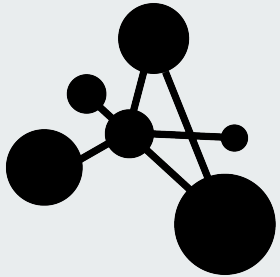
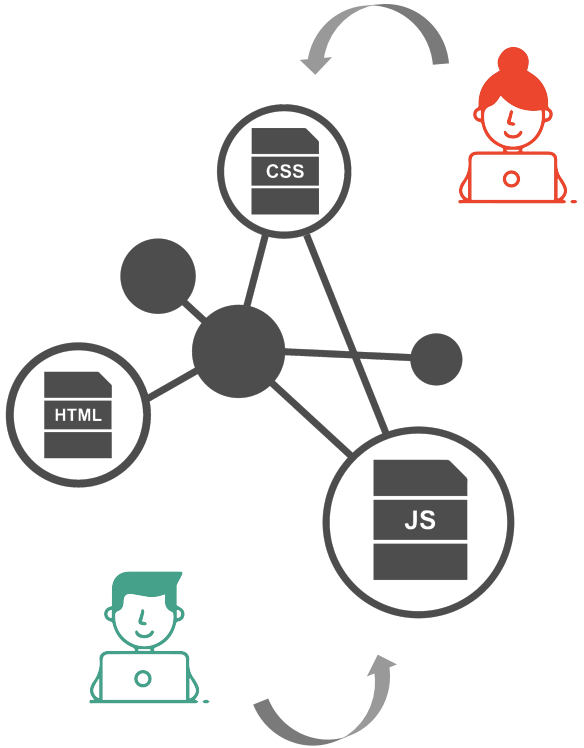
Finding the Way

BatViz (Rui Wu & Umang Sehgal)

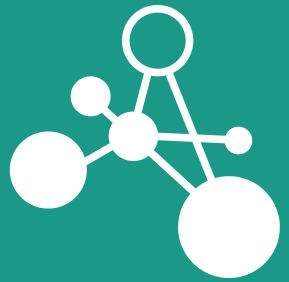


Agenda

- INTRODUCTION
  - Description of the Concept
  - Motivation for Visualization
  - Literature Survey & Background Work
- VISUALIZATION
  - Storyboard
  - Visual Demo
  - Results & Future Plan
- PROJECT TASKS
  - Main Tasks & Distribution



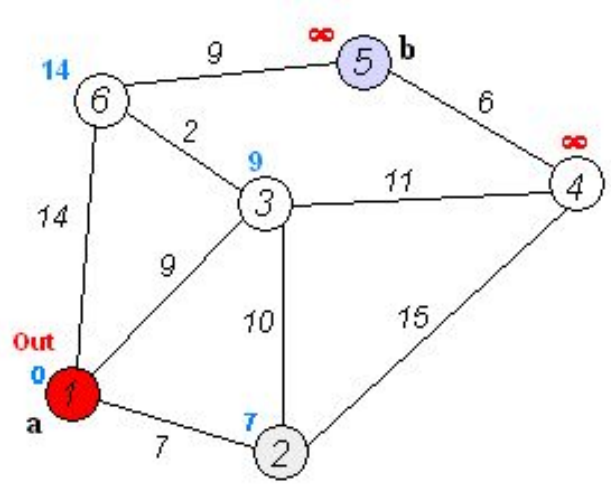
INTRODUCTION



Description of the Concept

Dijkstra's algorithm

The algorithm helps us find the shortest path between a and b. It picks the unvisited vertex with the lowest distance, calculates the distance through it to each unvisited neighbor, and updates the neighbor's distance if smaller. Mark visited when done with neighbors.

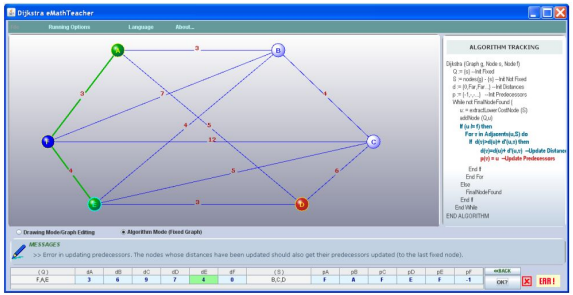


Motivation for Visualization

- What we want to try to do is translate those semi-subconscious mental steps to a list of steps that anyone (or a computer) can repeat to get the same answer every time.
- For us humans, looking at a 2d grid with many objects we can easily tell which path the character should take to reach his or her goal without thinking much about it.
- Learning through a story based visualization helps students gain clarity on the concept being delivered to them.

Literature Survey & Background Work

- PathFinder (Torrubia et al.), Fifth Program Visualization Workshop (http://oa.upm.es/4238/1/INVE_MEM_2008_59184.pdf)



- Java Based Visualization And Animation For Teaching The Dijkstra Shortest Path Algorithm In Transportation Networks (Makohon et al.) (http://aircconline.com/ijsea/V7N3/7316ijsea02.pdf)

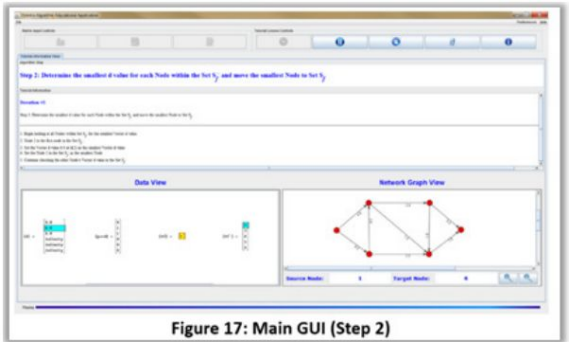


Figure 17: Main GUI (Step 2)

Literature Survey & Background Work

- E-learning Tool for Visualization of Shortest Paths Algorithms (Borissova et al.) (http://www.ips.iit.bas.bg/I_Mustakerov/2015-TJSR-2(3)-84-89.pdf)

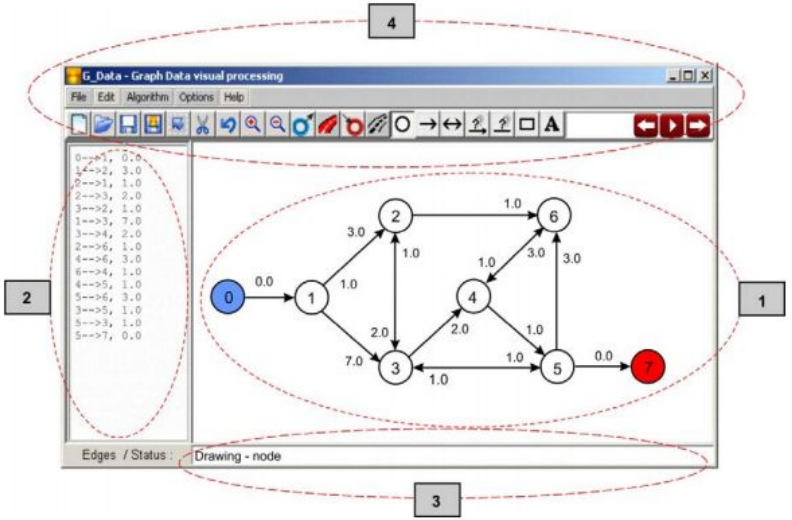
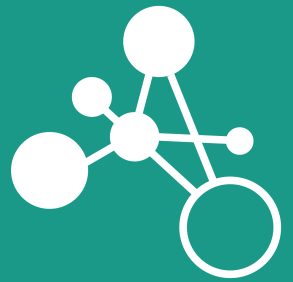
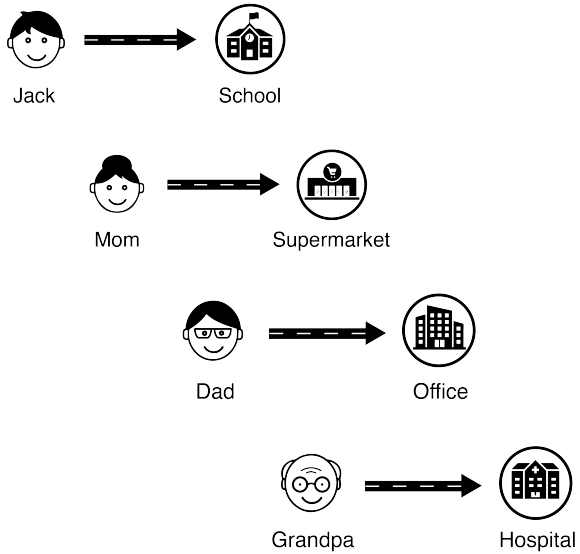


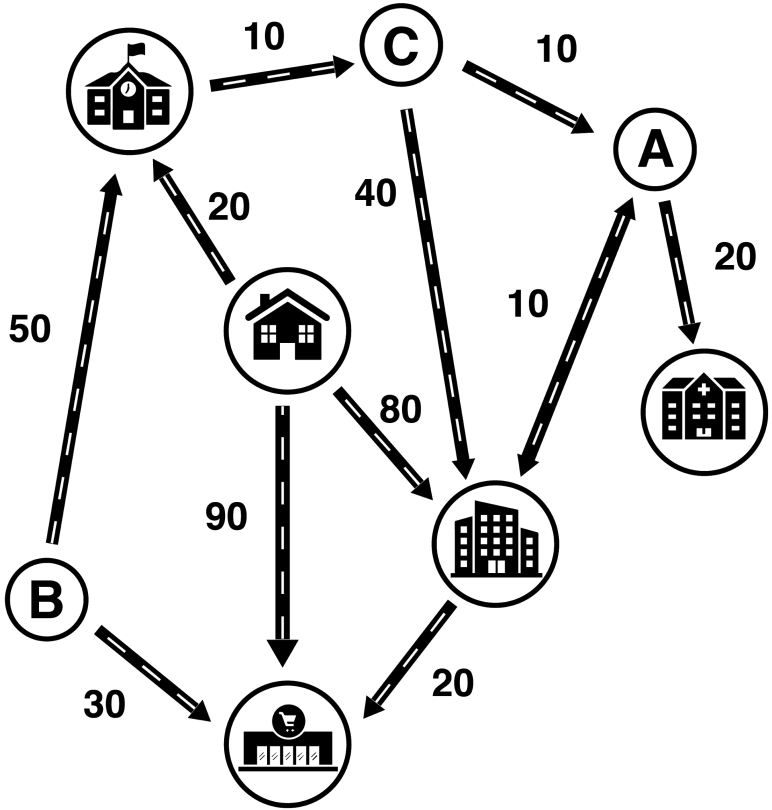
Figure 2. Main screen of visual processing of graph data tool

VISUALIZATION



Storyboard


Jack
School
Mom
Supermarket
Dad
Office
Grandpa
Hospital


10
C
10
A
20
40
20
50
10
80
90
B
30
20

Finding the Way

Make Dijkstra's Algorithm Easy to Understand

by BatViz (Rui & Umang)

Have you ever heard about Dijkstra's Algorithm? Do you know how Dijkstra's Algorithm can be used to solve problems in our daily life? Now thinking back to a busy morning when you and your family members are all in a hurry and need to go to different places at a certain time, how did you and your family members decide the most efficient way to share the ride? Dijkstra's Algorithm can help you find the answer.

Jack's Family Needs Some Help

Now, let's work together to help Jack's family make their busy morning easier.

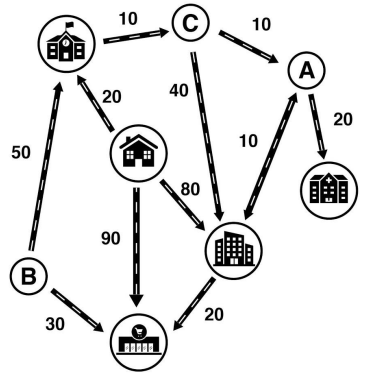
Jack is an elementary school student, and he lives with his Mom, Dad, and Grandpa. On a Tuesday morning, Jack needs to go to school as usual. His Dad needs to go to the office for an important meeting. His Mom is planning to go to the supermarket to buy some fresh vegetables to cook lunch. His Grandpa has a doctor appointment in the nearby hospital. They decide to leave the house together and share the ride. What is the fastest way for them to arrive at their destinations and how many cars do they need at minimum?

To solve this problem, we need to find the shortest paths between home and different destinations, and Dijkstra's Algorithm can help us find the answer. Let's use the directed edge-weighted graph at right as the map to solve this problem. You can click on the icon buttons below to find out where are the destinations located.

Learn the Concept & Solve the Problem

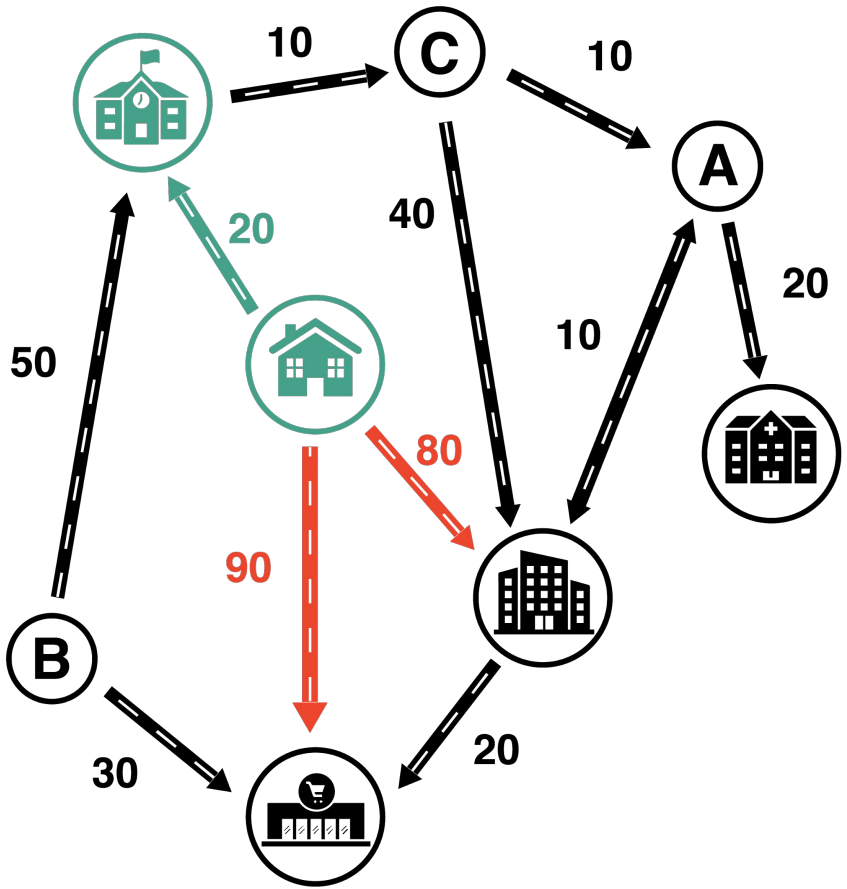
Dijkstra's Algorithm is an algorithm for finding the shortest paths between nodes in a graph (Wikipedia). The starting node is called initial node, and the end node is called destination node. The algorithm first marks all nodes in the graph unvisited. Then, it picks the unvisited node with the lowest distance, calculates the distance through it to each unvisited neighbor, and updates the neighbor's distance if smaller. Mark visited when done with neighbors. Finally, when the destination node has been marked visited, the algorithm stops and the shortest path is found.

Let's work on the problem step by step:



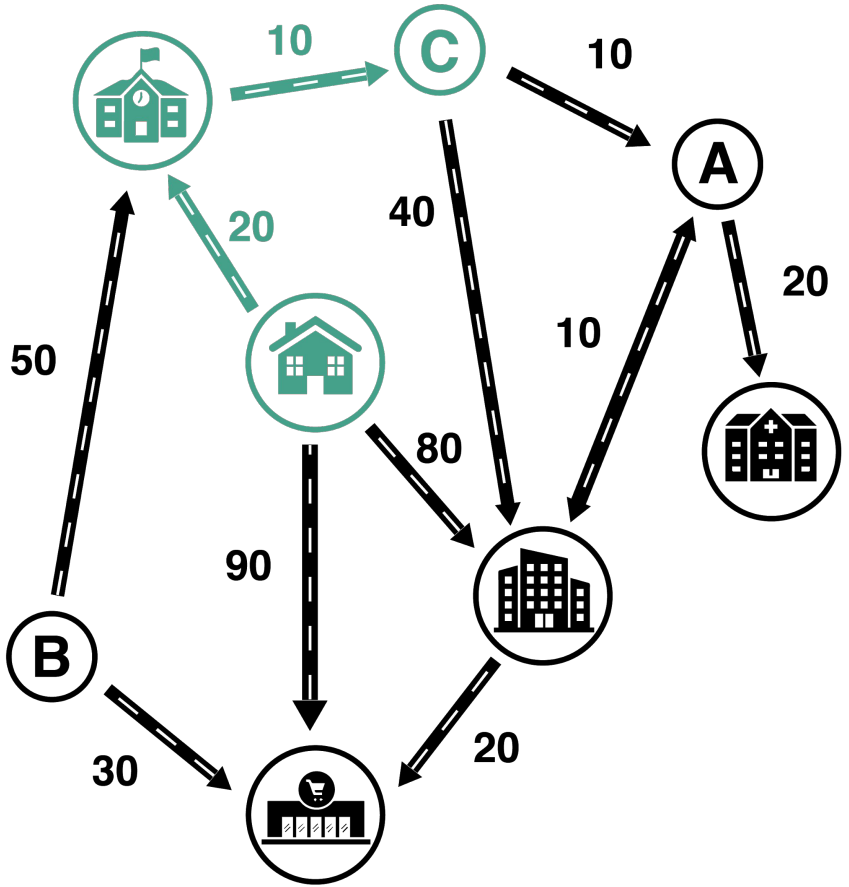
			A		B	C		
1		20	∞	80	∞	∞	90	∞
2		20	∞	80	∞	30	90	∞
3	C	20	40 C	70 C	∞	30	90	∞
4	A	20	40 C	50 A	∞	30	90	60 A
5		20	40 C	50 A	∞	30	70	60 A
6		20	40 C	50 A	∞	30	70	60 A
7		20	40 C	50 A	∞	30	70	60 A

Step 1



			A		B	C		
1		20	∞	80	∞	∞	90	∞
2								
3								
4								
5								
6								
7								

Step 1



			A		B	C		
1		20	∞	80	∞	∞	90	∞
2		20	∞	80	∞	30	90	∞
3	C							
4								
5								
6								
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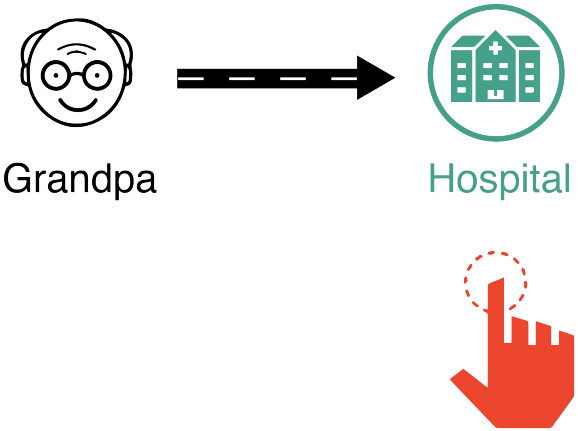
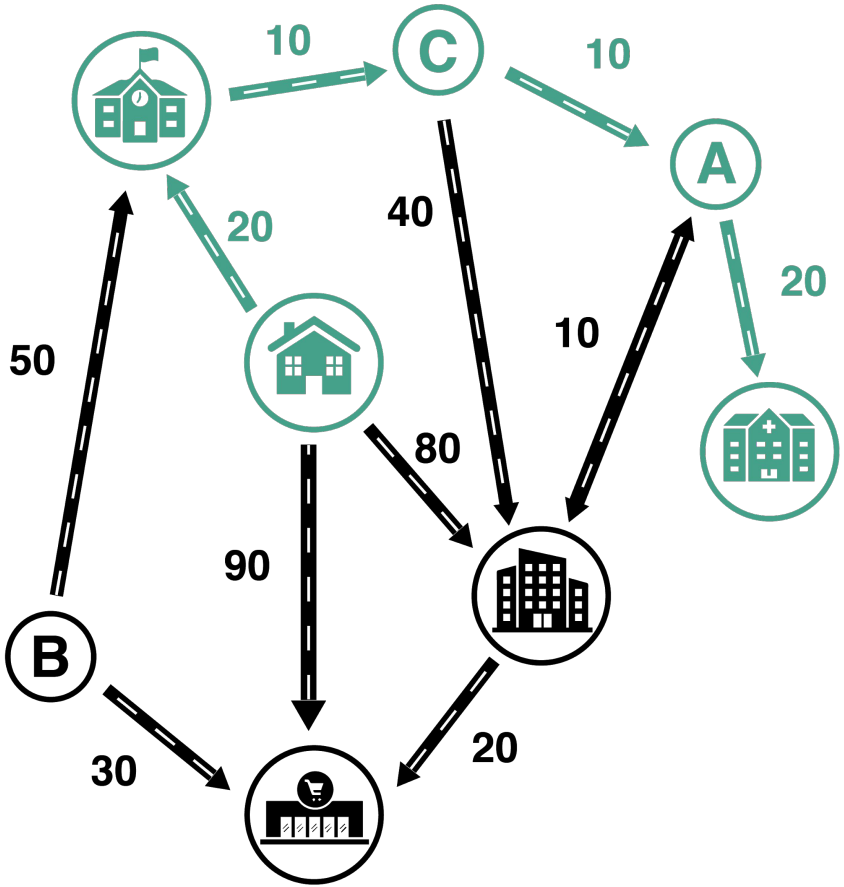
Step 2





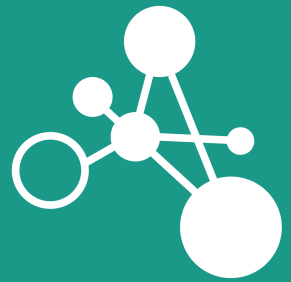
Visual Demo

Results & Future Plan

Objective: *Make Dijkstra's Algorithm Easier to Understand*

Metrics for Usability Testing	
Effectiveness Users should be able to easily understand the Dijkstra's Algorithm after going through the explorable explanation design	**Satisfaction** The comfort and acceptability of use. Users should be able to enjoy the learning process.
Engagement Users' control and freedom. Users should be able to actively interact with the design and highly engaged in the learning process	**Consistency and Standards** Words, actions, situations, etc. should always mean the same thing and users should be able to understand that

PROJECT TASKS



Main Tasks & Distribution

- Literature Research
- Visualization Implementation
  - Network Graph
- Design Evaluation

- Idea Formation
- Presentation
- Paper

- Storyboard Creation
- Visualization Design
- Visualization Implementation
  - Computation Table

Thank You

Q & A