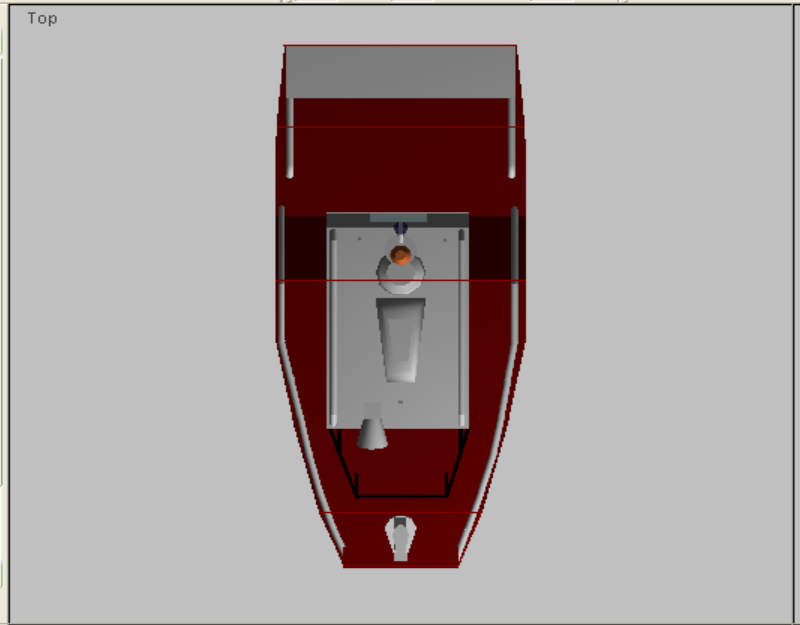

3D Terrain Viewer - Dredge108 - 8 vessels example.3dv
File View Terrain Camera Lighting Objects Vessels Tools Window Help
Circle Flight
Enable Stereo Eye Distance 0.50 Focal Point Distance 10 Show Focal Point
Camera Positi...
140.2
-5.8 Min
23.1 Max
X: 1405595. Y: 1178933 Depth: -7
Light Position ...
140.2
-5.8 Min
23.1 Max
X: 1405595. Y: 1178933 Depth: -7
Compact Camera Control
Speed and Turn Yaw
Tilt Height and Zoom
Camera Height
Up
Stop
Down
Zoom
45 Deg
Default
Depth: -74.9 Units
Rate of Change: 0 Units/sec
3D Terrain Window:1
Circle Flight
6
10
15
19
23
For Help, press F1
Depth
start
Audio CD (E:)
EN
8:45

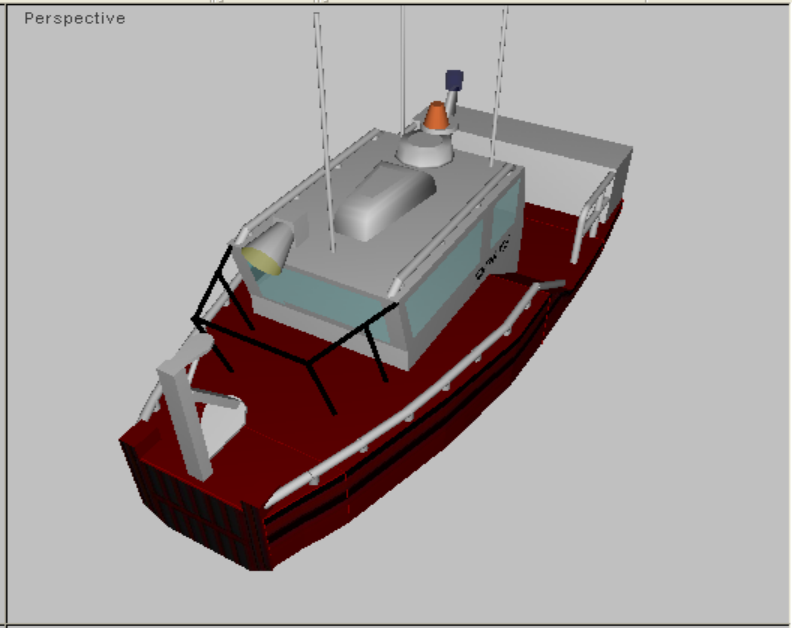
diamond_reef.3od - 3D Shape Editor

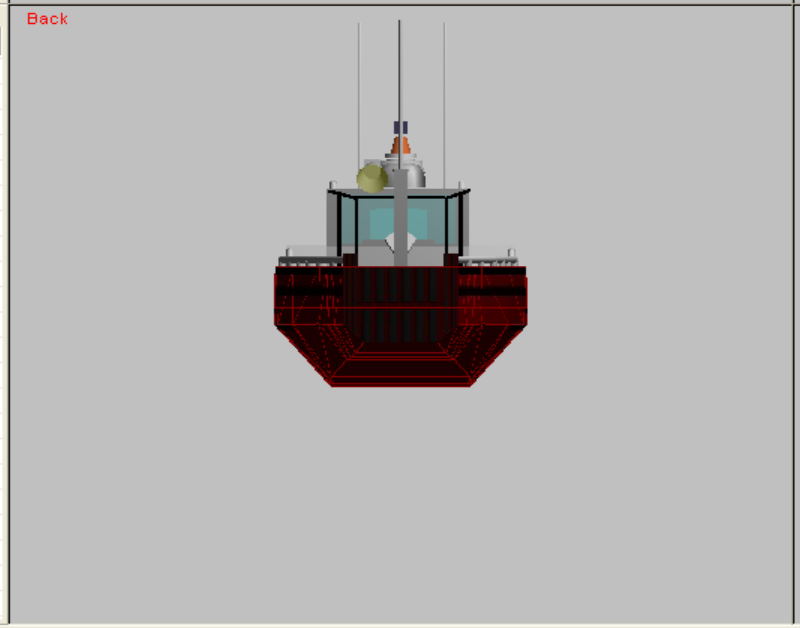
File Edit View Model Help

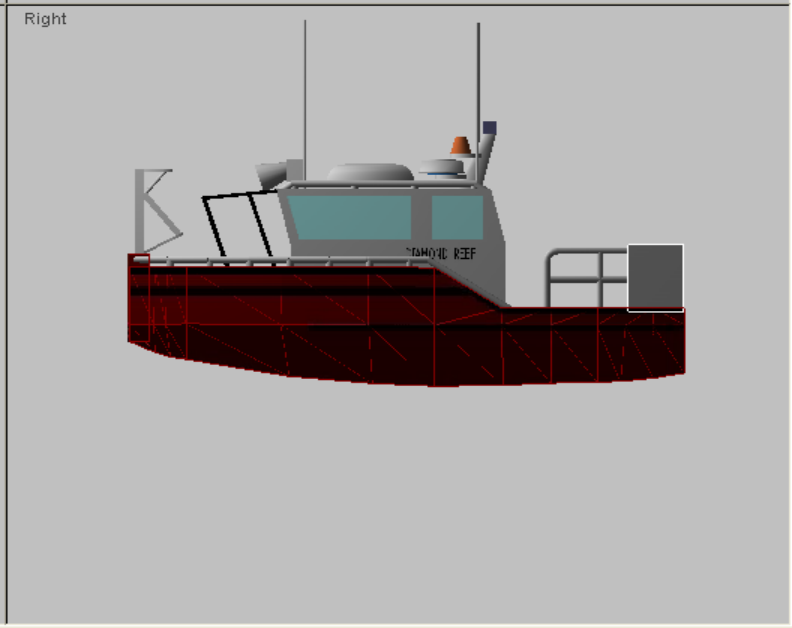






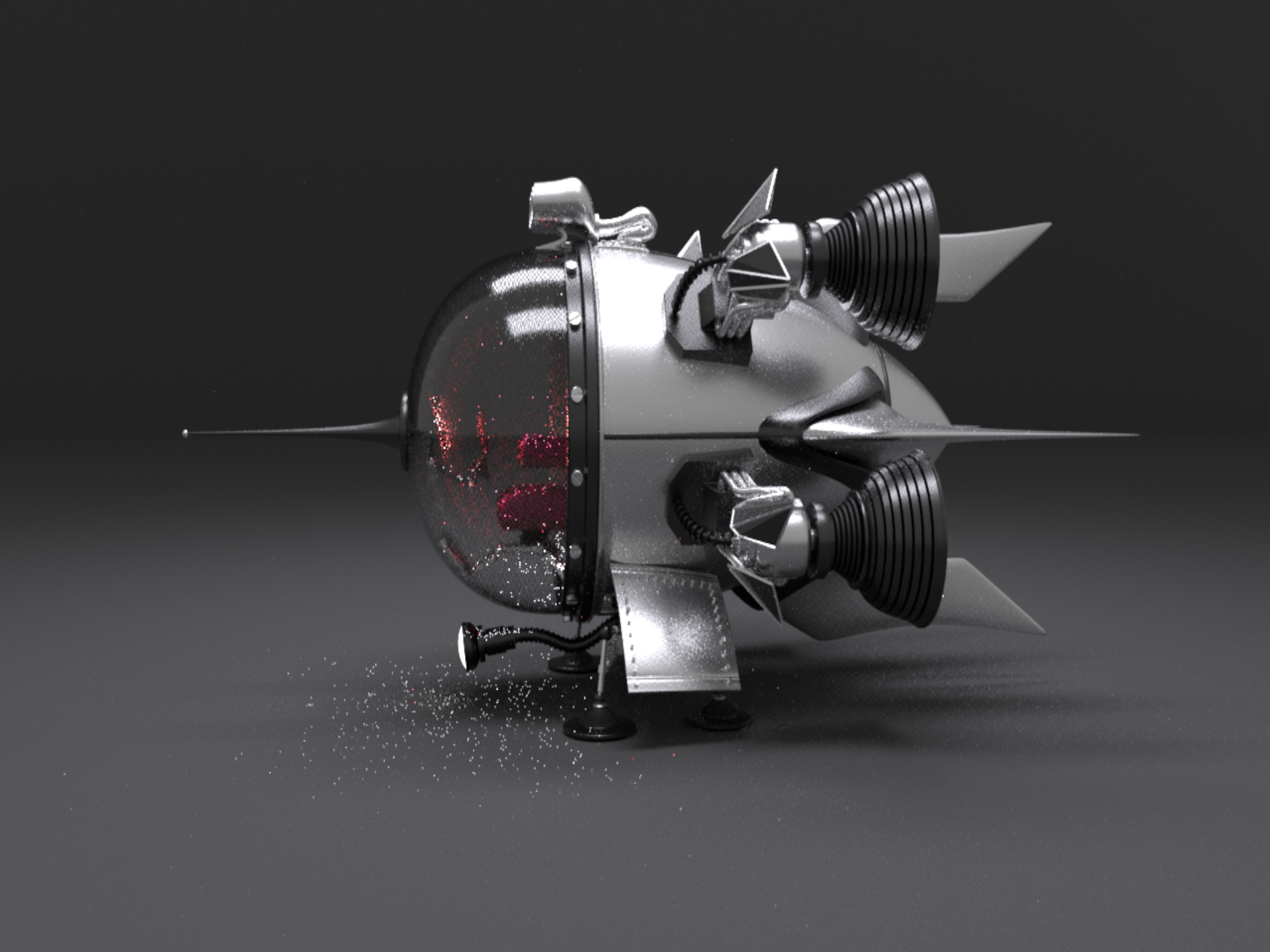


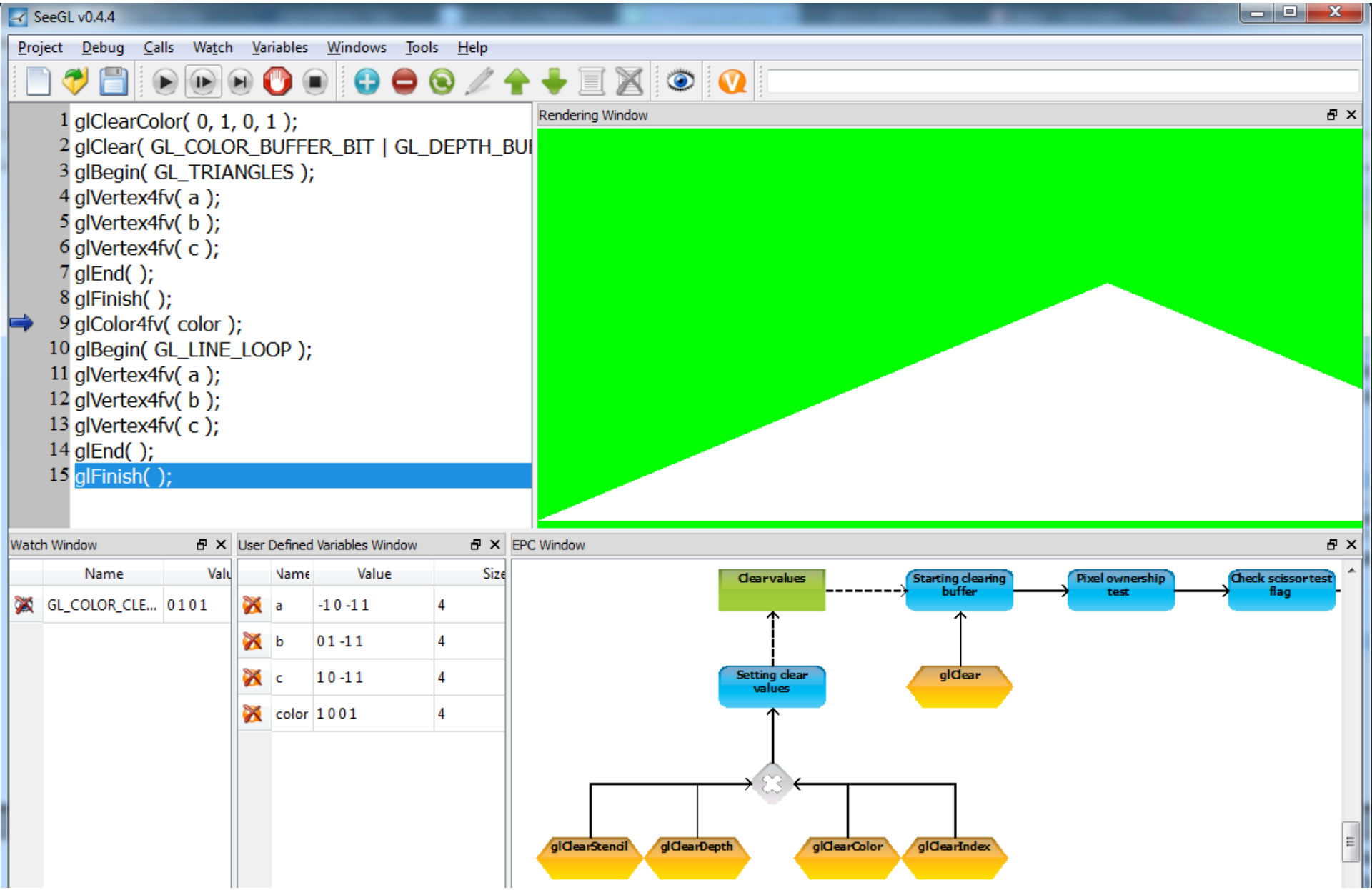


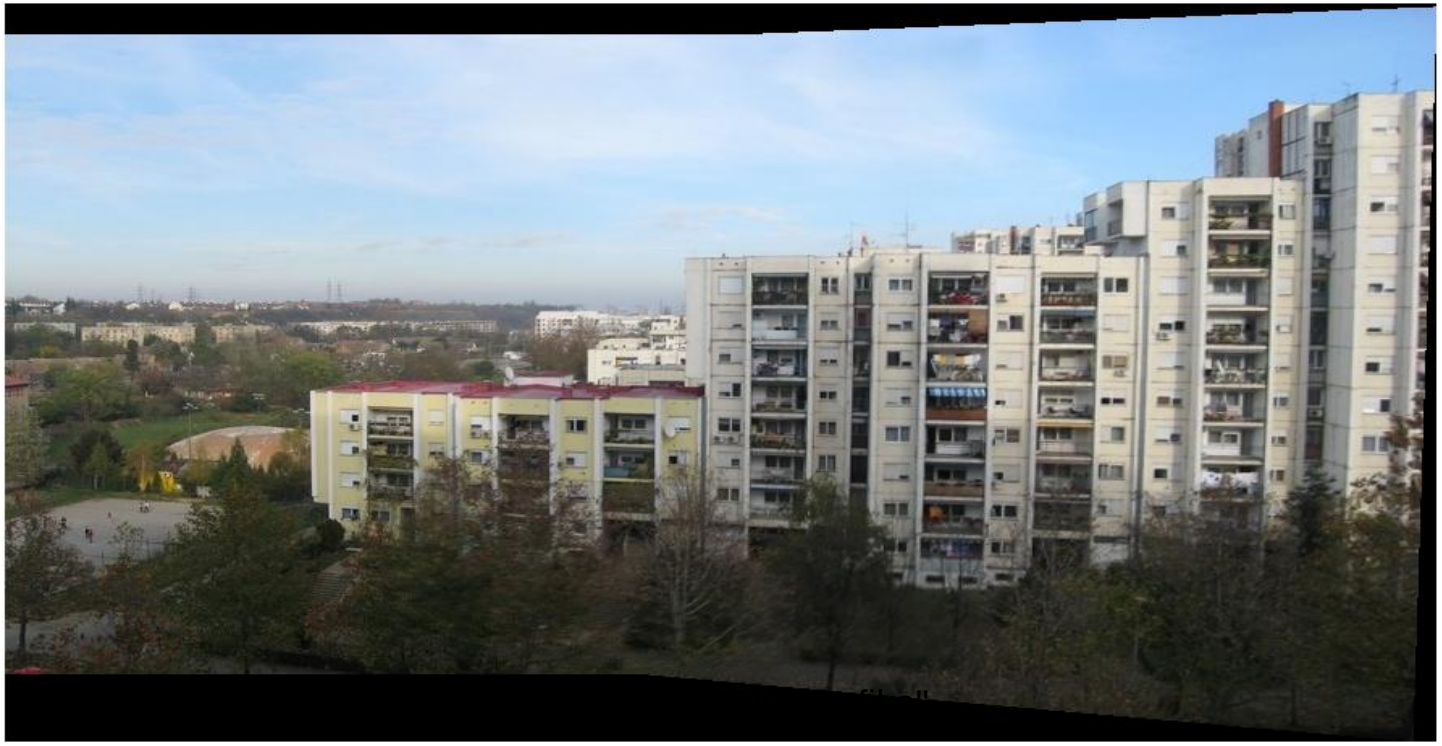


Prope...	Value
Type	Group
Name	hull
TransX	0.0000
TransY	-0.8633
TransZ	-0.2338
ScaleX	1.0000
ScaleY	1.0000
ScaleZ	1.0000
RotX	0.0000
RotY	0.0000
RotZ	0.0000
Color	
Transp...	
Texture	
Visible	Yes

Ready | Selection | X: -0.9924 | Y: 0.0000 | Z: 0.8959




SeeGL v0.4.4
Project Debug Calls Watch Variables Windows Tools Help
1 glClearColor(0, 1, 0, 1);
2 glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BU
3 glBegin(GL_TRIANGLES);
4 glVertex4fv(a);
5 glVertex4fv(b);
6 glVertex4fv(c);
7 glEnd( );
8 glFinish( );
9 glColor4fv(color);
10 glBegin(GL_LINE_LOOP);
11 glVertex4fv(a);
12 glVertex4fv(b);
13 glVertex4fv(c);
14 glEnd( );
15 glFinish( );
Rendering Window
Watch Window
Name
GL_COLOR_CLE...
0 1 0 1
User Defined Variables Window
Name
Value
Size
a
-1 0 -1 1
4
b
0 1 -1 1
4
c
1 0 -1 1
4
color
1 0 0 1
4
EPC Window
Clearvalues
Starting clearing buffer
Pixel ownership test
Check scissortest flag
Setting clear values
glClear
glClearStencil
glClearDepth
glClearColor
glClearIndex



Pitanja

?