

VANT 149

Submission of all data

The full names and student numbers of all team members:

(Allen) Zihang **Cheng** (71391593)

(Anna) Zicheng **Han** (75843656)

(Hannah) Chuhan **Zhang** (96464938)

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Data 1: Locations of all bluephone

Source: <https://security.ubc.ca/home/safety-prevention-resources/emergency-blue-phones/>

Formal_Name_and_Room	Street_Address	Latitude	Longitude
Blue Phone 01 ANSOC @ Northwest Marine Drive	6303 N W MARINE DR at ANSOC Building	49.26973	-123.25721
Blue Phone 03 Flagpole Plaza @ Main Mall & Crescent Road	Main Mall & Crescent Road	49.26894	-123.25657
Blue Phone 04 Wyman Plaza @ Main Mall & Memorial Road	Main Mall & Memorial Road	49.26777	-123.25504
Blue Phone 05 Ponderosa F @ Lower Mall & Pedestrian Path	2008 LOWER MALL Ponderosa Annex F	49.26497	-123.25755
Blue Phone 06 Ponderosa A @ West Mall & Agricultural Road	2011 WEST MALL Ponderosa Annex A	49.26534	-123.25625
Blue Phone 07 Hennings @ East Mall & Agricultural Road	6224 AGRICULTURAL RD/EAST MALL Hennings Bldg	49.26697	-123.25183
Blue Phone 08 North Parkade @ Student Union Plaza	6115 STUDENT UNION BLVD Outside North Parkade	49.26847	-123.25109
Blue Phone 09 IRC @ Health Sciences Plaza	2194 HEALTH SCIENCES MALL	49.2651	-123.24738
Blue Phone 10 Biological Sciences @ Main Mall & University Blvd	6270 UNIVERSITY BLVD Biological Sciences Bldg	49.26471	-123.25227
Blue Phone 11 Earth Sciences Building @ Main Mall & Stores Road	2207 MAIN MALL	49.26253	-123.25111
Blue Phone 12 Earth & Ocean Sciences @ Stores Road at EOS	6339 STORES RD	49.26195	-123.25239
Blue Phone 13 Ritsumeikan @ West Mall at Ritsumeikan	6460 AGRONOMY RD/WEST MALL Ritsumeikan House	49.26008	-123.25207
Blue Phone 14 MacMillan @ Main Mall & Agronomy Rd	2357 MAIN MALL H.R. MacMILLAN Bldg	49.26053	-123.24954
Blue Phone 15 Brock Hall @ East Mall at Memorial Road	1874 EAST MALL BROCK Hall	49.26843	-123.25254
Blue Phone 16 Old Barn Community Centre @ Main Mall & Thunderbird Blvd	6308 THUNDERBIRD Blvd Old Barn Community Ctr	49.25932	-123.24815
Blue Phone 17 Rhododendron Wood @ Main Mall & Eagles Drive	Main Mall	49.25758	-123.24671
Blue Phone 18 Life Sciences @ Health Sciences Mall & Agronomy Rd.	2350 HEALTH SCIENCES MALL Life Sciences Ctr	49.26187	-123.24574
Blue Phone 19 Frank Forward @ Rear Lane of Frank Forward	6350 STORES RD Rear Frank FORWARD Bldg	49.26146	-123.25169
Blue Phone 02 CK Choi @ West Mall & Crescent Road	1855 WEST MALL CHOI Bldg	49.26789	-123.25827
Blue Phone 20 Chemistry Physics @ East Mall & University Blvd.	6221 UNIVERSITY BLVD Chemistry A Block	49.26575	-123.25084
Blue Phone 21 Chemistry East @ Main Mall & Agricultural Road	2036 MAIN MALL	49.26616	-123.25372
Blue Phone 22 Buchanan D @ Crescent Road at Buchanan D	1866 MAIN MALL/CRESCENT RD Buchanan Bldgs	49.26948	-123.25443
Blue Phone 23 Fraser River Parkade @ Memorial Rd at Fraser River Parkade	6441 MEMORIAL RD Fraser River Parkade	49.26658	-123.25782
Blue Phone 24 Nitobe Garden @ Memorial Rd & Lower Mall	1895 LOWER MALL NITOBÉ Gardens	49.26612	-123.25867
Blue Phone 25 St. John's @ Lower Mall & University Blvd.	2111 LOWER MALL St John's College	49.26331	-123.25635
Blue Phone 26 Jack Bell @ West Mall & University Blvd	2080 WEST MALL JACK BELL School of Social Work	49.26421	-123.25494
Blue Phone 27 West Parkade @ Lower Mall & Pedestrian Path at West Parkade	2140 LOWER MALL	49.26201	-123.25514
Blue Phone 28 BRDF @ Lower Mall & Agronomy Road	2337 LOWER MALL & AGRONOMY Rd	49.26031	-123.25394
Blue Phone 29 CIRS @ West Mall & Stores Road	2260 WEST MALL & STORES Rd	49.26166	-123.25331
Blue Phone 30 Totem Park @ West Mall & Thunderbird Blvd	2525 WEST MALL & THUNDERBIRD Blvd	49.25846	-123.25067
Blue Phone 31 Tennis Centre @ Thunderbird & East Mall	6160 THUNDERBIRD BLVD & EAST MALL	49.26008	-123.24562
Blue Phone 32 TBIRD Parkade @ West Mall & Thunderbird	6085 THUNDERBIRD BLVD & WEST MALL	49.26165	-123.24189
Blue Phone 33 Pulp & Paper @ East Mall & Argonomy Road	2385 EAST MALL & Agronomy Rd at Pulp & Paper Centre	49.26143	-123.24712
Blue Phone 34 SPPH @ Health Sciences Mall & Hospital Lane	2206 East Mall	49.2642	-123.2479
Blue Phone 35 CEME East Mall & Applied Science Lane	6250 APPLIED SCIENCE LN at EAST MALL	49.2631	-123.2484
Blue Phone 36 Iona Building South Side	6000 Iona Drive South Side of IONA Building	49.27083	-123.25009
Blue Phone 37 UBC Exchange Bus Loop East - NE Side of Transit Loop	UBC Exchange Bus Loop Westbrook Mall N of University Blvd	49.26755	-123.24755
Blue Phone 38 Exchange North	UBC Exchange	49.26833	-123.24817
Blue Phone 39 FUTURE: Diesel Bus Loop	UBC Exchange	49.26755	-123.24755
Blue Phone 40 Tallwood House - Walter Gage Rd NE of Brock Commons	6088 House Walter GAGE Rd NE of Brock Commons	49.26974	-123.25097
Blue Phone 41 Thunderbird Park pedestrian pathway near Soccer Centre	3065 Westbrook Mall pathway near Soccer Centre	49.26753	-123.25268
Blue Phone 42 IK Barber 1st Floor Wall Unit	1961 EAST MALL	49.26753	-123.25268
Blue Phone 43 IK Barber 2nd Floor Wall Unit	1961 EAST MALL	49.26753	-123.25268
Blue Phone 44 IK Barber 3rd Floor Wall Unit	1961 EAST MALL	49.26753	-123.25268
Blue Phone 45 IK Barber 4th Floor Wall Unit	1961 EAST MALL	49.26753	-123.25268

Blue Phone 46 Vantage College Agronomy & West Mall	6363 Agronomy Road Vantage College	49.26039	-123.25096
Blue Phone 47 Fraser River Parkade North Entrance Level 1	6441 Memorial Rd Fraser River Parkade North Entrance Level 1	49.26625	-123.2579
Blue Phone 48 Fraser River Parkade South West Level 1	6441 Memorial Rd Fraser River Parkade South West Level 1	49.26568	-123.25827
Blue Phone 49 Fraser River Parkade South East Level 1	6441 Memorial Rd Fraser River Parkade South East Level 1	49.26596	-123.25746
Blue Phone 50 Fraser River Parkade North East Level 2	6441 Memorial Rd Fraser River Parkade North East Level 2	49.26627	-123.25786
Blue Phone 51 Health Sciences Parkade South East Ground Level	2250 Health Sciences Mall South East Ground Level	49.2633	-123.24768
Blue Phone 52 Health Sciences Parkade South West Ground Level	2250 Health Sciences Mall South West Ground Level	49.2633	-123.24768
Blue Phone 53 Health Sciences Parkade North East Bottom Level	2250 Health Sciences Mall	49.2633	-123.24768
Blue Phone 54 Health Sciences Parkade North West Roof Top Level 5	2250 Health Sciences Mall	49.2633	-123.24768
Blue Phone 56 North Parkade South East Level 3	6115 Student Union Boulevard South East Level 3	49.26895	-123.25095
Blue Phone 57 North Parkade South Entrance Level 3	6115 Student Union Boulevard South Entrance Level 3	49.26895	-123.25095
Blue Phone 58 North Parkade South Exit Level 2	6115 Student Union Boulevard South Exit Level 2	49.26895	-123.25095
Blue Phone 59 North Parkade North West Level 2	6115 Student Union Boulevard North West Level 2	49.26895	-123.25095
Blue Phone 60 North Parkade North East Level 3	6115 Student Union Boulevard North East Level 3	49.26895	-123.25095
Blue Phone 61 North Parkade South Side Rooftop Level 8	6115 Student Union Boulevard South Side Rooftop Level 8	49.26895	-123.25095
Blue Phone 62 Rose Garden Parkade Elevator Level 5	6278 NW Marine Drive Elevator Level 5	49.26945	-123.25658
Blue Phone 63 Rose Garden Parkade Elevator Level 4	6278 NW Marine Drive Elevator Level 4	49.26945	-123.25658
Blue Phone 64 Rose Garden Parkade Elevator Level 3	6278 NW Marine Drive Elevator Level 3	49.26945	-123.25658
Blue Phone 65 Rose Garden Parkade Elevator Level 2	6278 NW Marine Drive Elevator Level 2	49.26945	-123.25658
Blue Phone 66 Rose Garden Parkade Elevator Level 1	6278 NW Marine Drive Elevator Level 1	49.26945	-123.25658
Blue Phone 67 Thunderbird Parkade North West Level 1	6085 Thunderbird Blvd North West Level 1	49.26159	-123.24303
Blue Phone 68 Thunderbird Parkade West Level 1	6085 Thunderbird Blvd West Level 1	49.26159	-123.24303
Blue Phone 69 Thunderbird Parkade South East Level 1	6085 Thunderbird Blvd South East Level 1	49.26159	-123.24303
Blue Phone 70 Thunderbird Parkade North East Level 1	6085 Thunderbird Blvd North East Level 1	49.26159	-123.24303
Blue Phone 71 West Parkade North West Entrance Level 1	2140 Lower Mall	49.26281	-123.25539
Blue Phone 72 West Parkade South Level 2	2140 Lower Mall	49.26281	-123.25539
Blue Phone 73 West Parkade North Level 2	2140 Lower Mall	49.26281	-123.25539
Blue Phone 74 West Parkade North East Level 4	2140 Lower Mall	49.26281	-123.25539
Blue Phone 75 West Parkade South East Level 4	2140 Lower Mall	49.26281	-123.25539
Blue Phone 76 West Parkade North Rooftop Level 11	2140 Lower Mall	49.26281	-123.25539
Blue Phone 77 Fairview Crescent & Osoyoos Crescent	Fairview Crescent & Osoyoos Crescent	49.26246	-123.2388
Blue Phone 78 Osoyoos Crescent & Oyama Court	Osoyoos Crescent & Oyama Court	49.26072	-123.2382
Blue Phone 79 Point Grey Apartments	Osoyoos Crescent & Salmo Court	49.25961	-123.23727
Blue Phone 80 Osoyoos Crescent & Acadia Park Lane	Osoyoos Crescent & Acadia Park Lane	49.25967	-123.23522
Blue Phone 81 University Blvd Lot Stairs 1	Blue Phone 81 University Blvd Lot Stairs 1	49.26659	-123.24925
Blue Phone 82 University Blvd Lot Stairs 2	Blue Phone 82 University Blvd Lot Stairs 2	49.26662	-123.24912
Blue Phone 83 University Blvd Lot Stairs 3	Blue Phone 83 University Blvd Lot Stairs 3	49.26662	-123.24912
Blue Phone 84 University Blvd Lot Stairs 4	Blue Phone 84 University Blvd Lot Stairs 4	49.26662	-123.24912
Blue Phone 55 Health Science Pkd Rooftop Level 5	2250 Health Sciences Mall	49.2633	-123.24768
Blue Phone 85 Saltwater Orca House	5965 Student Union Blvd	49.26875	-123.24971
Blue Phone 86 Saltwater Sturgeon House	5955 Student Union Blvd	49.26915	-123.24856
Blue Phone 87	Saltwater Herring House	49.26927	-123.248
Blue Phone 88	Saltwater Sea Otter House	49.27007	-123.24837
Blue Phone 89	Saltwater Octopus House	49.27075	-123.24798

Data 2: Distances between Bluephones and Nearest Neighbors

Tidy data processed by R languages saved as csv file from Data 1

Bluephone_origin	origin_Lat	origin_Lon	closest_Bluephone	closest_lat	closest_lon	distance
Blue Phone 01 ANSOC @ Northwest Marine Drive	49.26973	-123.25721	Blue Phone 62 Rose Garden Parkade Elevator Level 5	49.26945	-123.25658	55.42413500175715
Blue Phone 03 Flagpole Plaza @ Main Mall & Crescent Road	49.26894	-123.25657	Blue Phone 62 Rose Garden Parkade Elevator Level 5	49.26945	-123.25658	56.72429339580808
Blue Phone 04 Wyman Plaza @ Main Mall & Memorial Road	49.26777	-123.25504	Blue Phone 03 Flagpole Plaza @ Main Mall & Crescent Road	49.26894	-123.25657	171.26136385783667
Blue Phone 05 Ponderosa F @ Lower Mall & Pedestrian Path	49.26497	-123.25755	Blue Phone 48 Fraser River Parkade South West Level 1	49.26568	-123.25827	94.76914092484958
Blue Phone 06 Ponderosa A @ West Mall & Agricultural Road	49.26534	-123.25625	Blue Phone 05 Ponderosa F @ Lower Mall & Pedestrian Path	49.26497	-123.25755	103.17813102739794
Blue Phone 07 Hennings @ East Mall & Agricultural Road	49.26697	-123.25183	Blue Phone 41 Thunderbird Park pedestrian pathway near Soccer Centre	49.26753	-123.25268	87.78280466714641
Blue Phone 08 North Parkade @ Student Union Plaza	49.26847	-123.25109	Blue Phone 56 North Parkade South East Level 3	49.26895	-123.25095	54.34680549740137
Blue Phone 09 IRC @ Health Sciences Plaza	49.2651	-123.24738	Blue Phone 34 SPPH @ Health Sciences Mall & Hospital Lane	49.2642	-123.2479	107.0098331563435
Blue Phone 10 Biological Sciences @ Main Mall & University Blvd	49.26471	-123.25227	Blue Phone 20 Chemistry Physics @ East Mall & University Blvd.	49.26575	-123.25084	155.59711993810393
Blue Phone 11 Earth Sciences Building @ Main Mall & Stores Road	49.26253	-123.25111	Blue Phone 12 Earth & Ocean Sciences @ Stores Road at EOS	49.26195	-123.25239	113.31800072125624
Blue Phone 12 Earth & Ocean Sciences @ Stores Road at EOS	49.26195	-123.25239	Blue Phone 29 CIRS @ West Mall & Stores Road	49.26166	-123.25331	74.32668666356724
Blue Phone 13 Ritsumeikan @ West Mall at Ritsumeikan	49.26008	-123.25207	Blue Phone 46 Vantage College Agronomy & West Mall	49.26039	-123.25096	87.8449871909675
Blue Phone 14 MacMillan @ Main Mall & Agronomy Rd	49.26053	-123.24954	Blue Phone 46 Vantage College Agronomy & West Mall	49.26039	-123.25096	104.52721853719001
Blue Phone 15 Brock Hall @ East Mall at Memorial Road	49.26843	-123.25254	Blue Phone 41 Thunderbird Park pedestrian pathway near Soccer Centre	49.26753	-123.25268	100.6106895978194
Blue Phone 16 Old Barn Community Centre @ Main Mall & Thunderbird Blvd	49.25932	-123.24815	Blue Phone 14 MacMillan @ Main Mall & Agronomy Rd	49.26053	-123.24954	168.36310992237296
Blue Phone 17 Rhododendron Wood @ Main Mall & Eagles Drive	49.25758	-123.24671	Blue Phone 16 Old Barn Community Centre @ Main Mall & Thunderbird Blvd	49.25932	-123.24815	220.0795343426319
Blue Phone 18 Life Sciences @ Health Sciences Mall & Agronomy Rd.	49.26187	-123.24574	Blue Phone 33 Pulp & Paper @ East Mall & Argonomy Road	49.26143	-123.24712	111.73273050989283
Blue Phone 19 Frank Forward @ Rear Lane of Frank Forward	49.26146	-123.25169	Blue Phone 12 Earth & Ocean Sciences @ Stores Road at EOS	49.26195	-123.25239	74.60411568466983
Blue Phone 02 CK Choi @ West Mall & Crescent Road	49.26789	-123.25827	Blue Phone 23 Fraser River Parkade @ Memorial Rd at Fraser River Parkade	49.26658	-123.25782	149.3272830310264
Blue Phone 20 Chemistry Physics @ East Mall & University Blvd.	49.26575	-123.25084	Blue Phone 81 University Blvd Lot Stairs 1	49.26659	-123.24925	148.72443796715476
Blue Phone 21 Chemistry East @ Main Mall & Agricultural Road	49.26616	-123.25372	Blue Phone 07 Hennings @ East Mall & Agricultural Road	49.26697	-123.25183	164.4279891251281
Blue Phone 22 Buchanan D @ Crescent Road at Buchanan D	49.26948	-123.25443	Blue Phone 62 Rose Garden Parkade Elevator Level 5	49.26945	-123.25658	156.5044982615307
Blue Phone 23 Fraser River Parkade @ Memorial Rd at Fraser River Parkade	49.26658	-123.25782	Blue Phone 50 Fraser River Parkade North East Level 2	49.26627	-123.25786	34.59931269036896
Blue Phone 24 Nitobe Garden @ Memorial Rd & Lower Mall	49.26612	-123.25867	Blue Phone 48 Fraser River Parkade South West Level 1	49.26568	-123.25827	56.939735159121554
Blue Phone 25 St. John's @ Lower Mall & University Blvd.	49.26331	-123.25635	Blue Phone 71 West Parkade North West Entrance Level 1	49.26281	-123.25539	89.30058336797676
Blue Phone 26 Jack Bell @ West Mall & University Blvd	49.26421	-123.25494	Blue Phone 25 St. John's @ Lower Mall & University Blvd.	49.26331	-123.25635	143.35566377222017
Blue Phone 27 West Parkade @ Lower Mall & Pedestrian Path at West Parkade	49.26201	-123.25514	Blue Phone 71 West Parkade North West Entrance Level 1	49.26281	-123.25539	90.8135964154881
Blue Phone 28 BRDF @ Lower Mall & Agronomy Road	49.26031	-123.25394	Blue Phone 13 Ritsumeikan @ West Mall at Ritsumeikan	49.26008	-123.25207	138.49969095820387
Blue Phone 29 CIRS @ West Mall & Stores Road	49.26166	-123.25331	Blue Phone 12 Earth & Ocean Sciences @ Stores Road at EOS	49.26195	-123.25239	74.32668666356724
Blue Phone 30 Totem Park @ West Mall & Thunderbird Blvd	49.25846	-123.25067	Blue Phone 16 Old Barn Community Centre @ Main Mall & Thunderbird Blvd	49.25932	-123.24815	206.8729769947377
Blue Phone 31 Tennis Centre @ Thunderbird & East Mall	49.26008	-123.24562	Blue Phone 33 Pulp & Paper @ East Mall & Argonomy Road	49.26143	-123.24712	185.6423005625256
Blue Phone 32 TBIRD Parkade @ West Mall & Thunderbird	49.26165	-123.24189	Blue Phone 67 Thunderbird Parkade North West Level 1	49.26159	-123.24303	83.24595118659444
Blue Phone 33 Pulp & Paper @ East Mall & Argonomy Road	49.26143	-123.24712	Blue Phone 18 Life Sciences @ Health Sciences Mall & Agronomy Rd.	49.26187	-123.24574	111.73273050989283
Blue Phone 34 SPPH @ Health Sciences Mall & Hospital Lane	49.2642	-123.2479	Blue Phone 51 Health Sciences Parkade South East Ground Level	49.2633	-123.24768	101.36609347947775
Blue Phone 35 CEME East Mall & Applied Science Lane	49.2631	-123.2484	Blue Phone 51 Health Sciences Parkade South East Ground Level	49.2633	-123.24768	56.9305663097431
Blue Phone 36 Iona Building South Side	49.27083	-123.25009	Blue Phone 40 Tallwood House - Walter Gage Rd NE of Brock Commons	49.26974	-123.25097	137.1011224378912
Blue Phone 37 UBC Exchange Bus Loop East - NE Side of Transit Loop	49.26755	-123.24755	Blue Phone 38 Exchange North	49.26833	-123.24817	97.78143078030268
Blue Phone 38 Exchange North	49.26833	-123.24817	Blue Phone 86 Saltwater Sturgeon House	49.26915	-123.24856	95.51104488709474
Blue Phone 39 FUTURE: Diesel Bus Loop	49.26755	-123.24755	Blue Phone 38 Exchange North	49.26833	-123.24817	97.78143078030268
Blue Phone 40 Tallwood House - Walter Gage Rd NE of Brock Commons	49.26974	-123.25097	Blue Phone 56 North Parkade South East Level 3	49.26895	-123.25095	87.87186865277693
Blue Phone 41 Thunderbird Park pedestrian pathway near Soccer Centre	49.26753	-123.25268	Blue Phone 07 Hennings @ East Mall & Agricultural Road	49.26697	-123.25183	87.78280466714641
Blue Phone 42 IK Barber 1st Floor Wall Unit	49.26753	-123.25268	Blue Phone 07 Hennings @ East Mall & Agricultural Road	49.26697	-123.25183	87.78280466714641
Blue Phone 43 IK Barber 2nd Floor Wall Unit	49.26753	-123.25268	Blue Phone 07 Hennings @ East Mall & Agricultural Road	49.26697	-123.25183	87.78280466714641
Blue Phone 44 IK Barber 3rd Floor Wall Unit	49.26753	-123.25268	Blue Phone 07 Hennings @ East Mall & Agricultural Road	49.26697	-123.25183	87.78280466714641
Blue Phone 45 IK Barber 4th Floor Wall Unit	49.26753	-123.25268	Blue Phone 07 Hennings @ East Mall & Agricultural Road	49.26697	-123.25183	87.78280466714641

Blue Phone 46 Vantage College Agronomy & West Mall	49.26039	-123.25096	Blue Phone 13 Ritsumeikan @ West Mall at Ritsumeikan	49.26008	-123.25207	87.8449871909675
Blue Phone 47 Fraser River Parkade North Entrance Level 1	49.26625	-123.2579	Blue Phone 50 Fraser River Parkade North East Level 2	49.26627	-123.25786	3.663715356137812
Blue Phone 48 Fraser River Parkade South West Level 1	49.26568	-123.25827	Blue Phone 24 Nitobe Garden @ Memorial Rd & Lower Mall	49.26612	-123.25867	56.939735159121554
Blue Phone 49 Fraser River Parkade South East Level 1	49.26596	-123.25746	Blue Phone 50 Fraser River Parkade North East Level 2	49.26627	-123.25786	45.123973049996756
Blue Phone 50 Fraser River Parkade North East Level 2	49.26627	-123.25786	Blue Phone 47 Fraser River Parkade North Entrance Level 1	49.26625	-123.2579	3.663715356137812
Blue Phone 51 Health Sciences Parkade South East Ground Level	49.2633	-123.24768	Blue Phone 35 CEME East Mall & Applied Science Lane	49.2631	-123.2484	56.9305663097431
Blue Phone 52 Health Sciences Parkade South West Ground Level	49.2633	-123.24768	Blue Phone 35 CEME East Mall & Applied Science Lane	49.2631	-123.2484	56.9305663097431
Blue Phone 53 Health Sciences Parkade North East Bottom Level	49.2633	-123.24768	Blue Phone 35 CEME East Mall & Applied Science Lane	49.2631	-123.2484	56.9305663097431
Blue Phone 54 Health Sciences Parkade North West Roof Top Level 5	49.2633	-123.24768	Blue Phone 35 CEME East Mall & Applied Science Lane	49.2631	-123.2484	56.9305663097431
Blue Phone 56 North Parkade South East Level 3	49.26895	-123.25095	Blue Phone 08 North Parkade @ Student Union Plaza	49.26847	-123.25109	54.34680549740137
Blue Phone 57 North Parkade South Entrance Level 3	49.26895	-123.25095	Blue Phone 08 North Parkade @ Student Union Plaza	49.26847	-123.25109	54.34680549740137
Blue Phone 58 North Parkade South Exit Level 2	49.26895	-123.25095	Blue Phone 08 North Parkade @ Student Union Plaza	49.26847	-123.25109	54.34680549740137
Blue Phone 59 North Parkade North West Level 2	49.26895	-123.25095	Blue Phone 08 North Parkade @ Student Union Plaza	49.26847	-123.25109	54.34680549740137
Blue Phone 60 North Parkade North East Level 3	49.26895	-123.25095	Blue Phone 08 North Parkade @ Student Union Plaza	49.26847	-123.25109	54.34680549740137
Blue Phone 61 North Parkade South Side Rooftop Level 8	49.26895	-123.25095	Blue Phone 08 North Parkade @ Student Union Plaza	49.26847	-123.25109	54.34680549740137
Blue Phone 62 Rose Garden Parkade Elevator Level 5	49.26945	-123.25658	Blue Phone 01 ANSOC @ Northwest Marine Drive	49.26973	-123.25721	55.42413500175715
Blue Phone 63 Rose Garden Parkade Elevator Level 4	49.26945	-123.25658	Blue Phone 01 ANSOC @ Northwest Marine Drive	49.26973	-123.25721	55.42413500175715
Blue Phone 64 Rose Garden Parkade Elevator Level 3	49.26945	-123.25658	Blue Phone 01 ANSOC @ Northwest Marine Drive	49.26973	-123.25721	55.42413500175715
Blue Phone 65 Rose Garden Parkade Elevator Level 2	49.26945	-123.25658	Blue Phone 01 ANSOC @ Northwest Marine Drive	49.26973	-123.25721	55.42413500175715
Blue Phone 66 Rose Garden Parkade Elevator Level 1	49.26945	-123.25658	Blue Phone 01 ANSOC @ Northwest Marine Drive	49.26973	-123.25721	55.42413500175715
Blue Phone 67 Thunderbird Parkade North West Level 1	49.26159	-123.24303	Blue Phone 32 TBIRD Parkade @ West Mall & Thunderbird	49.26165	-123.24189	83.24595118659444
Blue Phone 68 Thunderbird Parkade West Level 1	49.26159	-123.24303	Blue Phone 32 TBIRD Parkade @ West Mall & Thunderbird	49.26165	-123.24189	83.24595118659444
Blue Phone 69 Thunderbird Parkade South East Level 1	49.26159	-123.24303	Blue Phone 32 TBIRD Parkade @ West Mall & Thunderbird	49.26165	-123.24189	83.24595118659444
Blue Phone 70 Thunderbird Parkade North East Level 1	49.26159	-123.24303	Blue Phone 32 TBIRD Parkade @ West Mall & Thunderbird	49.26165	-123.24189	83.24595118659444
Blue Phone 71 West Parkade North West Entrance Level 1	49.26281	-123.25539	Blue Phone 25 St. John's @ Lower Mall & University Blvd.	49.26331	-123.25635	89.30058336797676
Blue Phone 72 West Parkade South Level 2	49.26281	-123.25539	Blue Phone 25 St. John's @ Lower Mall & University Blvd.	49.26331	-123.25635	89.30058336797676
Blue Phone 73 West Parkade North Level 2	49.26281	-123.25539	Blue Phone 25 St. John's @ Lower Mall & University Blvd.	49.26331	-123.25635	89.30058336797676
Blue Phone 74 West Parkade North East Level 4	49.26281	-123.25539	Blue Phone 25 St. John's @ Lower Mall & University Blvd.	49.26331	-123.25635	89.30058336797676
Blue Phone 75 West Parkade South East Level 4	49.26281	-123.25539	Blue Phone 25 St. John's @ Lower Mall & University Blvd.	49.26331	-123.25635	89.30058336797676
Blue Phone 76 West Parkade North Rooftop Level 11	49.26281	-123.25539	Blue Phone 25 St. John's @ Lower Mall & University Blvd.	49.26331	-123.25635	89.30058336797676
Blue Phone 77 Fairview Crescent & Osoyoos Crescent	49.26246	-123.2388	Blue Phone 78 Osoyoos Crescent & Oyama Court	49.26072	-123.2382	198.38064120158887
Blue Phone 78 Osoyoos Crescent & Oyama Court	49.26072	-123.2382	Blue Phone 79 Point Grey Apartments	49.25961	-123.23727	140.79087555857794
Blue Phone 79 Point Grey Apartments	49.25961	-123.23727	Blue Phone 78 Osoyoos Crescent & Oyama Court	49.26072	-123.2382	140.79087555857794
Blue Phone 80 Osoyoos Crescent & Acadia Park Lane	49.25967	-123.23522	Blue Phone 79 Point Grey Apartments	49.25961	-123.23727	149.3700543826124
Blue Phone 81 University Blvd Lot Stairs 1	49.26659	-123.24925	Blue Phone 82 University Blvd Lot Stairs 2	49.26662	-123.24912	10.032501364767866
Blue Phone 82 University Blvd Lot Stairs 2	49.26662	-123.24912	Blue Phone 81 University Blvd Lot Stairs 1	49.26659	-123.24925	10.032501364767866
Blue Phone 83 University Blvd Lot Stairs 3	49.26662	-123.24912	Blue Phone 81 University Blvd Lot Stairs 1	49.26659	-123.24925	10.032501364767866
Blue Phone 84 University Blvd Lot Stairs 4	49.26662	-123.24912	Blue Phone 81 University Blvd Lot Stairs 1	49.26659	-123.24925	10.032501364767866
Blue Phone 55 Health Science Pkd Rooftop Level 5	49.2633	-123.24768	Blue Phone 35 CEME East Mall & Applied Science Lane	49.2631	-123.2484	56.9305663097431
Blue Phone 85 Saltwater Orca House	49.26875	-123.24971	Blue Phone 56 North Parkade South East Level 3	49.26895	-123.25095	92.94444610340688
Blue Phone 86 Saltwater Sturgeon House	49.26915	-123.24856	Blue Phone 87	49.26927	-123.248	42.88441156150479
Blue Phone 87	49.26927	-123.248	Blue Phone 86 Saltwater Sturgeon House	49.26915	-123.24856	42.88441156150479
Blue Phone 88	49.27007	-123.24837	Blue Phone 89	49.27075	-123.24798	80.77665730552232
Blue Phone 89	49.27075	-123.24798	Blue Phone 88	49.27007	-123.24837	80.77665730552232

Mathematical Model

GitHub Repository: <https://github.com/AllenCheng5186/VANT149-Group9-Research-Project>

Data set folder: <https://github.com/AllenCheng5186/VANT149-Group9-Research-Project/tree/main/data>

Main Jupyter Notebook: <https://github.com/AllenCheng5186/VANT149-Group9-Research-Project/blob/main/Main%20Ready%20for%20Print.ipynb>

```
In [1]: library(tidyverse)
library(sf)
library(mapview)
library(rvest)
library(httr)
library(ggplot2)
library(ggmap)
library(maps)
library(ggsn)
library(geosphere)
library(dplyr)
library(RColorBrewer)
library(readxl)
library(leaflet)
library(leaflet.extras)
library(plot3D)
library(av)
library(rayshader)
library(lattice)
library(latticeExtra)
```

```

— Attaching core tidyverse packages — tidyverse
2.0.0 —
✓ dplyr      1.1.2      ✓ readr      2.1.4
✓ forcats    1.0.0      ✓ stringr    1.5.0
✓ ggplot2    3.4.2      ✓ tibble     3.2.1
✓ lubridate  1.9.2      ✓ tidyr      1.3.0
✓ purrr      1.0.1

```

```

— Conflicts — tidyverse_conflic
ts() —

```

```

✖ dplyr::filter() masks stats::filter()
✖ dplyr::lag()      masks stats::lag()
i Use the conflicted package (<http://conflicted.r-lib.org/>) to force al
l conflicts to become errors
Linking to GEOS 3.11.0, GDAL 3.5.3, PROJ 9.1.0; sf_use_s2() is TRUE

```

The legacy packages maptools, rgdal, and rgeos, underpinning this package will retire shortly. Please refer to R-spatial evolution reports on <https://r-spatial.org/r/2023/05/15/evolution4.html> (<https://r-spatial.org/r/2023/05/15/evolution4.html>) for details.
This package is now running under evolution status 0

Attaching package: 'rvest'

The following object is masked from 'package:readr':

guess_encoding

```

i Google's Terms of Service: <https://mapsplatform.google.com>
i Please cite ggmap if you use it! Use `citation("ggmap")` for details.

```

Attaching package: 'maps'

The following object is masked from 'package:purrr':

map

Loading required package: grid

```

Warning message:
"multiple methods tables found for 'elide'"

```

Attaching package: 'latticeExtra'

The following object is masked from 'package:ggplot2':

layer

```
In [2]: Bluephone_location <- read_csv("data/Bluephone Locations My Map Downloaded
head(Bluephone_location)
```

Rows: 89 Columns: 4

Column specification

Delimiter: ", "

chr (2): Formal_Name_and_Room, Street_Address

dbl (2): Latitude, Longitude

i Use `spec()` to retrieve the full column specification for this data.
i Specify the column types or set `show_col_types = FALSE` to quiet this message.

A tibble: 6 × 4

Formal_Name_and_Room	Street_Address	Latitude	Longitude
<chr>	<chr>	<dbl>	<dbl>
Blue Phone 01 ANSOC @ Northwest Marine Drive	6303 N W MARINE DR at ANSOC Building	49.26973	-123.2572
Blue Phone 03 Flagpole Plaza @ Main Mall & Crescent Road	Main Mall & Crescent Road	49.26894	-123.2566
Blue Phone 04 Wyman Plaza @ Main Mall & Memorial Road	Main Mall & Memorial Road	49.26777	-123.2550
Blue Phone 05 Ponderosa F @ Lower Mall & Pedestrian Path	2008 LOWER MALL Ponderosa Annex F	49.26497	-123.2575
Blue Phone 06 Ponderosa A @ West Mall & Agricultural Road	2011 WEST MALL Ponderosa Annex A	49.26534	-123.2562
Blue Phone 07 Hennings @ East Mall & Agricultural Road	6224 AGRICULTURAL RD/EAST MALL Hennings Bldg	49.26697	-123.2518

```
In [3]: Bluephone_location <- Bluephone_location |>
mutate(across(Longitude, as.double))
```

```
In [4]: head(Bluephone_location)
```

A tibble: 6 × 4

Formal_Name_and_Room	Street_Address	Latitude	Longitude
<chr>	<chr>	<dbl>	<dbl>
Blue Phone 01 ANSOC @ Northwest Marine Drive	6303 N W MARINE DR at ANSOC Building	49.26973	-123.2572
Blue Phone 03 Flagpole Plaza @ Main Mall & Crescent Road	Main Mall & Crescent Road	49.26894	-123.2566
Blue Phone 04 Wyman Plaza @ Main Mall & Memorial Road	Main Mall & Memorial Road	49.26777	-123.2550
Blue Phone 05 Ponderosa F @ Lower Mall & Pedestrian Path	2008 LOWER MALL Ponderosa Annex F	49.26497	-123.2575
Blue Phone 06 Ponderosa A @ West Mall & Agricultural Road	2011 WEST MALL Ponderosa Annex A	49.26534	-123.2562
Blue Phone 07 Hennings @ East Mall & Agricultural Road	6224 AGRICULTURAL RD/EAST MALL Hennings Bldg	49.26697	-123.2518

```
In [5]: base_map <- leaflet() %>%
  addTiles() %>%
  fitBounds(-123.22, 49.263, -123.28, 49.27)

#base_map
```

```
In [6]: # save the map view
mapshot(base_map, file = "Map Image Save/base map.png")
```




```
In [7]: bluephone_map <- leaflet(data = Bluephone_location) %>%
  addTiles() %>%
  fitBounds(-123.22,49.263,-123.28,49.27) %>%
  addMarkers(lng = ~Longitude,
             lat = ~Latitude,
             popup = ~Street_Address, label = ~Formal_Name_and_Room)

#bluephone_map
```

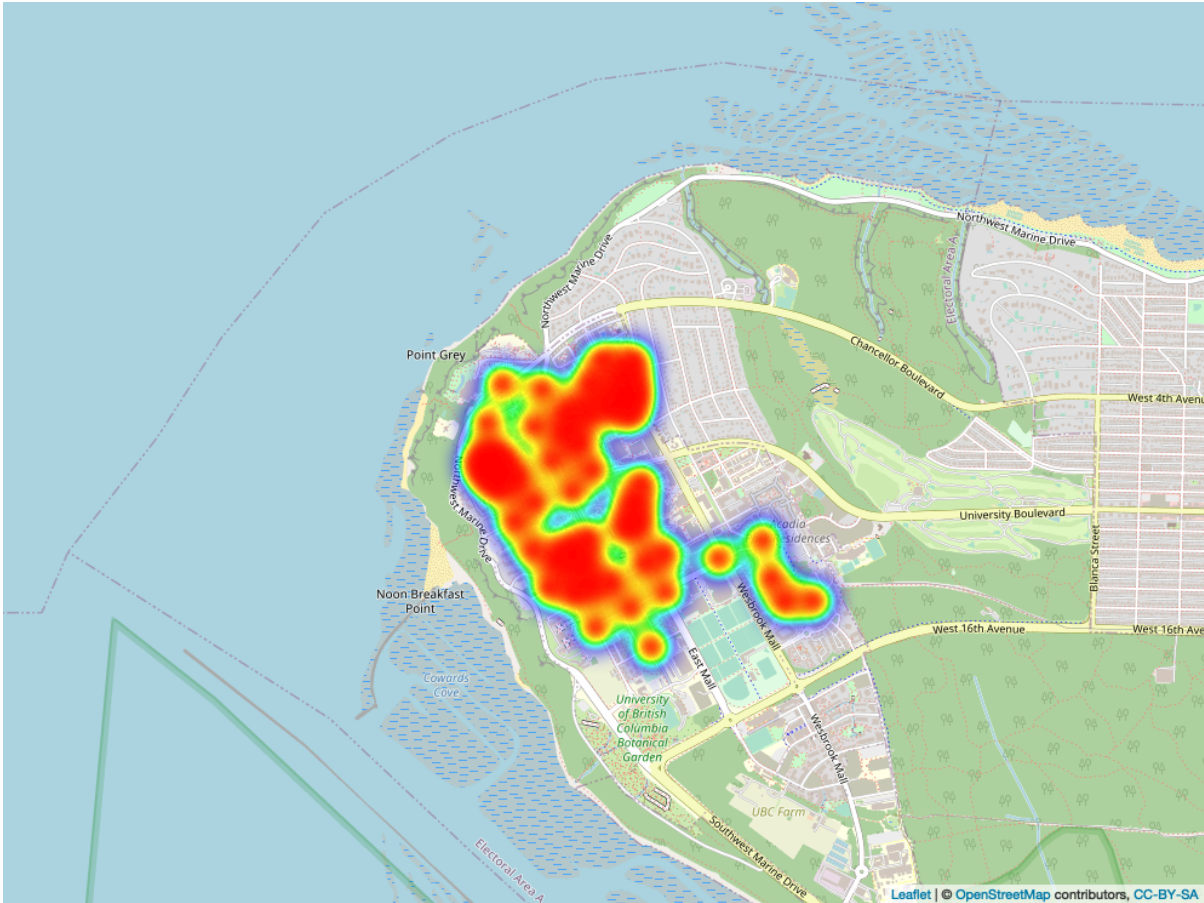
```
In [8]: # save the map view
mapshot(bluephone_map, file = "Map Image Save/bluephone map.png")
```



```
In [9]: # heatmap of bluephone density
bluephone_heatmap <- addHeatmap(base_map, lng = ~Longitude, lat = ~Latitude,
  layerId = NULL, group = NULL, minOpacity = 0.05, max = 0.05,
  radius = 20, blur = 25, gradient = NULL, cellSize = 10,
  data = Bluephone_location)

#bluephone_heatmap
```

```
In [10]: # save the map view
mapshot(bluephone_heatmap, file = "Map Image Save/bluephone heatmap.png")
```



```
In [11]: head(Bluephone_location)
```

A tibble: 6 × 4

Formal_Name_and_Room	Street_Address	Latitude	Longitude
<chr>	<chr>	<dbl>	<dbl>
Blue Phone 01 ANSOC @ Northwest Marine Drive	6303 N W MARINE DR at ANSOC Building	49.26973	-123.2572
Blue Phone 03 Flagpole Plaza @ Main Mall & Crescent Road	Main Mall & Crescent Road	49.26894	-123.2566
Blue Phone 04 Wyman Plaza @ Main Mall & Memorial Road	Main Mall & Memorial Road	49.26777	-123.2550
Blue Phone 05 Ponderosa F @ Lower Mall & Pedestrian Path	2008 LOWER MALL Ponderosa Annex F	49.26497	-123.2575
Blue Phone 06 Ponderosa A @ West Mall & Agricultural Road	2011 WEST MALL Ponderosa Annex A	49.26534	-123.2562
Blue Phone 07 Hennings @ East Mall & Agricultural Road	6224 AGRICULTURAL RD/EAST MALL Hennings Bldg	49.26697	-123.2518

```
In [12]: bluephone_lon_lat <- Bluephone_location |>
  select(Longitude, Latitude)
```

```
In [13]: first_bluephone <- Bluephone_location[89, ]
first_bluephone
first_bluephone_lon_lat <- select(first_bluephone, Longitude, Latitude)
first_bluephone_lon_lat
rest_bluephone <- Bluephone_location |>
  filter(Latitude != pull(first_bluephone, Latitude))

Bluephone_distance <- rest_bluephone |>
  group_by(Formal_Name_and_Room, Latitude, Longitude) |>
  summarize(distance = distGeo(first_bluephone_lon_lat, c(Longitude,
  arrange(distance) |>
  head(1) |>
  mutate(Bluephone_origin = pull(first_bluephone, Formal_Name_and_Room),
    origin_Lat = pull(first_bluephone, Latitude),
    origin_Lon = pull(first_bluephone, Longitude)) |>
  select(Bluephone_origin, origin_Lat, origin_Lon, Formal_Name_and_Room)

colnames(Bluephone_distance) <- c("Bluephone_origin", "origin_Lat", "origin_Lon", "distance")
Bluephone_distance
```

A tibble: 1 × 4

Formal_Name_and_Room	Street_Address	Latitude	Longitude
<chr>	<chr>	<dbl>	<dbl>
Blue Phone 89	Saltwater Octopus House	49.27075	-123.248

A tibble: 1 × 2

Longitude	Latitude
<dbl>	<dbl>
-123.248	49.27075

`summarise()` has grouped output by 'Formal_Name_and_Room', 'Latitude'. You can override using the `.groups` argument.

A grouped_df: 1 × 7

Bluephone_origin	origin_Lat	origin_Lon	closest_Bluephone	closest_lat	closest_lon	distance
<chr>	<dbl>	<dbl>	<chr>	<dbl>	<dbl>	<dbl>
Blue Phone 89	49.27075	-123.248	Blue Phone 88	49.27007	-123.2484	80.77666

```
In [14]: bluephone_closest_distance <- as_tibble(filter(Bluephone_distance, Bluephone_origin == "Blue Phone 89"))
bluephone_closest_distance
```

A tibble: 0 × 7

Bluephone_origin	origin_Lat	origin_Lon	closest_Bluephone	closest_lat	closest_lon	distance
<chr>	<dbl>	<dbl>	<chr>	<dbl>	<dbl>	<dbl>

```

In [15]: bluephone_closest_distance <- filter(Bluephone_distance, Bluephone_origin =
options(dplyr.summarise.inform = FALSE) #disable dplyr messages in code

for (i in 1:89){
  first_bluephone <- Bluephone_location[i, ]
  first_bluephone_lon_lat <- select(first_bluephone, Longitude, Latitude)
  rest_bluephone <- Bluephone_location |>
    filter(Latitude != pull(first_bluephone, Latitude))

  Bluephone_distance <- rest_bluephone |>
    group_by(Formal_Name_and_Room, Latitude, Longitude) |>
    summarize(distance = distGeo(first_bluephone_lon_lat, c(Longitude,
    arrange(distance) |>
    head(1) |>
    mutate(Bluephone_origin = pull(first_bluephone, Formal_Name_and_Room),
           origin_Lat = pull(first_bluephone, Latitude),
           origin_Lon = pull(first_bluephone, Longitude)) |>
    select(Bluephone_origin, origin_Lat, origin_Lon, Formal_Name_and_Room)

  colnames(Bluephone_distance) <- c("Bluephone_origin", "origin_Lat", "origin_Lon",
    "closest_Bluephone", "closest_lat", "closest_lon")

  bluephone_closest_distance <- bind_rows(bluephone_closest_distance, Bluephone_distance)
}

head(bluephone_closest_distance)

```

A grouped_df: 6 × 7

Bluephone_origin	origin_Lat	origin_Lon	closest_Bluephone	closest_lat	closest_lon	distance
<chr>	<dbl>	<dbl>	<chr>	<dbl>	<dbl>	<dbl>
Blue Phone 01 ANSOC @ Northwest Marine Drive	49.26973	-123.2572	Blue Phone 62 Rose Garden Parkade Elevator Level 5	49.26945	-123.2566	55.42414
Blue Phone 03 Flagpole Plaza @ Main Mall & Crescent Road	49.26894	-123.2566	Blue Phone 62 Rose Garden Parkade Elevator Level 5	49.26945	-123.2566	56.72429
Blue Phone 04 Wyman Plaza @ Main Mall & Memorial Road	49.26777	-123.2550	Blue Phone 03 Flagpole Plaza @ Main Mall & Crescent Road	49.26894	-123.2566	171.26136
Blue Phone 05 Ponderosa F @ Lower Mall & Pedestrian Path	49.26497	-123.2575	Blue Phone 48 Fraser River Parkade South West Level 1	49.26568	-123.2583	94.76914
Blue Phone 06 Ponderosa A @ West Mall & Agricultural Road	49.26534	-123.2562	Blue Phone 05 Ponderosa F @ Lower Mall & Pedestrian Path	49.26497	-123.2575	103.17813
Blue Phone 07 Hennings @ East Mall & Agricultural Road	49.26697	-123.2518	Blue Phone 41 Thunderbird Park pedestrian pathway near Soccer Centre	49.26753	-123.2527	87.78280

```
In [16]: write_csv(bluephone_closest_distance, file = "data/Each Bluephone Distance
```



```
In [17]: #rename from the formal name to index
bluephone_closest_distance_renamed <- bluephone_closest_distance |>
  mutate(Bluephone_No = substr(Bluephone_origin, 11, 13)) |>
  mutate(across(Bluephone_No, as.integer)) |>
  select(Bluephone_No, origin_Lat, origin_Lon, closest_Bluephone, closest
head(bluephone_closest_distance_renamed)
```

A grouped_df: 6 × 7

Bluephone_No	origin_Lat	origin_Lon	closest_Bluephone	closest_lat	closest_lon	distance
<int>	<dbl>	<dbl>	<chr>	<dbl>	<dbl>	<dbl>
1	49.26973	-123.2572	Blue Phone 62 Rose Garden Parkade Elevator Level 5	49.26945	-123.2566	55.42414
3	49.26894	-123.2566	Blue Phone 62 Rose Garden Parkade Elevator Level 5	49.26945	-123.2566	56.72429
4	49.26777	-123.2550	Blue Phone 03 Flagpole Plaza @ Main Mall & Crescent Road	49.26894	-123.2566	171.26136
5	49.26497	-123.2575	Blue Phone 48 Fraser River Parkade South West Level 1	49.26568	-123.2583	94.76914
6	49.26534	-123.2562	Blue Phone 05 Ponderosa F @ Lower Mall & Pedestrian Path	49.26497	-123.2575	103.17813
7	49.26697	-123.2518	Blue Phone 41 Thunderbird Park pedestrian pathway near Soccer Centre	49.26753	-123.2527	87.78280

```
In [18]: arranged_bluephone_closest_distance <- bluephone_closest_distance_renamed |
         arrange(desc(distance))
         head(arranged_bluephone_closest_distance, n = 15)
```

A grouped_df: 15 × 7

Bluephone_No	origin_Lat	origin_Lon	closest_Bluephone	closest_lat	closest_lon	distance
<int>	<dbl>	<dbl>	<chr>	<dbl>	<dbl>	<dbl>
17	49.25758	-123.2467	Blue Phone 16 Old Barn Community Centre @ Main Mall & Thunderbird Blvd	49.25932	-123.2481	220.0795
30	49.25846	-123.2507	Blue Phone 16 Old Barn Community Centre @ Main Mall & Thunderbird Blvd	49.25932	-123.2481	206.8730
77	49.26246	-123.2388	Blue Phone 78 Osoyoos Crescent & Oyama Court	49.26072	-123.2382	198.3806
31	49.26008	-123.2456	Blue Phone 33 Pulp & Paper @ East Mall & Agronomy Road	49.26143	-123.2471	185.6423
4	49.26777	-123.2550	Blue Phone 03 Flagpole Plaza @ Main Mall & Crescent Road	49.26894	-123.2566	171.2614
16	49.25932	-123.2481	Blue Phone 14 MacMillan @ Main Mall & Agronomy Rd	49.26053	-123.2495	168.3631
21	49.26616	-123.2537	Blue Phone 07 Hennings @ East Mall & Agricultural Road	49.26697	-123.2518	164.4280
22	49.26948	-123.2544	Blue Phone 62 Rose Garden Parkade Elevator Level 5	49.26945	-123.2566	156.5045
10	49.26471	-123.2523	Blue Phone 20 Chemistry Physics @ East Mall & University Blvd.	49.26575	-123.2508	155.5971
80	49.25967	-123.2352	Blue Phone 79 Point Grey Apartments	49.25961	-123.2373	149.3701
2	49.26789	-123.2583	Blue Phone 23 Fraser River Parkade @ Memorial Rd at Fraser River Parkade	49.26658	-123.2578	149.3273
20	49.26575	-123.2508	Blue Phone 81 University Blvd Lot Stairs 1	49.26659	-123.2493	148.7244
26	49.26421	-123.2549	Blue Phone 25 St. John's @ Lower Mall & University Blvd.	49.26331	-123.2563	143.3557
78	49.26072	-123.2382	Blue Phone 79 Point Grey Apartments	49.25961	-123.2373	140.7909
79	49.25961	-123.2373	Blue Phone 78 Osoyoos Crescent & Oyama Court	49.26072	-123.2382	140.7909


```
In [19]: # calculate the mean of the distance
distance_mean <- bluephone_closest_distance_renamed |>
  pull(distance) |>
  mean()

cat("The distance between each bluephone and its closet bluephone is", dist
```

The distance between each bluephone and its closet bluephone is 88.23234 m.

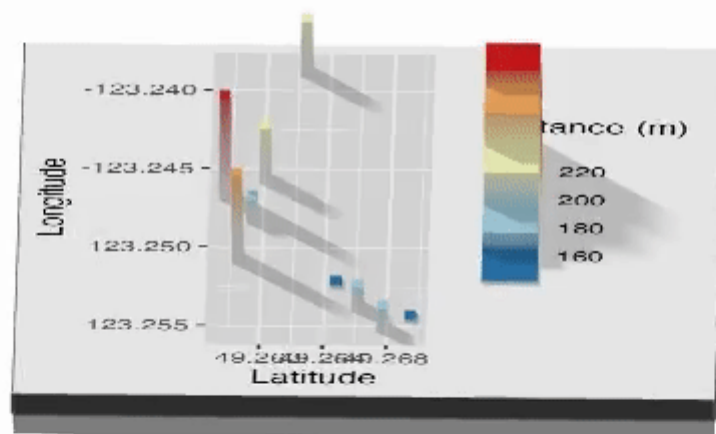
```
In [20]: # 3d bar plot in the exact coordinates locations
arranged_bluephone_closest_distance_9 <- head(arranged_bluephone_closest_di

Barplot_3d <- arranged_bluephone_closest_distance_9 |>
  ggplot(aes(origin_Lat, origin_Lon, fill = distance)) +
  geom_tile() +
  scale_fill_fermenter(type = "div", palette = "RdYlBu") +
  xlab("Latitude") +
  ylab("Longitude") +
  labs(fill = "Distance (m)")

suppressWarnings(plot_gg(Barplot_3d))
```

```
In [21]: suppressWarnings(render_movie(filename = "plot.gif"))
```

'/Users/chengxiansheng/Desktop/Jupyter Notebook/VANT
149/VANT149_Group9_Project/plot.gif.mp4'



```

In [22]: #3d bar plot according to the relative location base on coordinates
df.distance <- data.frame(matrix(NA, nrow=9, ncol=4))
names(df.distance) <- c("x", "y", "z", "z.rank")

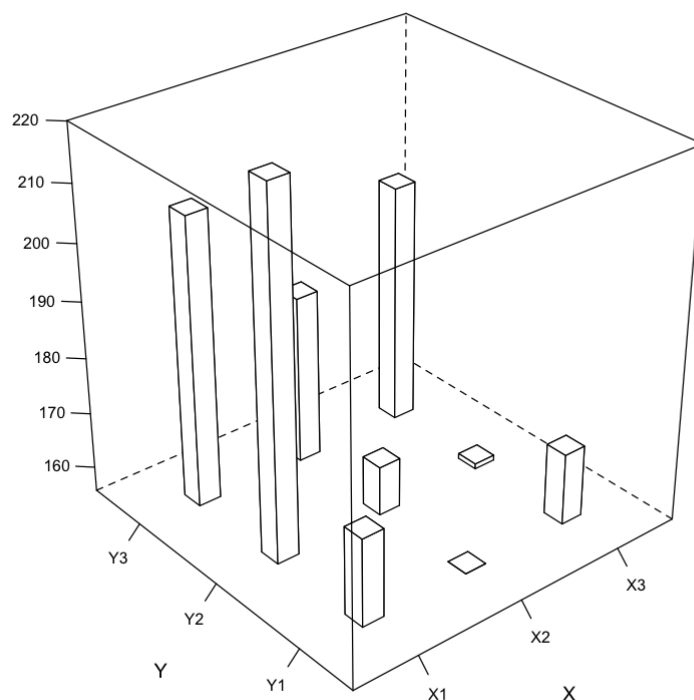
df.distance$x <- factor(rep(c("X1", "X2", "X3"), times=3), levels=c("X1", "
df.distance$y <- factor(rep( paste0("Y", 1:3), each=3), levels=c("Y1", "Y2"
df.distance$z <- pull(arrange(arranged_bluephone_closest_distance_9, Blueph

df.distance$z.rank <- as.numeric(rank(df.distance$z))

p1. <- cloud(z~x+y, data=df.distance, panel.3d.cloud=panel.3dbars,
  ylab="Y", xlab="X", zlab="Z",
  xbase=0.2, ybase=0.2, scales=list(arrows=FALSE, col="black", di
  par.settings = list(axis.line = list(col = "transparent")),
  #screen = list(z = 35, x = -35, y=0),
  alpha.facet = 1.00, border = "transparent",
  zoom=1.00);

print(p1.)

```



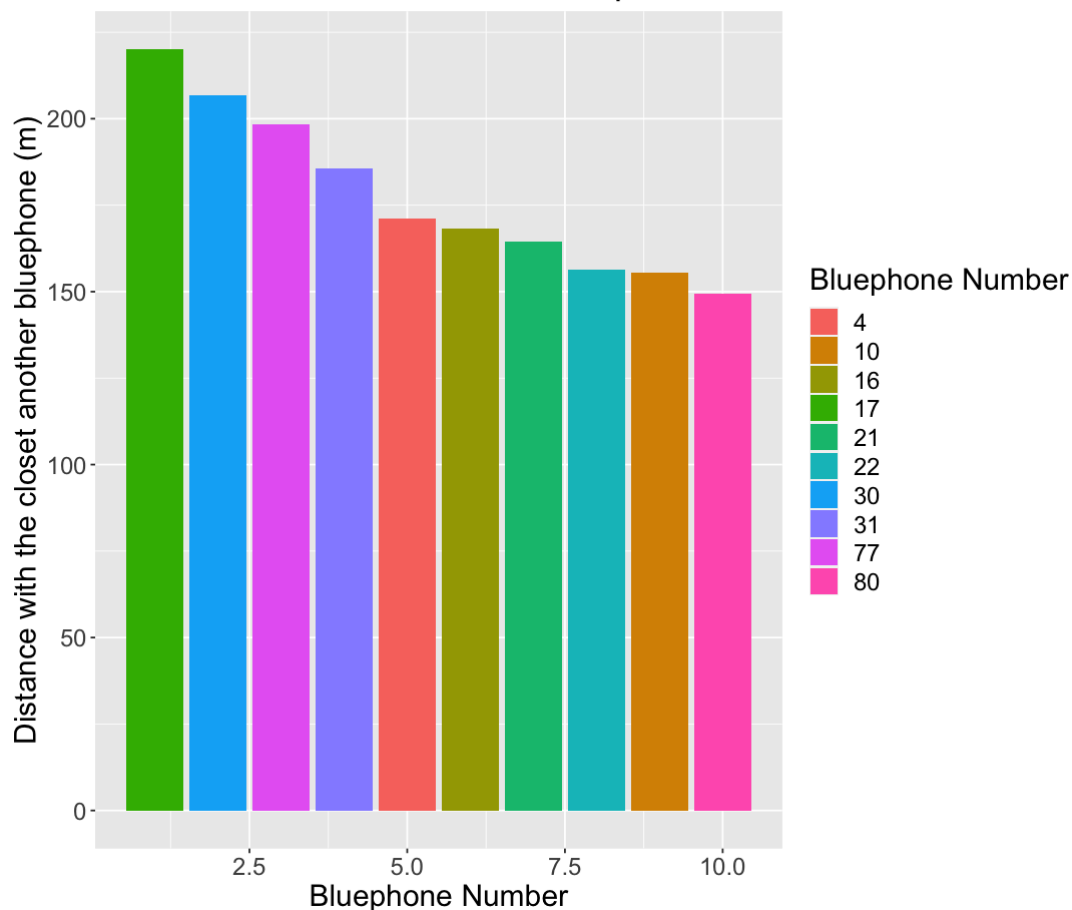
```
In [23]: #plot the distance between the current bluephone and its closet one in 2D
options(repr.plot.height = 8, repr.plot.width = 9)

bluephone_closest_distance_plot <- head(arranged_bluephone_closest_distance
  ggplot(aes(x = c(1:10), y = distance, fill = as_factor(Bluephone_No)))
  geom_bar(stat = "identity", bins = 10) +
  labs(x = "Bluephone Number",
       y = "Distance with the closet another bluephone (m)",
       fill = "Bluephone Number") +
  ggtitle("The distance between each bluephone and its closet one") +
  theme(text = element_text(size = 18))

bluephone_closest_distance_plot
```

Warning message in `geom_bar(stat = "identity", bins = 10)`:
 "Ignoring unknown parameters: `bins`"

The distance between each bluephone and its closet one



```
In [24]: #find the location of the bluephone such that has the maximum distance with
bluephone_distance_max <- bluephone_closest_distance |>
  arrange(desc(distance)) |>
  head(1)

bluephone_distance_max
```

A grouped_df: 1 × 7

Bluephone_origin	origin_Lat	origin_Lon	closest_Bluephone	closest_lat	closest_lon	distance
<chr>	<dbl>	<dbl>	<chr>	<dbl>	<dbl>	<dbl>
Blue Phone 17 Rhododendron Wood @ Main Mall & Eagles Drive	49.25758	-123.2467	Blue Phone 16 Old Barn Community Centre @ Main Mall & Thunderbird Blvd	49.25932	-123.2481	220.0795

```
In [25]: bluephone_distance_max_location <- Bluephone_location |>
  filter(Formal_Name_and_Room %in% c("Blue Phone 17 Rhododendron Wood @ M
    "Blue Phone 16 Old Barn Community Ce
    "Blue Phone 30 Totem Park @ West Mal
    "Blue Phone 31 Tennis Centre @ Thund

bluephone_distance_max_location
```

A tibble: 4 × 4

Formal_Name_and_Room	Street_Address	Latitude	Longitude
<chr>	<chr>	<dbl>	<dbl>
Blue Phone 16 Old Barn Community Centre @ Main Mall & Thunderbird Blvd	6308 THUNDERBIRD Blvd Old Barn Community Ctr	49.25932	-123.2481
Blue Phone 17 Rhododendron Wood @ Main Mall & Eagles Drive	Main Mall	49.25758	-123.2467
Blue Phone 30 Totem Park @ West Mall & Thunderbird Blvd	2525 WEST MALL & THUNDERBIRD Blvd	49.25846	-123.2507
Blue Phone 31 Tennis Centre @ Thunderbird & East Mall	6160 THUNDERBIRD BLVD & EAST MALL	49.26008	-123.2456

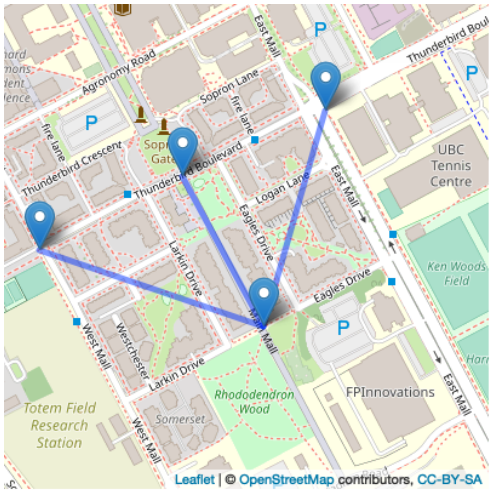
In [26]: *#plot the location on the map*

```
bluephone_map_max_distance <- leaflet(data = bluephone_distance_max_location)
  addTiles() |>
  fitBounds(-123.246, 49.257, -123.248, 49.26) |>
  addMarkers(lng = ~Longitude,
             lat = ~Latitude,
             popup = ~Street_Address,
             label = ~Formal_Name_and_Room) |>
  addMarkers(data = bluephone_distance_max_location,
             lng = ~Longitude,
             lat = ~Latitude,
             popup = ~Street_Address,
             label = ~Formal_Name_and_Room) |>
  addPolylines(data = bluephone_distance_max_location[1:2,], lng = ~Longitude, lat = ~Latitude) |>
  addPolylines(data = bind_rows(bluephone_distance_max_location[2, ],
                                bluephone_distance_max_location[3, ]),
               lng = ~Longitude, lat = ~Latitude) |>
  addPolylines(data = bind_rows(bluephone_distance_max_location[2, ],
                                bluephone_distance_max_location[4, ]),
               lng = ~Longitude, lat = ~Latitude) |>
  addScaleBar()

#bluephone_map_max_distance
```

In [27]: *# mapview image save*

```
mapshot(bluephone_map_max_distance, file = "Map Image Save/Longest_Bluephon
```



In []: