Challenge Final Report Submission Information

Team ID

Melrose 19

School Name

Melrose High School

Project's Area of Science

Mapping and Information services

Computer language(s) used in your project

NetLogo

Team members grade levels in school (comma separated)

Tenth, Tenth

Team member's email addresses (comma separated)

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The 4U App

New Mexico

Supercomputing Challenge

Final Report

April 4, 2018

Melrose 19

Melrose High School

Team Members

Gracie Sanchez

Chantilly Fulgham

Teacher(s)

Mr. Alan Daugherty

Project Mentor

Mr. Dewayne Fulgham

Proposal

4U App

We have created a NetLogo program that will run a model designed to help disadvantaged people navigate in unfamiliar surroundings. What we have created is a program that models a school setting that shows how the student will go through their daily school schedule. This is the basis for building an app that the surroundings a student can use to help them find their way around a new environment.

Executive Summary

This NetLogo model is a proof of concept for an app that we hope to make in the near future as the next step of this project. This program will help people with special needs to get around a school environment, or to just help them to get around any unfamiliar space. Essentially it will be a personal indoor GPS devise that assists those in new surroundings.

It will show on the home screen the location where they are, and some other helpful things we can decide on in the future. These might include pictures of the teacher they are passing near, and of the teacher they will report to and the location of restrooms and school nurses. It will mainly be used for special needs people but also can be used for other purposes too. For instance

if someone is new to a school they could use this app to help get from place to place. Or an assisted living home could use it with the elders to get around as well.

Report

Introduction

The problem we have been investigating is how to help people with special needs that require assistance and monitoring to get from place to place. We came up with this project idea to assist a new student that came in to our school that had special needs and was confused on where to go. We thought this idea could become helpful for her, and that it could be extended to help many others as well.

Methods and Materials

Our hypothesis is that if you give someone a devise with a map on it they can get around a new place. So what we did was we made a program with the layout of the buildings. Then we set up way points that the devise uses to see where they are. We then made routes from room to room for the student.

We have made this using parameter files. That means the code in the program pulls information from .CSV files in Excel spreadsheets to define the buildings, hallways, way points, doorways, classrooms, etc.

Results

With the Excel .CSV files we created we have the parameters by which we can draw the map of the buildings. Other files also provide. The daily schedule needed and the way points used to make the routes. These files are necessary to run the program.

The Building Layout sets up the walls and the hallways, the door ways, and classrooms.

See Attachment A Building Layout

The Waypoints tell the student where to go from class to class.

See Attachment B Waypoints

The Student Schedule is the bell system. It tells them which building and classroom they need to be in.

See Attachment C Student Schedule

The Routes tell the student where to go and how to get there.

See Attachment D Routes

For the Code of the model

See Attachment E

Discussion

The data we used was the .CSV files used to build and operate the model. The model did not generate any extra data as it ran. When it runs it runs at 100% accuracy. We are proud of the facts that the model is able to always show the right way to go. This accuracy will be instrumental for the actual app's success.

Conclusions

We were able to make sure it was feasible to make an app that can help special needs people with their requirements. Our desire to make a proof of concept was successful.

Personal Statement

We think that our best achievement is being able to actually make this app a real thing. It will be able to help a lot of people. When we make the app, we plan that it will be free for use and it will be available on both Apple devices and Android devises.

Acknowledgments

We have a big thank you for Mr. Alan Daugherty and Mr. Dewayne Fulgham. They have helped us so much with this project. It would not have happened without them. We also thank Mr. Chris from Brain Hackers for helping come up with some ideas to figure out the use of RFID tags and scanners and using the way points.

Sample code used as references included from the NetLogo sample programs:

Pac-man

Sequential_timeseries_using_CSV

PC_Drone_Delivery_Network

Building	Feature	Start Latitude	Start Longitude	Heading	Ending Latitude	Ending Longitude	Color
Main	Outside Wall	-15	12	180	-15	-12	105
Main	Outside Wall	-15	-12	90	15	-12	105
Main	Outside Wall	15	-12	0	15	12	105
Main	Outside Wall	15	12	270	-15	12	105
Main	Outside Door	-15	1	180	-15	-1	25
Main	Outside Door	11	12	90	13	12	25
Main	Classroom 1 Wall	-14	11	180	-14	4	55
Main	Classroom 1 Wall	-14	4	90	-5	4	55
Main	Classroom 1 Wall	-5	4	0	-5	12	55
Main	Classroom 1 Wall	-5	7	0	-5	9	15
Main	Classroom 2 Wall	0	11	180	0	4	55
Main	Classroom 2 Wall	0	4	90	10	4	55
Main	Classroom 2 Wall	10	4	0	10	12	55
Main	Classroom 2 Wall	14	4	0	14	12	55
Main	Classroom 2 Wall	5	4	90	7	4	15
Main	Classroom 3 Wall	-14	-11	0	-14	-3	55
Main	Classroom 3 Wall	-14	-3	90	-5	3	55
Main	Classroom 3 Wall	-5	-3	180	-5	-12	55
Main	Classroom 3 Wall	-10	-3	90	-8	-3	15
Main	Classroom 4 Wall	-4	-3	90	10	-3	55

Main	Classroom 4 Wall	10	-3	180	10	-12	55
Main	Classroom 4 Wall	4	-3	90	6	-3	15
Main	Classroom 4 Wall	14	-3	180	14	-12	55
Cafeteria	Outside Wall	-15	30	180	-15	20	105
Cafeteria	Outside Wall	-15	20	90	15	20	105
Cafeteria	Outside Wall	15	20	0	15	31	105
Cafeteria	Outside Wall	15	30	270	-15	20	105
Cafeteria	Classroom 5	-6	29	180	-6	20	55
Cafeteria	Classroom 5	-6	21	270	-15	21	55
Cafeteria	Classroom 5	-14	21	0	-14	30	55
Cafeteria	Classroom 5	-6	25	0	-6	27	15
Cafeteria	Lunch Room	0	21	90	15	22	55
Cafeteria	Lunch Room	14	21	0	14	30	55
Cafeteria	Lunch Room	0	29	180	0	21	55
Cafeteria	Lunch Room	0	25	0	0	27	15
Cafeteria	Outside Door	-2	20	270	-4	20	25

Attachment A

Building	Waypoint ID	Waypoint Type	Waypoint Latitude	Waypoint Longitude	Waypoint Heading	Waypoint Repeat	Color
Main	Outside	Doorway	-15	1	180	1	9.9
Main	Classroom 1	Doorway	-5	7	180	1	9.9
Main	Classroom 2	Doorway	5	4	90	1	9.9
Main	Classroom 3	Doorway	-9	-3	90	1	9.9
Main	Classroom 4	Doorway	5	-3	90	1	9.9
Main	Main Hallway 1	Turnpoint	-9	1	90	1	9.9
Main	Main Hallway 2	Turnpoint	-2	1	90	1	9.9
Main	Main Hallway 3	Turnpoint	5	1	90	1	9.9
Main	North/South Hallway	Turnpoint	-2	7	90	1	9.9
Main	North/South Hallway to outside door		12	1	0	1	9.9
Main	North Door		12	12	0	1	9.9
Outside	North of Main Bldg		12	16	270	1	9.9
Outside	North of Main Bldg		-3	16	0	1	9.9
Cafeteria	outside door		-3	20	0	1	9.9

Attachment A

Bell Number	Building	Classroom
1	Main	1
2	Main	2
3	Main	4
4	Main	3
5	Cafeteria	lunch room
6	Main	3
7	Main	1
8	Main	2

Attachment C

Current Building	Current Classroom	Destination Building	Destination Classroom	Next Waypoint Latatude	Next Waypoint Longitude	Next Waypoint Heading	Number of Waypoints Remaini
Main	0	Main	1	-15	1	90	
Main	0	Main	1	-9	1	90	
Main	0	Main	1	-2	1	90	
Main	0	Main	1	-2	7	0	
Main	0	Main	1	-5	7	270	
Main	0	Main	1	-11	8	270	
Main	1	Main	2	-5	7	90	
Main	1	Main	2	-2	7	90	
Main	1	Main	2	-2	1	180	
Main	1	Main	2	5	1	90	
Main	1	Main	2	5	4	0	
Main	1	Main	2	5	7	0	
Main	2	Main	4	5	4	180	
Main	2	Main	4	5	1	180	
Main	2	Main	4	5	-3	180	
Main	2	Main	4	5	-7	180	
Main	4	Main	3	5	-3	0	
Main	4	Main	3	5	1	0	
Main	4	Main	3	-2	1	270	
Main	4	Main	3	-9	1	270	
Main	4	Main	3	-9	-3	180	
Main	4	Main	3	-9	-6	180	
Main	3	Cafeteria	lunch room	-9	-3	0	
Main	3	Cafeteria	lunch room	-9	1	0	
Main	3	Cafeteria	lunch room	-2	1	90	
Main	3	Cafeteria	lunch room	5	1	90	
Main	3	Cafeteria	lunch room	12	1	90	
Main	3	Cafeteria	lunch room	12	12	0	
Main	3	Cafeteria	lunch room	12	16	0	
Main	3	Cafeteria	lunch room	-3	16	270	
Main	3	Cafeteria	lunch room	-3	20	0	
Main	3	Cafeteria	lunch room	-3	25	0	
Main	3	Cafeteria	lunch room	0	25	90	
Main	3	Cafeteria	lunch room	6	25	90	
Cafeteria	lunch room	Cafeteria	classroom 5	0	25	270	
Cafeteria	lunch room	Cafeteria	classroom 5	-3	25	270	
Cafeteria	lunch room	Cafeteria	classroom 5	-6	25	270	

Cafeteria	lunch room	Cafeteria	classroom 5	-10	25	270

Attachment D

```
globals
  [
    data
    data-pointer
    data-length
    stucurbldg          ;; Student current building
    stucurroom          ;; student current classrooom
    studestbldg         ;; student destination building
    studestroom         ;; student destination classroom
    stucurlat           ;; student current latitiude
    stucurlon           ;; student current longitude
    stucurhead          ;; student current heading
    stucurbell          ;; student current bell
    studestroom1        ;; student destination first bell
    studestroom2        ;; student destination second bell
    studestroom3        ;; student destination third bell
    studestroom4        ;; student destination forth bell
    studestroom5        ;; student destination fifth bell
    studestroom6        ;; student destination sixth bell
    studestroom7        ;; student destination seventh bell
    studestroom8        ;; student destination eighth bell
    studestroom9        ;; student destination end of day
    last-waypoint       ;; last-waypoint = 1 when last waypoint reached for a student route
    steps               ;; steps turtle is to move
    outofworld          ;; current or destination of student is out of the boundaries of the patch
    studestlat          ;; destination of student x value
    studestlon          ;; destination of student y val
    studesthead         ;; student heading
    wmcurlat
```

```
    wmcurlon
    wmhead
    wmdestlat
    wmdestlon
    repeatval
    routebell
  ]

extensions [csv]            ;; Included routines to read .csv paramenter files
breed[wall-makers wall-maker]  ;; Breed and turtle for building layout
breed [waypoints waypoint]
breed [students student]
to setup
  clear-all
  layoutbuilding
  clear-turtles
  markwaypoints
  set studestroom1 0        ;; student destination first bell
  set studestroom2 0        ;; student destination second bell
  set studestroom3 0        ;; student destination third bell
  set studestroom4 0        ;; student destination forth bell
  set studestroom5 0        ;; student destination fifth bell
  set studestroom6 0        ;; student destination sixth bell
  set studestroom7 0        ;; student destination seventh bell
  set studestroom8 0        ;; student destination eighth bell
  set studestroom9 0        ;; student destinaotion end of day bell
  reset-ticks

end
```

```
to layoutbuilding
  set data-length 0
  set data-pointer 0
  file-open "building_layout.csv"       ;; set data-source "Building_Layout.csv"
  set data csv:from-row file-read-line  ;; skip  the heading line
  read-building-layout
  file-close
end
to read-building-layout
  crt 1 [set breed wall-makers]
  while [not file-at-end?]
    [
      set data csv:from-row file-read-line ; read building layout paramenters
      set wmcurlat item 2 data
      set wmcurlon item 3 data
      set wmhead item 4 data
      set wmdestlat item 5 data
      set wmdestlon item 6 data
      setup-wm-move
    ]
  file-close-all                    ;; end-of-file reached close the file
end
to setup-wm-move
  if wmcurlon < wmdestlon and wmhead = 0
    [
      set repeatval wmdestlon - wmcurlon
      wm-move-0
    ]
  if wmcurlat < wmdestlat and wmhead = 90
```

```
   [
    set repeatval wmdestlat - wmcurlat
    wm-move-90
   ]
   if wmcurlon > wmdestlon and wmhead = 180
   [
    set repeatval wmcurlon - wmdestlon
    wm-move-180
   ]
   if wmcurlat > wmdestlat and wmhead = 270
   [
    set repeatval wmcurlat - wmdestlat
    wm-move-270
   ]
end
to wm-move-0
 ;; print  "do-move-0"
      while [wmcurlon < wmdestlon]
       [
        ask wall-makers
         [
          setxy wmcurlat wmcurlon
          set heading wmhead
          repeat repeatval [ set pcolor item 7 data fd 1 ]
         ]
    set wmcurlon wmcurlon + repeatval
   ]

end
```

```
to wm-move-90
     while [wmcurlat < wmdestlat]
      [
        ask wall-makers
         [
          setxy wmcurlat wmcurlon
          set heading wmhead
          repeat repeatval [ set pcolor item 7 data fd 1]
         ]
        set wmcurlat wmcurlat + repeatval
   ]
end
to wm-move-180
  ;; print  "do-move-180"
       while [wmcurlon > wmdestlon]
        [
         ask wall-makers
          [
          setxy wmcurlat wmcurlon
          set heading wmhead
          repeat repeatval [set pcolor item 7 data fd 1]
          ]
         set wmcurlon wmcurlon - repeatval
   ]

end
to wm-move-270
  ;; print  "do-move-270"
       while [wmcurlat > wmdestlat]
```

```
        [
         ask wall-makers
          [
           setxy wmcurlat wmcurlon
           set heading wmhead
           repeat repeatval [set pcolor item 7 data fd 1]
          ]
       set wmcurlat wmcurlat - repeatval
     ]
end
to markwaypoints
  file-close-all                    ;; close any open files
  let file "waypoints.csv"          ;; set data-source "waypoints.csv"
  set data-length 0
  set data-pointer 0
  file-open file
  set data csv:from-row file-read-line    ; skip the heading record
 read-waypoint-layout
 file-close-all
 clear-turtles
end
to read-waypoint-layout
  crt 1 [set breed waypoints]
    while [not file-at-end?]
    [
      set data csv:from-row file-read-line ; read waypoint layout paramenters
      ask waypoints
        [
          setxy item 3 data item 4 data
```

```
        set heading item 5 data
        repeat item 6 data
         [
           set pcolor item 7 data fd 1
         ]
       ]

   ]

end
to create_student
 create-turtles 1 [
                set breed students set color yellow
                set shape "person"
                set size 2 setxy stucurlat stucurlon
               ]
 ask turtles
    [
      set label who
    ]
 file-close-all
 let file "student 1 schedule.csv"  ; set data-source
 set data-length 0
 set data-pointer 0
 file-open file
 set data csv:from-row file-read-line ; read to skip the heading line
 read-student-schedule
 file-close-all
```

```
end
to read-student-schedule
  let loopcnt  0
  while [not file-at-end?]
    [
      set data csv:from-row file-read-line
      set loopcnt  loopcnt + 1
      if loopcnt = 1  [ set studestroom1 item 2 data]
      if loopcnt = 2  [ set studestroom2 item 2 data]
      if loopcnt = 3  [ set studestroom3 item 2 data]
      if loopcnt = 4  [ set studestroom4 item 2 data]
      if loopcnt = 5  [ set studestroom5 item 2 data]
      if loopcnt = 6  [ set studestroom6 item 2 data]
      if loopcnt = 7  [ set studestroom7 item 2 data]
      if loopcnt = 8  [ set studestroom8 item 2 data]
      if loopcnt = 9  [ set studestroom9 item 2 data]
    ]
  file-close-all
end
to next-class
  set stucurbell (stucurbell + 1)
 if stucurbell >= 10 [stop]
  set last-waypoint 0
  get-route
end



to get-route
```

```
  file-close-all
  let file "Routes.csv"  ; set data-source to the Routes file
  set data-length 0
  set data-pointer 0
  file-open file
  set data csv:from-row file-read-line ; read to skip the heading line
  while [last-waypoint = 0]
    [
      set data csv:from-row file-read-line
      set routebell  item 8 data
        if stucurbell = item 8 data
            [walk-to-waypoint]
    ]
  file-close-all
end
to walk-to-waypoint
  set studestlat item 4 data
  set studestlon item 5 data
  set studesthead item 6 data
  checkxy
  setup-move
      if item 7 data = 0
        [
          set last-waypoint 1
          set stucurroom item 3 data
          set stucurbldg item 2 data
        ]

end
```

```
to checkxy
  ;;  print "checkxy"
     if stucurlat > max-pxcor
      [
       output-print sentence "stucurlat greater than max-pxcor : " stucurlat
       output-print sentence "max-pxcor : " max-pxcor
       set outofworld 1
      ]
     if stucurlat  < min-pxcor
       [
        output-print sentence " stucurlat less than min-pxcor : " stucurlat
        set outofworld 1
       ]
     if stucurlon > max-pycor
      [
       output-print sentence "stucurlon greater than max-pycor : " stucurlon
       set outofworld 1
      ]
     if stucurlon < min-pycor
       [
        output-print sentence "stucurlon less than min-pycor : " stucurlon
        set outofworld 1
       ]
      if stucurlat > max-pxcor
      [
       output-print sentence "stucurlat greater than max-pxcor : " stucurlat
       output-print sentence "max-pxcor : " max-pxcor
      set outofworld 1
```

```
        ]
      if studestlat  < min-pxcor
        [
         output-print sentence " studestlat less than min-pxcor : " studestlat
         set outofworld 1
        ]
      if studestlon > max-pycor
       [
         output-print sentence "studestlon greater than max-pycor : " studestlon
         set outofworld 1
       ]
      if studestlon < min-pycor
        [
         output-print sentence "studestlon less than min-pycor : " studestlon
         set outofworld 1
        ]
end
to setup-move
 ;;  print "setup-move"
 if stucurlon < studestlon and studesthead = 0
   [
    set repeatval studestlon - stucurlon
    do-move-0
   ]
 if stucurlat < studestlat and studesthead = 90
   [
    set repeatval studestlat - stucurlat
    do-move-90
   ]
```

```
   if stucurlon > studestlon and studesthead = 180
   [
     set repeatval stucurlon - studestlon
     do-move-180
   ]
   if stucurlat > studestlat and studesthead = 270
   [
     set repeatval stucurlat - studestlat
     do-move-270
   ]
end
to do-move-0
  ;; print  "do-move-0"
       while [stucurlon < studestlon]
        [
         ask students
          [
           setxy stucurlat stucurlon
           set heading studesthead
           repeat repeatval [ fd 1]
          ]
     set stucurlon stucurlon + repeatval
   ]
end
to do-move-90
  ;; print  "do-move-90"
     while [stucurlat < studestlat]
      [
        ask students
```

```
          [
           setxy stucurlat stucurlon
           set heading studesthead
          repeat repeatval [ fd 1] ;; set pcolor green]]
          ]
      set stucurlat stucurlat + repeatval
    ]
end
to do-move-180
  ;; print  "do-move-180"
        while [stucurlon > studestlon]
        [
         ask students
          [
           setxy stucurlat stucurlon
           set heading studesthead
          repeat repeatval [ fd 1] ;; set pcolor green]]
          ]
      set stucurlon stucurlon - repeatval
    ]
end
to do-move-270
  ;; print  "do-move-270"
        while [stucurlat > studestlat]
        [
         ask students
          [
           setxy stucurlat stucurlon
           set heading studesthead
```

```
          repeat repeatval [ fd 1]
        ]
    set stucurlat stucurlat - repeatval
  ]
end
```

Attachment E