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A Location Aware Service to Minimize Travel Costs Using Dynamic Information

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ABSTRACT

Automotive navigation systems have become common accessories in vehicles manufactured today. However, the information provided by these systems is quite limited in that many systems only provide static information. As a result, manufacturers of such systems have not been able to fully capitalize from the potential applications for mobile commerce (m-commerce) which is critically dependent on providing consumers with dynamic information. The objective of this paper is to discuss a novel method, known as Dynamic Location Cost Minimization (DLCM), which can be used with a vehicle's navigation system to determine the optimum location to purchase gas. With the increasing cost of gas and the possibility of higher prices due to proposed gas price taxes, providing a means for consumers to minimize their costs to travel could prove to be very beneficial, and potentially help drive down prices due to increased competition. In addition, the proposed method could also be used in conjunction with mobile phones to facilitate real-time decisions for other services or purchases. Anecdotal evidence presented in this paper merits further investigation into the usability and acceptance of this technology.

Keywords

Location aware systems, ubiquitous computing, m-commerce, real-time decision support, recommender systems

INTRODUCTION

Often, individuals will purchase gas at one location and then realize that there was a gas station within close proximity which sells gas at a cheaper price. Unfortunately, this gas station may not be visible from the gas station where the individual purchased gas. An application that could provide this information in advance would enable users to minimize their cost for purchasing gas and other products. Some services such as http://www.gasbuddy.com and http://www.gaspricewatch.com provide dynamic information for fluctuating gas prices which can be accessed via the web or mobile devices. However, the method presented in this paper not only reveals fluctuating gas prices it also recommends the gas station which will minimize the total cost to travel a specific route based on the individual's current location and final destination. This does not necessarily mean that an individual will purchase gas with the minimum price. Depending on the distance and convenience sometimes, it may be more economical to purchase gas at a higher price if the location of the gas with the cheaper price is significantly farther away. Therefore, an application which utilizes the DLCM method will allow the user to not only know the status and price of gas at various locations, but to also recommend the location which will minimize the user's traveling costs.

The next section summarizes literature relating to location aware systems and m-commerce. Subsequently, several scenarios are presented to provide insight into the design of an application based on the DLCM method. Next, an example is provided to demonstrate the improvement of the DLCM method over other location aware systems which are used for m-commerce. This paper concludes with a summary of key points and possible future research to evaluate the acceptance of an application based on anecdotal evidence.

RELATED WORK

Location-aware applications use the location of people, places, and things to augment or streamline interaction. (Li et al 2004). An early example of an application which demonstrated how location aware systems could be used to enhance

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interaction was Cyberguide. Cyberguide was one of the first systems that used location aware information to help tourists identify locations of interest (Long et al 1996). In addition to tourism based applications, similar research in this domain includes navigation systems for pedestrians (Jörg et al 2003) and a pocket-sized location aware system, based on GPS (Global Positioning System) signals, which presents different audio cues to the user according to location and heading (Strachan et al (2005). While the original intention of these services were to provide users with information "anywhere" and "anytime", the rapid increase of wireless, RFID and GPS based technologies has led to knew services and applications which promoted the extension of e-commerce into what is known as mobile commerce or ubiquitous commerce or u-commerce. U-commerce refers to the ability to interact and transact with anything and anyone, anytime and anywhere (Sheng et al, 2006).

While the main benefit of u-commerce for consumers is convenience, the key benefit of u-commerce for merchants is that they are able to personalize their products and services based on the consumer's location. However, regardless of these benefits the main challenge for obtaining wide scale acceptance of u-commerce is privacy (Sheng et al 2006). The advancement of technologies embedded and used in the u-commerce environment raises concerns of customers because their personal information not only can be constantly accessed and continuously tracked, but also can be easily disseminated and possibly used in ways unknown to them (Sheng et al 2006, Gunther and Spiekermann, 2005). Numerous extant studies have treated the construct of privacy concerns as an antecedent to various behavior-related variables, e.g., willingness to disclose personal information (Chellappa and Sin 2005), intention to transact (Dinev and Hart 2006b), and information disclosure behavior (Buchanan et al, 2007). The negative impact of privacy concerns on behavioral intention has been empirically supported in the e-commerce context (Chellappa and Sin 2005; Dinev and Hart 2006a; Malhotra et al, 2004). While privacy concerns have been a critical factor inhibiting the wide scale adoption of location based services (Clarke 2001; Levy 2004) recent research indicates that privacy concerns may not entirely influence consumers intention to use location based technologies (Xu and Gupta, 2009). This may be in conflict with previous privacy research, but the validity in their results may lie in consumers' willingness to share more private information due to the proliferation of Web 2.0 technologies. The wide spread use of many social networking sites such as Facebook, YouTube, and Linkedin and the content that users are willing to share on these sites demonstrates that to some degree privacy concerns may no longer be the main barrier to entry. Other evidence supporting this claim include consumers who are enrolling in a new service run by Blippy (http://www.blippy.com) which allows people to link their credit cards and e-commerce accounts to its site, so those people can share with friends and strangers everything they buy (Stone, 2010). For example, users can link their Gmail accounts, so Blippy can skim their inboxes for Amazon receipts. Surprisingly, despite the obvious privacy risks many people have signed up for this service.

In addition, location aware systems pose other technical as well as social challenges that need to be addressed. Mokbel et al provide technical insights into two main areas that need to be addressed in order to design and develop efficient location aware services. They argue that location aware services need query optimization techniques that provide fast query responses. "In a location-aware environment, where objects are continuously moving, any delay in query response results in an invalid and an obsolete answer." Mokbel states that the main hindrances for designing such systems are due to issues with scalability and complexity (Mokbel et al 2003). Jones et al focus on social aspects such as "place" that influence people's information sharing (Jones et al 2004). Their preliminary findings suggest that information about places need to be integrated with data about user's routines and social relationships. There has also been significant research for applications which utilize location based services. For example, Li et al state that a high level of technical expertise is required to build location-enhanced applications, making it hard to iterate on designs. To address this problem they have developed Topiary, a tool for rapidly prototyping location-enhanced applications (Li et al 2004). As a result of the confluence of global devices and increasing research in ubiquitous computing new applications for location aware services are increasing in demand.

In this paper a novel application for u-commerce utilizing dynamic information obtained from an automobile's navigation system will be presented. The application can also be used to compute the minimum cost to purchase other products based on the cost of the product and the cost to drive to location X versus location Y to purchase the product.

RESEARCH METHODOLOGY

This research employs the design-science methodology in which knowledge and understanding of a problem domain and its solution are achieved in the building and application of the designed artifact (Hevner et al 2004). To this extent this paper adheres to the 7 design science guidelines, proposed by Hevner et al (2004), illustrated in Table 1. With respect to Guidelines 1, and 2 this research presents an algorithm (method) to provide enhanced services using vehicular navigation systems which addresses the advantages (problem relevance) of enabling navigation systems with dynamic information.

Guidelines	Description
Guideline 1: Design as an Artifact	Design-science research must produce a viable artifact in the form of a construct, a model, a method or an instantiation.
Guideline 2: Problem Relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
Guideline 3: Design Evaluation	The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4: Research Contribution	Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations and/or design methodologies.
Guideline 5: Research Rigor	Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.
Guideline 6: Design as a Search Process	The search for a effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7: Communication of Research	Design-science must be communicated effectively both to technology-oriented as well as management oriented audiences.

Table 1. Design Science Guidelines (Hevner et al, 2004)

The following sub-section focuses on Guidelines 2 and 5. Guideline 5, Research Rigor is evaluated using scenario-based design.

ANALYSIS AND DESIGN

In this section we begin with a scenario-based approach which is used to help construct the design artifact and to emphasize the problem relevance by highlighting the existing limitations associated with making the most economical gas purchase. "Scenarios afford multiple views of an interaction, diverse kinds and amounts of detailing, helping developers manage the many consequences entailed by any given design move." (Carroll 2000, pg. 43) Therefore, the following scenarios are presented to assist in requirements specification by providing different perspectives or insights into the possible uses and advantages for an application based on the DLCM method. Subsequently, the main steps and inputs for the application are discussed.

Scenario-Based Design

Scenario 1

John needs gas and is on his way to work. He pulls into Frank's gas station and fills up his tank at $2.19/gallon. After he pays for the gas he leaves the gas station, he notices the same gas for sale at Mike's gas station, within 1 mile, for $2.07/gallon. Both gas stations are on John's way to work. The next week on his way to work he decides to go to Mike's gas station and passes Franks gas station on the way. He notices that Frank is selling gas at $2.13/gallon. When John arrives at Mike's gas station, Mike is now selling the same gas for $2.19/gallon. How can John know which gas station has the better price? Why should he or any consumer pay more for gas at one location if there is another gas station within close proximity that sells cheaper gas?

The distinction between cheaper gas and minimizing total cost may at first seem trivial, but there is a significant difference. In the preceding scenario when John purchases gas for $2.19/gallon instead of purchasing gas at $2.07/gallon it does not suffice to say that given these two prices it would be obvious to purchase the cheaper gas. This may not make sense, for example, if John has to travel 4 miles out of his way to buy the cheaper gas. If there are gas stations along a particular route that the individual is traveling then the individual should purchase gas at the gas station with the cheapest price. If there are several gas stations within a certain radius then purchasing the gas depends on the total cost for the individual to drive out of his/her way and then reach his/her final destination. See scenario 2.

Scenario 2

Lisa is traveling to school for class. On her way she sees a gas station. The cost of gas is $2.17/gallon. If she drives 1 mile out of her way she could purchase gas at $2.15/gallon. This means she would have to travel a total of 2 miles out of her way to buy gas at $2.15/gallon. Her vehicle gets 17 mpg. Should she drive out of her way to buy this gas? What if the gas price is $2.11/gallon instead of $2.15/gallon? What would be her total cost to travel from her current location to any of these gas stations and then to her final destination?

From scenario 2 it is clear that the application should not only provide the location of the cheapest gas, but should also recommend the most economical location which may not always be the location with the cheapest gas.

Scenario 3

Tracy has rented a car while on a business trip. She needs to fill up her vehicle with gas before she returns to the car rental agency. If she does not fill up the vehicle with gas she will be charged $4.00/gallon by the agency to fill up the tank. She would like to find a gas station that is on her way to the car rental agency or is not too far out of her way in order to minimize the cost she will pay for gas. Why should Tracy pay more for gas simply because she is not aware of more economical places to purchase gas?

The preceding 3 scenarios help elucidate the limitations with current navigation systems and also can be used to help developers maintain focus during the analysis and design stages. Specifically, these scenarios provide insight on how the technology can help transform and improve the challenges associated with everyday gasoline and other u-commerce related purchases.

The inputs required for the application and an overview of the process to retrieve dynamic information are discussed in the following sections.

SYSTEM OVERVIEW

Initial User Input Requirements

The proposed application will suggest locations which minimize the total cost to purchase gas or other products using a Global Positioning System (GPS) within a vehicle's navigation system. However, prior to using the application, there are 3 parameters which need to be specified by the driver. The driver only needs to specify these parameters, once, during initialization of the service. The initial required inputs are:

1. Miles per gallon (mpg) for the vehicle.
   The user must enter this information, during the first use of the application. This information will be stored for future requests using an application specific integrated circuit (ASIC) or system on a chip (SOC) within the vehicles navigation system.

2. Price/gallon for the gas in the vehicle.
   This only has to be done once and is used to initially compute average cost/mile which will be needed for future requests. For example, the initial price/gallon the user paid for the gas in her vehicle could be $2.19. This value will be used to average the cost/mile. This will allow the application to compute optimum locations which minimize costs to purchase gas or other products.

3. Final destination.
   This will be used to calculate total distance to be traveled which is used to compute the cost/mile.

Process

After configuring the input parameters described in the previous section the application would be initialized to accept requests to determine the most economical location to purchase gas based on the driver's location. Immediately following a driver's request for gas the application would recommend the optimum location to purchase gas based on a 6 stage process which is described in Table 2 below.

Step	Description
1	The request is sent to a satellite to calculate vehicle's exact location.
2	The location data is sent to a server. This server contains a location engine which will compute which database server to contact based on the vehicle's current location. Several database servers will be required per geographic area.
3	The database server will contain the location of gas stations related to the vehicle's current position and gas prices at each individual gas station.
4	The server calculates the cost to travel a certain route and returns the gas stations which would provide the minimum cost.
5	The location of the gas station along with the price, using GPS, is sent back to the vehicles navigation system.
6	The GPS provides directions as well as time to travel to the gas station

Table 2. Process Overview

Step 2 in Table 2 could be simplified by utilizing online services instead of using multiple servers to store and collect gas price information For example, the information could be retrieved from web portals such as GasBuddy.com (http://gasbuddy.com) and GasPriceWatch.com (http://www.gaspricewatch.com) which currently store and update gas prices for multiple geographic regions. For illustrative purposes this process is depicted in Figure 1 below. The grey communication links represent all possible paths and the black communication links represent the actual path chosen based on the vehicle's location.

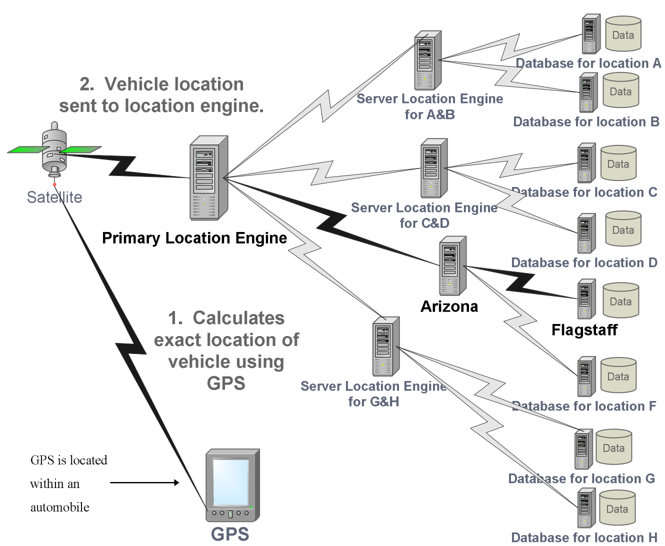

Figure 1. Technology Infrastructure

If a request for gas or other dynamic information is initiated on the vehicles navigation system, the request is routed to the server which contains gas price information specific to the location where the request for gas originated. This path is depicted in the figure with black communication lines. If the request for gas originated in Flagstaff, Arizona, the request would be sent to the main location engine server which would identify the incoming request as Arizona and would then route the request to the location engine server in Arizona. The request would again be routed to the server that corresponded to the geographic region which contains gas price information for Flagstaff. The algorithm would compute the minimum cost for gas as described in the following section. The minimum cost as well as travel time, distance and directions would be passed back to the vehicle navigation system. The actual path is indicated by the black communication path which is illustrated in Figure 1.

Algorithm

After inputting the mpg for a particular vehicle (this is only done one time during the initial launch of the application), the DLCM Algorithm is used in conjunction with a navigation system to (1) calculate a vehicle's location. The algorithm uses the mpg to compute the cost/mile for each successive request for gas. Next (2), DLCM computes the distance from the vehicle's current location to nearest gas stations. The application will allow the user to input the radius to search for gas stations. For example, the application should allow the user to search for gas stations within any specified range such as within a 5 mile radius of the vehicle's current position. Once the gas stations within a certain radius are retrieved along with the price/gallon for each gas station, (3) the algorithm will compute the distance from each gas station to the final destination. This process is required to compute the total distance which will be traveled to go from point A to point C via the optimal gas station B. Therefore, the total distance computed is the distance from A--->B--->C. After the total distance for each individual gas station is calculated (4) the algorithm will then compute the cost/mile using the mpg, and the price for gas at each gas station. Cost/Mile is stored locally in the vehicles navigation system to compute future average cost/mile. For example, if initially cost/mile is .12 and next time cost/mile is .15 then the actual cost/mile is .12+.15/2 = 0.135. Next (5) the total cost for gas at each gas station is computed by taking the cost/mile and multiplying it by the total distance that will be traveled. The final result (6) will be the minimum of the total cost. Figure 2 graphically portrays the parameters involved in the DLCM Algorithm.

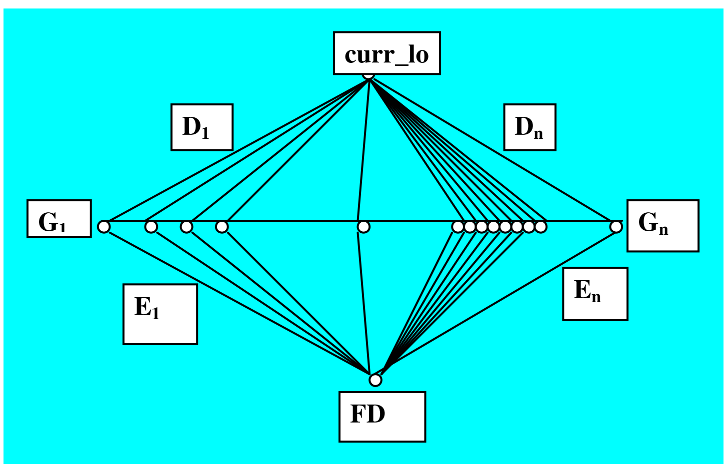

Figure 2. Algorithm Parameters

curr_loc is the vehicle's current location. D_1 thru D_n represent the distance from the vehicles location to all possible gas stations, G_n. E_1 thru E_n represent the distance from each gas station, G_n to FD, the final destination. There could be n paths to FD. The idea is to return to the user the optimal path based on gas price. The total time traveled for the optimal path will also be given to the user.

Example

In the following example a driver has up to 8 different gas stations displayed on her navigation system corresponding to gas stations within a 5 mile radius of her current location. The cheapest gas based on her current position and the specified radius (5 miles) to search is $2.52 at location 5. However, this is 2.1 miles from her current location and is not in the direct path to her final destination. The next cheapest price for gas is $2.59 at location 1. However, the driver has already passed this location. Should she go back and purchase the cheapest gas or continue to the next location? If she was returning to this location and would have enough gas to get back, then the answer is yes. However, what if she will not be returning to that location? The possible set of gas stations and locations are depicted in Figure 3 below.

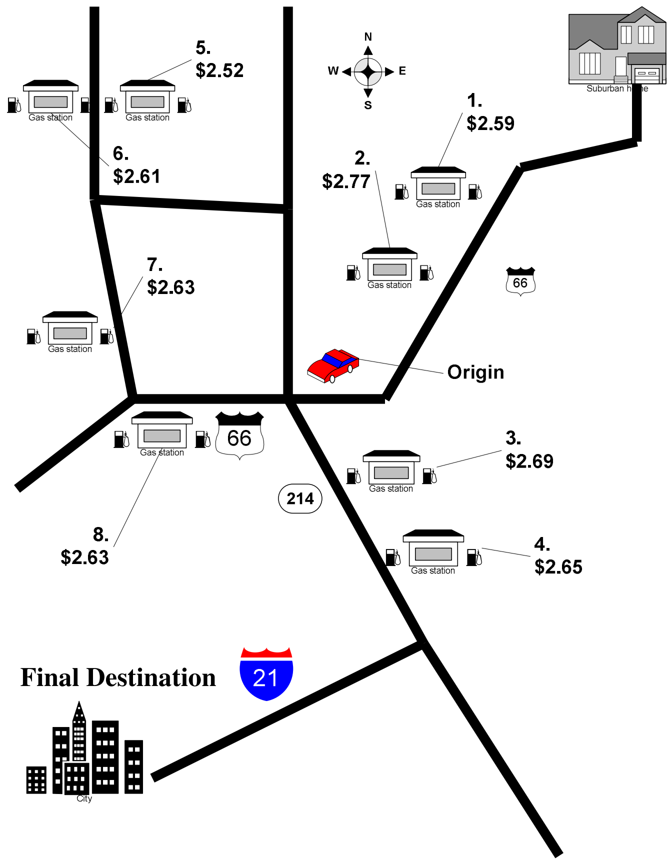

Figure 3. Gas Station Locations and Gas Prices

Given the set of all possible prices and locations, it is extremely complicated to manually and efficiently compute the optimal location. The total cost for each gas station is summarized in Table 3 below. Table 3 is sorted in ascending order by the total cost, T_{Cn}. If the driver had to choose between purchasing gas at location 3 or location 5 (Denoted as G_3 and G_5 in Table 3), it may at first appear that since location 3 is on the direct path to the final destination it would be optimal choice even though it is 0.17 cents/gallon more expensive than location 5. The total distance to travel from the current location to the final destination via location 3 is 42.5 miles. While the total distance to travel from the current location to the final destination via location 5 is 52.5 miles. Therefore the total difference to the final destination between both locations is 10 miles. That is, location 5 is 10 miles further away from the final destination than location 3. When the price at each gas station is considered the total cost to purchase gas at location 3 is $6.70 versus $7.69 at location 5. This demonstrates that it would be more feasible to travel the additional 10 miles to purchase cheaper gas. The values associated with this example are shaded in grey in Table 3 below. Of course, one would have to evaluate the benefit in terms of the inconvenience cost related to traveling the additional 10 miles. This will be further investigated in future usability studies. Alternatively, gas station location 4 would be more economical compared to location 6 (Denoted G_4 and G_6 in Table 3) even though gas station G_6 sells gas at a lower price and the distance to the final destination via location 4 is less than the distance to the final destination via location 6.

G_n	D_n (miles)	acm ($)	C_{Dn} ($)	E_n (miles)	$^*C_n$ ($)	C_{En} ($)	T_{Cn} ($)	T_n (miles)	P_n ($)
4	3.5	0.13	0.455	39	0.156	6.08	6.53	42.5	2.65
3	1	0.13	0.13	41.5	0.158	6.57	6.70	42.5	2.69
8	1	0.13	0.13	43.5	0.155	6.73	6.86	44.5	2.63
2	1	0.13	0.13	43.5	0.163	7.09	7.22	44.5	2.77
1	3.5	0.13	0.455	46	0.152	7.01	7.46	49.5	2.59
7	3.5	0.13	0.455	46	0.155	7.12	7.57	49.5	2.63
5	5	0.13	0.65	47.5	0.148	7.04	7.69	52.5	2.52
6	5	0.13	0.65	47.5	0.154	7.29	7.94	52.5	2.61

Table 3. Total cost of gas at different locations

**For C_n the mpg used was 17. Also, we assume acm=.13*

$T_{Cn}=C_{Dn}+C_{En}$ represents the total cost to purchase gas station n

A description of the notations used in Table 3 are the computational details are provided in Appendix 2.

CONCLUSION AND FUTURE WORK

The method proposed, in this paper, is an improvement over other navigation systems which only provide static information. In addition, the DLCM method extends beyond existing applications which have the ability to provide users with the cheapest location to purchase gas by *recommending* the best location which minimizes the users overall average driving costs.

Preliminary results based on discussions and brief survey with 10 graduate students who all use their vehicle to commute to school indicated they would be interested in an application which recommends the location that minimizes their overall traveling costs. While anecdotal evidence collected during the discussions has several limitations it provided useful insight into the design of several questions relating to the acceptance of the application which will be evaluated in future research. The set of questions used for the preliminary results is provided in Appendix 1. These questions will be extended further In future studies to investigate issues relating to privacy, and usability using a more comprehensive and tested survey on a much larger population In addition, future research will also evaluate aspects of interface design by developing and testing a mock-up of the application.

APPENDIX 1 SURVEY

1. Amount of time spent driving during the week.

   a. Less than 1 hour

   b. Between 1 hour and 5 hours

   c. More than 5 hours

2. Amount of miles traveled during the week.

   a Less than 5 miles

   b Between 5-20 miles

   c Between 20-60 miles

   d More than 60 miles

3. Amount of money spent driving during the week.

   a Less than $10

   b Between $10-$40

   c More than $40

4. If you need to purchase gas would you like to know about gas prices in your area while you're driving?

   Yes

   No

5. How far would you drive to purchase the cheapest gas?

   a One Mile

   b Two Miles

   c Three Miles

   d Four Miles

   e More than 5 Miles

6. Would you like an application that can help you consistently purchase gas and other products which minimizes your cost?

   Yes

No

7. Would you like to automatically receive information on your navigation system for other products and services based on your location?

Yes

No

8. Would you be concerned that you could be identified based on your location?

Yes

No

8. Willingness to use the application

a Not at all.

b Occasionally, depending on convenience of use

c Most of the time, because it provides it would significantly save me money.

d Every time, and I would recommend it to others.

APPENDIX 2 NUMERICAL EXAMPLE

See Figure 2 in the Algorithm sub-section for an illustration of the variables involved in the computation of the optimal location to purchase gas for this example. Descriptions of the variables used in the computations are provided in Table 1 below.

Variable	Description
curr_loc	current vehicle location
mpg	mile per gallon
acm	average cost/mile
X	price for specified product
FD	Final Destination
G_n	Gas stations 1 thru n
P_n	Price for gas at each gas station for 1 thru n
D_n	Distance from curr_loc to gas station n
E_n	Distance from gas station n to FD
C_n	cost/mile for each G_n. (P_n/mpg)
(P_n /gallon)/(miles/gallon)	cost/mile
$C_{Dn} = (D_n * acm)$	Cost associated with traveling to $D_{n.}$. Initially, we assume acm=0
$C_{En} =(E_n * C_n)$	Cost associated with traveling to $E_{n.}$
$T_{Cn} =C_{Dn} + C_{En}$	Total cost associated with each route from current location to G_n to FD.
$OPT_p=min(T_{C1}, T_{C2}, TC_3,…, T_{Cn})$	Optimal Location

Table 1. Algorithm Variable Descriptions

Here is an example of how the algorithm would compute the best location using the data in Figure 3 and Table 3 in the sub-section titled Example.

The example below compares the cost for purchasing gas at gas station G_3 versus $G_{5.}$ For this example we assume the vehicle's current average cost/mile (acm) is chosen to be 0.13 cents/mile and the vehicle's mpg =17.

acm = 0.13

mpg = 17

<u>Cost of G_3</u>

1) C_{D3} = Cost to travel to gas station, G_3, based on the current cost/mile.

D_3 = Distance from the vehicles current location to gas station $G_{3.}$ Using the data in Table 3, D_3 =1

Therefore, C_{D3}

$= acm*D_3 = 0.13*1 = 0.13$

2) Cost to travel from gas station $G_{3,}$ to the final destination.

Price/gallon= $.2.65

Cost/mile = price/gallon / mile/gallon = price/mpg = $2.69/17 = 0.158 = C_3

Distance to travel to final destination via G_3 = 42.5 miles = $T_{3.}$

Cost to travel from G_3 to final destination $C_{E3} = E_3 * C_3$

= 41.5 * 0.156 = $6.57

Total cost for this route = $T_{C3} = C_{D3} + C_{E3}$

= 0.13 + $6.57 = $6.70

<u>Cost of G_5</u>

The cost to purchase gas at gas station G_5 is as follows:

acm = 0.13

mpg=17

1) Cost to travel to gas station, G_5 based on your current cost/mile.

$C_{D5} = acm*D_5 = 0.13*5 = 0.65$

2) Cost to travel from gas station, G_5 to your final destination.

Price/gallon= $.2.52

Cost/mile = price/gallon /miles/gallon = price/mile = $2.52/17 = 0.148 = C_5

Distance to travel to final destination via G_5 = 52.5 miles = T_5

Cost to travel from G_3 to final destination $C_{E5} = E_5 * C_5$

= 47.5 * 0.148 = $7.04

Total cost for this route = $T_{C5} = C_{D5} + C_{E5}$

= 0.65 + $7.04 = $7.69

The process iterates through all possible locations and the gas station which minimizes the cost to travel to the final destination is returned. This is expressed as:

Opt_p=Min(TC_1, TC_2, TC_3, …, TC_n)= TC_4=$6.53

This example demonstrates that while gas station G_3 may be closer to the vehicle's current location than gas station G_5 it is not the best choice to minimize the total overall cost. As another example, gas station G_4 would be better than gas station G_6 even though gas station G_6 sells gas at a lower price.

APPENDIX 3 PRIOR ART[2]

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NO.	PUB. APP	TITLE
1	20060010499	Methods and arrangements for limiting access to computer controlled functions and devices
2	20060010496	Active and contextual risk management using risk software objects
3	20060010446	Method and system for concurrent execution of multiple kernels
4	20060010426	System and method for generating optimized test cases using constraints based upon system requirements
5	20060010425	Methods and apparatus for automated management of software
6	20060010402	Graphical user interface navigation method and apparatus
7	20060010399	Space-efficient linear hierarchical view and navigation
8	20060010396	Method and apparatus for capturing and rendering text annotations for non-modifiable electronic content
9	20060010395	Cute user interface
10	20060010386	Microbrowser using voice internet rendering
11	20060010381	Method for visually indicating the quality of on-screen help messages
12	20060010379	Automatic identification and storage of context information associated with phone numbers in computer documents
13	20060010374	Defining the visual appearance of user-interface controls
14	20060010371	Packages that contain pre-paginated documents
15	20060010369	Enhancements of data types in XML schema
16	20060010368	Method for storing and retrieving digital ink call logs
17	20060010367	System and method for spreadsheet data integration
18	20060010364	Information recording medium on which sector data generated from ECC block is recorded, information recording apparatus for recording sector data, and information reproduction apparatus for reproducing sector data
19	20060010340	Protection of non-volatile memory component against data corruption due to physical shock
20	20060010294	Write-back to cells
21	20060010246	Human-machine interface system and method
22	20060010237	Device and method for managing data between communication facilities to obtain a mobile service
23	20060010234	Dynamic provisioning of service components in a distributed system
24	20060010231	Network for targeting individual operating a microcomputer regardless of his location

[2] Source: http://www.uspto.gov

25 20060010229 User intention modeling for web navigation

26 20060010217 System and method for dynamic adaptive user-based prioritization and display of electronic messages

27 20060010205 Systems and methods for collaboration impersonation

28 20060010196 Portal federated applications and portal federated web applications

29 20060010168 System for processing objects for storage in a document or other storage system

30 20060010167 Apparatus for navigation of multimedia content in a vehicle multimedia system

31 20060010142 Modeling sequence and time series data in predictive analytics

32 20060010125 Systems and methods for collaborative shared workspaces

33 20060010118 System and method for role-based spreadsheet data integration

34 20060010117 Methods and systems for interactive search

35 20060010102 Method and system for business reporting

36 20060010098 Diabetes care host-client architecture and data management system

37 20060010095 Synchronizing distributed work through document logs

38 20060010044 System and method for placing a product order via a communications network

39 20060010037 Method and system for auction or sales of deliverable prepared food via the internet

40 20060009991 Method and apparatus for using meta-rules to support dynamic rule-based business systems

41 20060009964 Text messaging device

42 20060009944 Network-based system for selecting or purchasing hardware products

43 20060009935 Knowledge-based condition survey inspection (KBCSI) framework and procedure

44 20060009909 Systems and methods for determining bearing

45 20060009908 Navigation apparatus and method

46 20060009907 Navigation system, data server, traveling route establishing method and information providing method

47 20060009906 Data security system for a navigation system

48 20060009904 Vehicular navigation system

49 20060009890 Method and device for operating a vehicle

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