

SYSTEMS AND METHODS FOR INTELLIGENT PREPARATION TIME ANALYSIS

TECHNICAL FIELD

[001] Embodiments of the present disclosure relate to systems and methods for multi-point arrival analysis. More particularly, embodiments of the present disclosure relate to enabling delivery systems to provide their customers with accurate estimated times of arrival for their delivery that is updated throughout the delivery process in real time.

BACKGROUND

[002] Users (e.g., online customers, online merchants, delivery personnel) often use online website portal or mobile applications to order items (e.g. ordering food or groceries). These delivery systems usually involve a complex network of systems and devices, including servers associated with the delivery systems, customer devices, merchant devices, and delivery devices. These delivery services are often associated with a third-party service provider that coordinate with delivery workers that may be independent or associated with the third-party service providers. Through these systems, a customer can order items delivered from merchants that do not employ delivery workers and would otherwise be unable to deliver their products to their customers.

[003] Generally, customers may utilize these third-party service providers through a website or mobile applications that allow the customer to select items for delivery from a variety of merchants that partner with the service provider. Once the order is placed, the delivery system will often calculate an estimated time of arrival (ETA) of the ordered items at the customer's location and will provide the ETA to the customer through the website or mobile application. However, these ETA

estimations rely on a multitude of other time estimates associated with the delivery of the items, such as the preparation time of the item, the travel time between a delivery worker and the merchant at the time of the order, the travel time between merchant and the customer, and more. Each of these are estimated with a large degree of uncertainty, as many of these durations depend on factors that may vary during the delivery process.

[004] In one example, a delivery worker may not yet be assigned to fulfill an order at the time the order is placed, and thus the travel time between the unknown delivery worker and the merchant location may be estimated with a large degree of uncertainty. Additionally, the actual preparation time of the items may be much different than the estimated preparation time when the order is placed. Over the course of delivery, these variables may result in an actual delivery time that is much different than the ETA provided at the time of delivery, causing inconvenience to the customer. Further, inaccurate preparation time estimates may result in the assigned delivery worker arriving at the merchant at a time much different than the time preparation of the item concludes, resulting in wasted costs.

[005] Therefore, improved systems and methods for analyzing and providing an ETA during at multiple points (e.g., at delivery worker assignment and at retrieval of the items from the merchant), which would apprise the customer of ETA changes as they occur, are desired. Further, improved systems and methods for intelligently estimated the preparation time of orderable items is desired in order to avoid costs associated with assigning delivery workers to fulfill an order based off of inaccurate estimated preparation times.

SUMMARY

[006] One aspect of the present disclosure is directed to a computer-implemented system for multi-point destination arrival time analysis. The system may include: a memory storing instructions; and at least one processor configured to execute the instructions to: receive, from a first external system via a network, a plurality of durations associated with at least one orderable item and associated metadata, the durations based on past history of producing the orderable items; store the plurality of durations associated with the at least one orderable item in a data store, the durations based on past history of producing the orderable items; retrieve, from the data store, the stored plurality of durations associated with the at least one item; feed the stored plurality of durations associated with the at least one orderable item and associated metadata to a machine learning algorithm; receive an estimated preparation time for the at least one orderable item; determine, based on the estimated preparation time, an assigned delivery worker associated with a second external system; and forward a request to the second external system to fulfill a delivery of the at least one orderable item.

[007] Another aspect of the present disclosure is directed to a computer-implemented method for multi-point destination arrival time analysis. The method may include: receiving, from a first external system via a network, a plurality of durations associated with at least one orderable item and associated metadata, the durations based on past history of producing the orderable items; storing the plurality of durations associated with the at least one orderable item in a data store, the durations based on past history of producing the orderable items; retrieving, from the data store, the stored plurality of durations associated with the at least one item; feeding the stored plurality of durations associated with the at least one orderable

item and associated metadata to a machine learning algorithm; receiving an estimated preparation time for the at least one orderable item; determining, based on the estimated preparation time, an assigned delivery worker associated with a second external system; and forwarding a request to the second external system to fulfill a delivery of the at least one orderable item.

[008] Yet another aspect of the present disclosure is directed to a computer-implemented system for multi-point destination arrival time analysis. The system may include: a memory storing instructions; and at least one processor configured to execute the instructions to: receive, from a merchant device via a network, a plurality of durations associated with at least one orderable item and associated metadata, the durations based on past history of producing the orderable items; store the plurality of durations associated with at least one orderable item in a data store, the durations based on past history of producing the orderable items; retrieve, from the data store, the stored plurality of durations associated with the at least one item; feed the stored plurality of durations associated with the at least one item and associated metadata to a machine learning algorithm; receive an estimated preparation time for the at least one item; determine, based on the estimated preparation time, an assigned delivery worker associated with a delivery device; and forward a request to the delivery device to fulfill a delivery of the at least one orderable item. receive, from the assigned second external system via the network, an acceptance of an order associated with the first external system, the order comprising at least one item; determine an arrival estimate based on a first estimated travel time between locations associated with the first external system and the third external system, and one of: the estimated preparation time for the at least one item, or a second estimated travel time between locations associated with the first external system and

the assigned second external system; and forward the arrival estimate to the third external system.

BRIEF DESCRIPTION OF DRAWINGS

[009] The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate disclosed embodiments and, together with the description, serve to explain the disclosed embodiments. In the drawings:

[010] FIG. 1 is a block diagram of an exemplary system, consistent with disclosed embodiments;

[011] FIG. 2 is a block diagram of an exemplary server system, consistent with disclosed embodiments;

[012] FIG. 3 is a block diagram of an exemplary user device, consistent with disclosed embodiments;

[013] FIG. 4 is a flowchart of an exemplary computerized process for intelligently estimating an arrival time of at least one orderable item, consistent with disclosed embodiments.

[014] FIG. 5 is a flowchart of an exemplary computerized process for calculating the estimated preparation time of at least one orderable item, consistent with disclosed embodiments.

[015] FIG. 6 is an illustration of an exemplary predictive model that may be generated by a machine learning algorithm, consistent with disclosed embodiments.

[016] FIG. 7 is a flowchart of an exemplary computerized process for assigning a delivery worker to fulfill a specific order, consistent with disclosed embodiments.

[017] FIG. 8 is a flowchart of another exemplary computerized process for assigning a delivery worker to a specific order, consistent with disclosed embodiments.

DETAILED DESCRIPTION

[018] Reference will now be made in detail to the disclosed embodiments, examples of which are illustrated in the accompanying drawings. Wherever convenient, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

[019] While the following description is directed to providing customers with accurate estimated times of arrival throughout the delivery process in real time, these embodiments are made by example only. It should be appreciated that the present disclosure is not limited to the specific disclosed embodiments and details, which are exemplary only. It is further understood that one possessing ordinary skill in the art, in light of known systems and methods, would appreciate the use of the embodiments of the present disclosure for their intended purposes and benefits in any number of alternative embodiments, depending on specific design and other needs.

[020] FIG. 1 is a block diagram of an exemplary system 100, for performing one or more operations consistent with disclosed embodiments. In some embodiments, system 100 includes one or more customer devices 102(1), ... 102(n) located at corresponding customer location 104(1),... 104(n) respectively, one or more item delivery provider devices 106(1), ... 106(n) located in corresponding delivery transportations 108(1), ... 108(n) (e.g., cars, bikes, motorcycles) respectively, one or more item service provider devices 110(1),... 110(n) located at corresponding merchant stores 112(1),... 112(n). Further, system 100 includes an

integration server system 116, a remote database 120 and a communication network 114. The system 100 may also include a plurality of integration server system 116 and a plurality of remote databases 120 communicating with each other directly and further communicating with the customer devices 102(1)-102(n), item delivery provider devices 106(1)-106(n), item service provider devices 110(1)-110(n) via the communication network 114. The components and arrangement of the components included in system 100 may vary. Thus, system 100 may include other components that perform or assist in the performance of one or more operations consistent with the disclosed embodiments.

[021] As more fully described below, customer devices 102(1)-102(n), item delivery provider devices 106(1)-106(n), item service provider devices 110(1)-110(n), integration server system 116, and remote database 120 may include one or more computing devices (e.g., computer(s), server(s), etc.), memory storing data and/or software instructions (e.g., database(s), memory devices, etc.), and other known computing components. In some embodiments, the one or more computing devices may be configured to execute software instructions stored in the memory to perform one or more operations consistent with the disclosed embodiments. Aspects of customer device(s) 102(1)-102(n), item delivery provider device(s) 106(1)-106(n), item service provider devices 110(1)-110(n), integration server system 116 and remote database 120 may be configured to communicate with one or more other components of system 100 via communication network 114, for example. In certain aspects, customers associated with the customer location 104(1)-104(n) are respectively associated with and operate customer devices 102(1)-102(n), drivers associated with the delivery transportations 108(1)-108(n) are respectively associated with and operate item delivery provider devices 106(1)-106(n), merchants

associated with the merchant stores 112(1)-112(n) are respectively associated with and operate item service provider devices 110(1)-110(n), to interact with one or more components of system 100 by sending and receiving communications, initiating operations, and/or providing input for one or more operations consistent with the disclosed embodiments.

[022] Integration server system 116 may be associated with an online ordering entity that receives, processes, manages, or otherwise offers ordering services for items. For example, the items that may be ordered via the online ordering entity may include, prepared food, groceries, furniture, books, computers, and/or clothes, although any other type of items may also be ordered. For example, the integration server system 116 may receive order requests from customers using customer devices 102(1)-102(n) and process the received order request by transmitting the request to item service provider devices 110(1)-110(n) associated with merchant stores 112(1)-112(n) that would provide the ordered item. Integration server system 116 receives an order confirmation communication from item service provider devices 110(1)-110(n). Upon receiving the order confirmation from the item service provider devices 110(1)-110(n), integration server system 116 transmits a request to item delivery provider devices 106(1)-106(n), to collect the order from the merchant stores 112(1)-112(n) and deliver the order to customer location 104(1)-104(n). Item delivery provider devices 106(1)-106(n) accepts the requests and collects the requested item and delivers it to the customer location 104(1)-104(n).

[023] Remote database 120 of system 100 may be communicatively coupled to integration service system 116 directly or via communication network 114. Further, the remote database 120 of system 100 may be communicatively coupled to customer devices 102(1)-102(n), item delivery provider devices 106(1)-106(n) and

item service provider devices 110(1)-110(n) via the communication network 114. Remote database 120 may include one or more memory devices that store information and are accessed and/or managed by one or more components of system 100. By way of example, remote database 120 may include Oracle™ databases, Sybase™ databases, or other relational databases or nonrelational databases, such as Hadoop sequence files, HBase, or Cassandra. Remote database 120 may include computing components (e.g., database management system, database server, etc.) configured to receive and process requests for data stored in memory devices of remote database 120 and to provide data from remote database 120.

[024] Remote database 120 is configured to store, among another things, merchant profile information for merchants associated with the item service provider devices 110(1)-110(n) located at the merchant stores 112(1)-112(n), customer profile information for customers associated with the customer devices 102(1)-102(n) located at the customer locations 104(1)-104(n) and driver profile information for the drivers associated with the item delivery provider devices 106(1)-106(n). Remote database 120, in some embodiments, stores data entries that include, for example, merchant profile information, customer profile information, and driver profile information.

[025] The merchant stores 112(1)-112(n) may include a restaurant, coffee shop, , bookstore, clothing stores, although any other type of stores can also be included. Further, merchant profile information includes merchant store name, store menu, list of items offered by the merchant, pictures of food, pictures of merchant store, categories of items, categories of food, merchants address, merchant store hours, and/or merchants phone number, although any other type of information

associated with the merchant can also be included. The customer location 104(1)-104(n) may include a residential location, an office building, an apartment, although any other type of residence can also be included. Further, customer profile information in remote database 120 may include customer name, customers home address, pictures of customer, and/or customer phone number, although any other type of information associated with the merchant can also be included. The delivery transportation 108(1)-108(n) may include a car, bike, truck, bus, although any other type of delivery transportation can also be included. Further, driver profile information includes drivers name, drivers home address, pictures of driver, and/or drivers phone number, make and model of a delivery transportation the driver drives, although any other type of information associated with the driver can also be included.

[026] In one aspect, integration server system 116 may include one or more computing devices, configured to perform one or more operations consistent with disclosed embodiments as described more fully below in relation to FIGS. 4-7. In one aspect, integration server system 116 may include one or more servers or server systems. Integration server system 116 may include one or more processors configured to execute software instructions stored in a memory or other storage device. The one or more processors may be configured to execute the stored software instructions to perform internet-related communication, online order-based processes, and receiving and propagating efficient search updates in real time. The one or more computing devices of integration server system 116 may be configured to modify and store customer profile information, merchant profile information and/or driver profile information. The one or more computing devices of integration server system 116 may also be configured to communicate with other components of system 100 to receive and propagate efficient search updates in real time. In some

embodiments, integration server system 116 may provide one or more mobile applications, web-sites or online portals that are accessible by customer devices 102(1)-102(n), item delivery provider devices 106(1)-106(n), item service provider device 110(1)-110(n) over communication network 114. The disclosed embodiments are not limited to any particular configuration of integration server system 116.

[027] Communication network 114 may comprise any type of computer networking arrangement configured to provide communications or exchange data, or both, between components of system 100. For example, communication network 114 may include any type of network (including infrastructure) that provides communications, exchanges information, and/or facilitates the exchange of information, such as the Internet, a private data network, a virtual private network using a public network, a LAN or WAN network, a Wi-Fi™ network, and/or other suitable connections that may enable information exchange among various components of system 100. Communication network 114 may also include a public switched telephone network ("PSTN") and/or a wireless cellular network. Communication network 114 may be a secured network or unsecured network. In some embodiments, one or more components of system 100 may communicate directly through a dedicated communication link(s).

[028] Customer devices 102(1)-102(n), item delivery provider devices 106(1)-106(n), item service provider devices 110(1)-110(n) may be one or more computing devices configured to perform one or more operations consistent with the disclosed embodiments, as described more fully below in relation to FIG. 2. Customer devices 102(1)-102(n), item delivery provider devices 106(1)-106(n), item service provider devices 110(1)-110(n) may execute browser or related mobile display software that displays an online portal for placing online orders for delivery of

items, receiving orders and delivering items that are ordered, on a display included in, or connected to, customer devices 102(1)-102(n). Customer devices 102(1)-102(n) may also store and execute other mobile applications that allow customers, merchants, and/or drivers to interact with an online portal provided by the integration server system 116.

[029] It is to be understood that the configuration of the functional blocks of system 100 has been defined herein for convenience of description. The components and arrangement of the components included in system 100 may vary. For example, in some embodiments, system 100 may include other components that perform or assist in the performance of one or more processes consistent with disclosed methods. System 100 includes a number of components generally described as computing devices. Each of the computing devices may include any number of computing components particularly configured as a special purpose computing device to perform the functionality disclosed herein. Alternatives (including equivalents, extensions, variations, deviations, etc., of those described herein) will be apparent to persons skilled in the relevant art(s) based on the teachings contained herein. Such alternatives fall within the scope and spirit of the disclosed embodiments.

[030] FIG. 2 shows an exemplary server device 200 consistent with the disclosed embodiments. Variations of exemplary server device 200 may constitute one or more components of integration server system 116. In one embodiment, server device 200 includes one or more memories 202, one or more I/O devices 206, and one or more processors 208. In some embodiments, server device 200 may be a part of integration server system 116. In some embodiments, server device 200 may take the form of a specially programmed server or computing system used by

integration server system 116 to perform complete functions of integration server system 116. In some embodiments, server device 200 may be configured as an apparatus, embedded system, dedicated circuit, or the like based on the storage, execution, and/or implementation of software instructions that perform one or more operations consistent with the disclosed embodiments.

[031] Memory 202 may include one or more storage devices configured to store instructions used by processor 208 to perform functions related to disclosed embodiments. For example, memory 202 may be configured with one or more software instructions, such as program(s) 204 that may perform one or more operations when executed by processor 208. The disclosed embodiments are not limited to separate programs or computers configured to perform dedicated tasks. For example, memory 202 may include a single program 204 that performs the functions of server device 200, or program 204 may comprise multiple programs. In certain embodiments, memory 202 may store sets of instructions or programs 204 for performing functions of integration server system 116. These sets of instructions may be executed by processor 208 to perform communication and/or processes consistent with disclosed embodiments.

[032] In certain embodiments, when server device 200 constitutes one or more of the components of integration server system 116, memory 202 includes a domain services module 210, entity change listener module 212, transaction listener module 214, cache event publisher module 216, search event publisher module 218, search index database 220, entity change storage 222 and cache database 224, as described in detail below.

[033] In other embodiments, each of the domain services module 210, entity change listener module 212, transaction listener module 214, cache event publisher

module 216, search event publisher module 218, search index database 220, entity change storage 222 and cache database 224, may be implemented as separate and individual servers communicating with each other, remote database 120 and customer devices 102(1)-102(n), item delivery provider devices 106(1)-106(n), item service provider devices 110(1)-110(n) over communication network 114. In another example, search index database 220, entity change storage and cache database may be hosted at remote database 120.

[034] Input/output (I/O) 206 may include various input/output devices, such as a keyboard, a mouse-type device, a gesture sensor, an action sensor, a physical button, switch, microphone, touchscreen panel, stylus, etc., that may be manipulated by customer devices 102(1)-102(n), item delivery provider device 106(1) and/or item service provider device 110(1)-110(n). I/O devices 206 may also include an audio output device. Exemplary communication modules of I/O devices 206 may include, for example, a short-range or near field wireless communication modem, a Wi-Fi™ communication modem, or a cellular communication modem. I/O devices 206 may include a transceiver or transmitter configured to communicate using one or more wireless technologies/protocols that may include, without limitation, cellular (e.g., 3G, 4G, etc.) technology, Wi-Fi™ hotspot technology, RFID, near-field communication (NFC) or BLUETOOTH® technologies, etc. More generally, any uni- or bi-directional communication technology known to one of ordinary skill in the art may be implemented in server device 200 to exchange information with integration server system 116, customer devices 102(1)-102(n) item delivery provider device 106(1), item service provider device 110(1)-110(n) or remote database 120 via communication network 114.

[035] Processor 208 may include one or more known processing devices, such as a microprocessor from the Pentium™ or Xeon™ family manufactured by Intel™, or the Turion™ family manufactured by AMD™, for example. The disclosed embodiments are not limited to any type of processor(s) otherwise configured to meet the computing demands required of different components of system 100.

[036] FIG. 3 shows an exemplary configuration of user device 300, consistent with disclosed embodiments. User device 300 of FIG. 3 represents an exemplary configuration of each of the customer devices 102(1)-102(n), the item delivery provider devices 106(1)-106(n) and item service provider devices 110(1)-110(n).

[037] User device 300 may enable associated customers, drivers and merchants associated with customer devices 102(1)-102(n), the item delivery provider devices 106(1)-106(n) and item service provider devices 110(1)-110(n), respectively to, for example, perform remote interactions or mobile transactions with integration server system 116, or receive information from integration server system 116. In some embodiments, user device 300 may be a personal computing device. For example, user device 300 may be a smartphone, a laptop or notebook computer, a tablet, a multifunctional watch, a pair of multifunctional glasses, or any mobile or wearable device with computing ability, or any combination of these computers and/or affiliated components.

[038] User device 300 includes one or more processors 308 configured to execute software instructions stored in memory, such as a memory 312. Memory 312 may store one or more software programs 314 that when executed by processor 308 perform known Internet-related communication, content display processes, and other interactive processes for customers, drivers and/or merchants. For instance,

user device 300 may execute a browser or related mobile display software that generates and displays interfaces including content on a display device 302 included in, or in communication with, user device 300. User device 300 may be a mobile device that executes mobile device applications and/or mobile device communication software, included in programs 314, that allows user device 300 to communicate with integration server system 116 and other components via communication network 114, to generate and display content in interfaces via display device 302. The disclosed embodiments are not limited to any particular configuration of user device 300. User device 300 may include any arrangement of one or more computing devices configured to perform one or more operations consistent with disclosed embodiments.

[039] User device 300 may be configured to store, in memory 312, one or more operating systems that perform known operating system functions when executed by processor 308. By way of example, the operating systems may include Microsoft Windows™, Unix™, Linux™, Android™, Apple™ Mac OS operating systems, iOS, Chrome OS, or other types of operating systems. Accordingly, disclosed embodiments may operate and function with computer systems running any type of operating system. User device 300 may also include communication software stored in memory 312 that, when executed by processor 308, provides communications with communication network 114, such as Web browser software, tablet or smart handheld device networking software, etc.

[040] Display device 302 may include, for example, a liquid crystal displays (LCD), a light emitting diode screen (LED), an organic light emitting diode screen (OLED), a touch screen, and other known display devices. Display device 302 may display various information to customers, drivers and merchants. For example,

display device 302 may display an interactive interface enabling customers, drivers and merchants to operate user device 300 to perform certain aspects of the disclosed methods. Display device 302 may display touchable or selectable options for customers, drivers and merchants to select and may receive customer selection of options through a touch screen.

[041] User device 300 includes I/O devices 304 that allows to send and receive information or interact with customers, drivers and merchants or another device. For example, I/O devices 304 may include various input/output devices, such as a keyboard, a mouse-type device, a gesture sensor, an action sensor, a physical button, switch, microphone, touchscreen panel, stylus, etc., that may be manipulated by customers, drivers and merchants to input information using user device 300. I/O devices 304 may also include an audio output device, such as a speaker configured to provide sound and audio feedback to customers, drivers and merchants operating user device 300. In some embodiments, I/O devices 304 may include a light emitting component, such as a LED or other component capable of providing a visible signal to customers, drivers and merchants. I/O devices 304 may also include haptic output devices, to provide haptic feedback to customers, drivers and merchants. I/O devices 304 may also include one or more communication modules (not shown) for sending and receiving information from other components in system 100 by, for example, establishing wired or wireless connectivity between user device 300 and communication network 114. I/O devices 304 may include radio frequency, infrared, or other near-field communication interfaces, for communicating with other devices associated with communication network 114. Exemplary communication modules of I/O devices 304 may include, for example, a short-range or near field wireless communication modem, a Wi-Fi™ communication modem, or a cellular

communication modem. I/O devices 304 may include a transceiver or transmitter configured to communicate using one or more wireless technologies/protocols that may include, without limitation, cellular (e.g., 3G, 4G, etc.) technology, Wi-Fi™ hotspot technology, RFID, near-field communication (NFC) or BLUETOOTH® technologies, etc. More generally, any uni- or bi-directional communication technology known to one of ordinary skill in the art may be implemented in user device 300 to exchange information with integration server system 116 or remote database 120 via communication network 114.

[042] As described above, user device 300 may be a device that executes mobile applications for performing operations consistent with disclosed embodiments. Thus, in some embodiments, programs 314 stored on user device 300 may include one or more software applications 316 installed thereon, that enable user device 300 to communicate with integration server system 116 via communication network 114 and perform aspects of the disclosed methods. For example, user device 300 may connect to integration server system 116 by using browser software to access and receive information or perform other operations associated with an internet service provider.

[043] According to an exemplary embodiment, software applications 316 associated with integration server system 116 may be installed on user device 300, as shown in Fig. 3. For example, integration server system 116 may receive a request from customer device 102(1) to download one or more software applications 316 to user customer device 102(1). In one embodiment, integration server system 116 may receive the request from a customer associated with customer device 102(1), using a web browser application installed on customer device 102(1) respectively. In another embodiment, integration server system 116 may receive the

request to download one or more software applications 316 associated with integration server system 116 onto customer device 102(1) from a webpage or another portal associated with integration server system 116 accessed via, e.g., customer device 102(1). In this embodiment, integration server system 116 may store software instructions corresponding to one or more software applications 316 in remote database 120. For responding to the download request, integration server system 116 may receive additional information from customer device 102(1) regarding the particular device specifications of customer device 102(1) to enable customer device 102(1) to download software instructions corresponding to the particular specifications. Alternatively, integration server system 116 may push a download request link to customer device 102(1) or transmit software code corresponding to one or more software applications 316 directly to customer device 102(1) in, for example, an e-mail, a text or short message service (SMS) message, a prompt through an app, or other suitable method. Customer device 102(1) may receive the software code related to one or more software applications 316, such as via communication network 114, to download and install the software code. Similarly, in another example, integration server system 116 may receive a request from a deliverer associated with item delivery provider device 106(1) to download one or more software applications 316 onto the item delivery provider device 106(1). Further, similarly, in another example, integration server system 116 may receive a request from a merchant associated with item service provider device 110(1) to download one or more software applications 316 onto the item service provider device 110(1).

[044] FIG. 4 is a flowchart of an exemplary computerized process 400 for intelligently estimating an arrival time of at least one orderable item. In preferred

embodiments, process 400 may be executed by one or more components of integration server system 116 and/or server device 200 (e.g., processor(s) 208). Thus, by way of example, process 400 is described as being executed by processor 208. However, process 400 or a portion thereof may be performed by the system 100 as a whole or by any component of system 100 capable of performing at least a portion of the process (e.g., integration server system 116, server device 200, etc.).

[045] Process 400 begins at step 401. At step 401, processor 208 may receive, a request for at least one orderable item from a customer device via a network and store a timestamp in a data store. The customer device may, for example, be a computerized system associated with a customer that is utilizing system 100 to order an item from a merchant. The computerized system may be a device, such as customer device 102(1)-102(n), which may be a computerized device as described with reference to FIG. 3 (e.g., user device 300). The customer may use application 316 installed onto the user device 300 to order the at least one orderable item from a merchant. For example, the customer may place an order request including one or more food items from a restaurant associated with system 100. Once the customer's order is submitted through application 316, the user device may send a communication to integration server system 116 indicating that the customer has requested delivery of the at least one orderable item through communication network 114. The request may also be sent to item service provider device 110(1)-110(n) for confirmation or acceptance of the order. Upon receipt of this request, processor 208 may record the time at which the request was received and store the recorded time as a time stamp within a data store. The data store may, for example, be one or more of any type of data storage component or device associated with remote database 120.

[046] After step 401 has been completed, process 400 may then continue to step 402. At step 402, processor 208 may receive an acceptance of the order associated with the customer device from a merchant device via the network. The merchant device may be a device, such as item service provider device 102(1)-102(n), which may be a computerized device as described with reference to FIG. 3 (e.g., user device 300). As discussed above, in response to receiving the order request from customer device 102(1)-102(n), the merchant may determine that it can fulfill the particular order requested and input a confirmation of acceptance into item service provider device 110(1)-110(n). Inputting a confirmation of acceptance may, for example, include inputting the confirmation through an application 316 of a user device 300. The confirmation may then be sent through communication network 114 to integration server system 116 where it may be received by processor 208.

[047] After step 402 has been completed, process 400 may then continue to one of steps 403(a), 403(b), or 403(c). At steps 403(a), 403(b), or 403(c), processor 208 may determine a first arrival estimate, a second arrival estimate, and a third arrival estimate, respectively. At step 403(a), the first arrival estimate may be based on a first estimated travel time between locations associated with the customer device and the merchant device based on a first estimated travel time between locations associated with the customer device and the merchant device and a determined preparation time for the at least one item (e.g., a total of an estimated travel time between a merchant location and a customer location and an estimated preparation time of the at least one item). The determined preparation time may, in some embodiments, be calculated using previously recorded preparation times and associated metadata, which is discussed in further detail below with reference to FIG. 5.

[048] In some embodiments, the first arrival estimate may be based on the first estimated travel time between locations associated with the customer device and the merchant device (e.g., an estimated travel time between a merchant location and a customer location) and a second estimated travel time between locations associated with the merchant device and at least one delivery device. The at least one delivery device may include one or more devices, such as item delivery provider device 106(1)-106(n) associated with vehicle 108(1)-108(n), which may be a computerized device as described with reference to FIG. 3 (e.g., user device 300). In other words, the second estimated travel time may be an estimate of the travel time between potential delivery workers and the merchant location.

[049] In some embodiments, the estimated travel time between locations may be calculated by determining a straight-line distance between two locations, selecting a constant speed, and determining the estimated travel time along the straight-line distance at the selected constant speed. The straight-line distance may be a numerical value representing the physical distance between two locations (e.g., locations associated with the customer device and the merchant device). In some embodiments, this physical distance may also be a distance corresponding to the shortest travel distance between two locations along roads, or a determined distance corresponding to the shortest travel time between two locations along roads. Once a straight-line distance between two locations is determined, processor 208 may use a selected constant speed to calculate the estimated travel time. The selected constant speed distance may, in some embodiments, be a constant number determined to be an average travel speed when delivering goods, and may also be based on historical data collected by integration server system 116 from past delivery work (e.g., from item delivery provider device 106(1)-106(n)). In some

embodiments, the selected speed may vary on individually for each order and may be based on other factors such as time of day, traffic, type of vehicle, weather conditions, etc.

[050] In preferred embodiments, an estimated arrival time will not be before the actual delivery time, as it could negatively impact customer satisfaction. Thus, in some embodiments, processor 208 may determine which one of the determined preparation time and the second estimated travel time is greater, and use the greater value to determine the first arrival estimate. For example, processor 208 may determine the first arrival estimate using the variables describe above in the following algorithm:

$$ETA_1 = \max(T_{prep}, T_2) + T_1 \pm T_{buffer}$$

(1)

[051] Where ETA_1 is the first arrival estimate, T_{prep} is the determined preparation time, T_1 is the first estimated travel time, T_2 is the second estimated travel time, and T_{buffer} is a buffer time. In some embodiments, the buffer time may be a predetermined amount of time used to compensate for errors in the delivery process. The errors may be attributed due to any number of factors such as traffic, lack of resources at the merchant, etc. The buffer time may be a fixed amount of time (e.g., 10 minutes) or a fixed percentage of the calculated arrival estimate (e.g., 10% of the calculated arrival estimate), or may be calculated individually for each order based on any number of factors such as time and date of order, item ordered, average variance in preparation time and/or travel time, etc. In some embodiments, processor 208 may calculate the first arrival estimate upon receiving the acceptance

of the order from the merchant device and forward the first arrival estimate to the customer device at step 404, concluding process 400.

[052] At step 403(b) of process 400, processor 208 may determine a second delivery estimate. The second delivery estimate may, for example, be based on the first estimated travel time and one of the determined preparation time for the at least one item or a third estimated travel time. The second delivery estimated may, in some embodiments, be calculated upon receiving an acceptance to fulfill the order from the delivery device during one or both the processes 700 and 800 for assigning a delivery worker to a specific order, which will be discussed in detail below with reference to FIGS. 6 and 7. In contrast to the calculation of the first arrival estimate, which bases the calculation on an estimated travel time between locations associated with the merchant device and a plurality of delivery devices that may potentially fulfill the order, the second arrival estimate may be based on a third estimated travel time between locations associated with the merchant device and a specifically assigned delivery device. Thus, as there is no speculation on which delivery device will be associated with the fulfillment of the order, the second delivery estimate may be calculated with a higher degree of certainty. For example, processor 208 may determine the second arrival estimate using the variables describe above in the following algorithm:

$$ETA_2 = \max(T_{prep}, T_3) + T_1 \pm T_{buffer}$$

(2)

[053] Where ETA_2 is the second arrival estimate, T_{prep} is the determined preparation time, T_1 is the first estimated travel time, T_3 is the third estimated travel time, and T_{buffer} is a buffer time. In some embodiments, processor 208 may

calculate the second arrival estimate upon receiving the acceptance of the order from the merchant device and forward the first arrival estimate to the customer device at step 404, concluding process 400.

[054] At step 403(c) of process 400, processor 208 may determine a third arrival estimate. The third arrival estimate may, for example, be based on the first estimated travel time. The third arrival estimate may, in some embodiments, be calculated upon determining that the delivery worker associated with the delivery device has retrieved the order from the merchant associated with the merchant device. In contrast to the calculation of the first and second arrival estimates, which bases the calculation on an estimated travel time between locations associated with the merchant device and at least one delivery device, the third arrival estimate may be based only on the first estimated travel time between locations associated with the customer device and the second (i.e., estimated travel time between the merchant and the customer). Thus, as there is no estimation on preparation time or travel time between the delivery worker and the merchant, the third arrival estimate may be calculated with a higher degree of certainty than the previous estimates. For example, processor 208 may determine the third arrival estimate using the variables describe above in the following algorithm:

$$ETA_3 = T_1 \pm T_{buffer}$$

(3)

[055] Where ETA_3 is the third arrival estimate, T_1 is the first estimated travel time, T_3 is the third estimated travel time, and T_{buffer} is a buffer time. In some embodiments, processor 208 may calculate the third arrival estimate upon

determining that the order has been retrieved and forward the first arrival estimate to the customer device at step 404, concluding process 400.

[056] FIG. 5 is a flowchart of an exemplary computerized process 500 for calculating the estimated preparation time of at least one orderable item. In some embodiments, the estimated arrival times may be based at least in part on a determined preparation time for the at least one item. For example, some merchants may not have goods readily available upon customer order and must prepare the at least one item before the delivery worker picks it up from the merchant (e.g., restaurants). Process 500 may begin at step 501, where processor 208 may receive a plurality of durations based on past history of producing the orderable items associated with the at least one orderable item and associated metadata (e.g., merchant provided preparation time, time of order, customer customization, sale price etc.) from a merchant device via a network.

[057] At step 502, processor 208 may store the plurality of durations in a data store (e.g., data storage associated with external database 120). The plurality of durations, for example, may be data points representing the amount of time a restaurant takes to prepare one or more of the orderable items on their menu. These durations may be recorded, for example, on a per item basis by the merchant through an application on item service provider device 110(1)-110(n) (e.g., application 316) and communicated to integration server system 116, where processor 208 may then store the durations in a data store.

[058] After step 502 is completed, process 500 may continue to step 503. At step 503, processor 208 may retrieve the stored plurality of durations and associated metadata associated with the at least one item from the data store. In some embodiments, at step 504, calculating the determined preparation time for the at

least one item may include feeding the stored plurality of durations associated with the at least one and associated metadata to a machine learning algorithm. The machine learning algorithm may use the previously stored durations and associated metadata to generate a predictive model that will produce an estimated preparation time for at least one ordered item of a specified order based on the stored durations and associated metadata. The predictive model may, in some embodiments, include a decision tree that outputs an estimated preparation time produced from a series of decisions based on the variety of factors discussed above. An exemplary predictive model consistent with the present disclosure is discussed in further detail with reference to FIG. 6 below. After step 504 is completed, process 500 may continue to step 505, where processor 208 may receive the estimated preparation time generated by the machine learning algorithm.

[059] In some embodiments, the associated metadata may include other data points corresponding to the order that have also been stored in the data store in addition to the duration time of the plurality of stored orders. For example, this metadata may include a price of the order, a total dish count of the order (e.g., 3 total items), specific customization options elected at the time of the order (e.g., additional toppings), time of day (e.g., 5:00 PM) and/or day of the week of the order (e.g., Tuesday), resources available at the restaurant during the time of order, a merchant-provided estimated preparation time, an inventory of the at least one orderable item, or and other factors that may influence the preparation time of the at least one ordered item. In some embodiments, the metadata may also include statistics and historical relating to all past orders prior to the time of the order.

[060] For example, the associated metadata may include statistical data such as one or more averages, maximums, minimum, percentiles, and standard

deviation values corresponding to historical data representing actual preparation times, merchant provided estimated preparation times, the difference between estimated and actual preparation times, etc. of all past orders.

[061] In some embodiments, the associated metadata may include a set of statistical data (e.g., averages, maximums, minimums, percentiles, standard deviations, etc.) representing actual preparation times, merchant provided estimated preparation times, the difference between estimated actual preparation times, etc. of past orders occurring during a specified day of the week and/or time period. For example, the metadata may include the above-mentioned statistical data for past orders placed during a specified hour (e.g., 5:00 P.M.) or a day of the week (e.g., Tuesday).

[062] At step 506, processor 208 may determine an assigned delivery worker associated with a second external system. The second external system may, for example, include item delivery provider device 106(1)-106(n). Determining an assigned delivery worker is discussed in further detail below with reference to FIGS. 7 and 8. Once processor 208 determines an assigned delivery worker, process 500 may continue to step 507, where processor 208 may forward a request to the second external system to fulfill a delivery of the at least one orderable item.

[063] FIG. 6 is an illustration of an exemplary predictive model 600 that may be generated by a machine learning algorithm, consistent with the present disclosure. Processor 208 may generate predictive model 600 based on the retrieved plurality of durations and associated metadata from step 503 of process 500. Generation of the predictive model might include collecting at least a portion of the retrieved plurality of durations and associated metadata, as a training data set, to determine which parameters (e.g., merchant provided preparation time, time of

order, customer customization, sale price etc.) that may be used to predict an estimated preparation time with the least amount of error. For example, processor 208 may determine, based on an analysis of the training data set, that items with an average preparation time greater than or equal to 850 seconds are likely to take X amount of time to prepare if the order for the item was placed after 6:00 P.M. or Y amount of time if the order for the item was placed before 6:00 P.M. Processor 208 may also determine that items with an average preparation time lower than 850 seconds are likely to take Z amount of time. Thus, processor 208 may generate a decision tree predictive model 600 that, when given an order including at least one orderable item and associated metadata, may determine whether the average preparation time for the at least one orderable item is greater than or equal to 850 seconds at decision point 601, and if so, determine whether the order was placed before or after 6:00 P.M. at decision point 602. Once processor 208 has completed these series of decisions, predictive model 600 may thus output an estimated preparation time of X, Y, or Z. Once the predictive model is generated, processor 208 may apply it to another portion of the stored plurality of durations and associated metadata, as a validation data set, to determine whether the generated predictive model produces accurate estimations.

[064] It is to be understood that the decisions points and outputs illustrated in FIG. 6 are non-limiting and for exemplary purposes only. For example, the generated predictive model 600 may include any number of decision points, where decisions are made based on any number of factors, such as the average preparation time, the merchant provided preparation time, time of order, customer customization, sale price, and more.

[065] FIG. 7 is a flowchart on of exemplary computerized process 700 for assigning a delivery worker to fulfill a specific order. Process 700 may begin at step 701, where processor 208 may receive locations associated with the plurality of second external systems from signals transmitted by a plurality of second external systems associated with a plurality of delivery workers. The signals may be transmitted from the second external systems through any suitable form of electronic communication, such as WiFi, Bluetooth, GPS, GLONASS, BeiDoe, Galileo, etc.

[066] At step 702, processor 208 may determine a first cost associated with an estimated travel time between the locations associated with the plurality of second external systems and the merchant location. For example, the first cost may be determined based on the total distance between each delivery worker and the merchant. The first cost may be greater at longer distances and may be associated with a variety of factors including travel time and fuel efficiency.

[067] At step 703, processor 208 may additionally determine a second cost associated with the difference between the at least one estimated travel time and the estimated preparation time. For example, the second cost may be associated with inefficiencies associated with either the time that the delivery worker spends at the merchant location waiting on the at least one item to finish preparation or the time elapsed between completion of preparation of the at least one item and the arrival of the delivery worker at the merchant location.

[068] In some embodiments, processor 208 may determine an assigned delivery worker based on the first costs and second costs. For example, at step 704, processor 208 may calculate a sum of the first costs and the second costs for each second external system in the plurality of second external systems.

[069] At step 705, processor 208 may compare the calculated sums associated with each second external system in the plurality of second external systems and determine an assigned second external system based on the comparison at step 706. For example, processor 208 may assign a delivery worker to fulfill a specific order due to a determination that the sum costs associated with their estimated travel time and the preparation time is the lowest of the sums for each delivery worker in the plurality of delivery workers. Thus, the delivery worker with the lowest sum of costs would be the most efficient option for fulfilling the order. After the assigned second external system is determined at step 706, processor 208 may forward a request to the second external system to fulfill the order.

[070] FIG. 8 is a flowchart of another exemplary computerized process 800 for assigning a delivery worker to a specific order. Process 800 may begin at step 801, where a location of the delivery device is determined based on signals transmitted by the delivery device. For example, the delivery device may be connected to a global positioning system (GPS) that determines and communicates the location and/or coordinates of the delivery device. The GPS may be associated with system 100 or may be associated with a third-party service provider. Using the GPS system, the delivery device may send signals indicating its location and/or coordinates to integration server system 116 through communication network 114.

[071] After step 801 is completed, process 800 may continue to step 802, where processor 208 may determine that the delivery device (i.e., the delivery worker) will arrive at the location associated with the merchant device (i.e., the merchant) before the determined preparation time has elapsed. In preferred embodiments, the delivery worker will not arrive at the merchant a substantial amount of time before the at least one ordered item is prepared, as the time spent by

the delivery worker constitutes wasted time that would ideally be spent travelling between customers and merchants. Thus, to prevent waste, process 800 may continue to step 803 where processor 208 may delay the assignment of the order to the delivery device for a delay period. The delay period may, for example, be a fixed amount of time (e.g., 1 minute) or a fixed percentage of the preparation time (e.g., 10%). In some embodiments, however, processor 208 may be configured to continuously execute the assignment process, and the delay period may be the period time between the time that the order is placed and the time that processor 208 determines that a delivery worker will arrive at approximately the same time that preparation for the at least concludes and assigns fulfillment of the order to the delivery worker accordingly. Once the delay period has elapsed, process 800 may continue to step 804 where processor 208 may assign the order to the delivery device, concluding process 800.

[072] While the present disclosure has been shown and described with reference to particular embodiments thereof, it will be understood that the present disclosure can be practiced, without modification, in other environments. The foregoing description has been presented for purposes of illustration. It is not exhaustive and is not limited to the precise forms or embodiments disclosed. Modifications and adaptations will be apparent to those skilled in the art from consideration of the specification and practice of the disclosed embodiments. Additionally, although aspects of the disclosed embodiments are described as being stored in memory, one skilled in the art will appreciate that these aspects can also be stored on other types of computer readable media, such as secondary storage devices, for example, hard disks or CD ROM, or other forms of RAM or ROM, USB media, DVD, Blu-ray, or other optical drive media.

[073] Computer programs based on the written description and disclosed methods are within the skill of an experienced developer. Various programs or program modules can be created using any of the techniques known to one skilled in the art or can be designed in connection with existing software. For example, program sections or program modules can be designed in or by means of .Net Framework, .Net Compact Framework (and related languages, such as Visual Basic, C, etc.), Java, C++, Objective-C, HTML, HTML/AJAX combinations, XML, or HTML with included Java applets.

[074] Moreover, while illustrative embodiments have been described herein, the scope of any and all embodiments having equivalent elements, modifications, omissions, combinations (e.g., of aspects across various embodiments), adaptations and/or alterations as would be appreciated by those skilled in the art based on the present disclosure. The limitations in the claims are to be interpreted broadly based on the language employed in the claims and not limited to examples described in the present specification or during the prosecution of the application. The examples are to be construed as non-exclusive. Furthermore, the steps of the disclosed methods may be modified in any manner, including by reordering steps and/or inserting or deleting steps. It is intended, therefore, that the specification and examples be considered as illustrative only, with a true scope and spirit being indicated by the following claims and their full scope of equivalents.

WHAT IS CLAIMED IS:

1. A computer-implemented system for multi-point destination arrival time analysis, the system comprising:
a memory storing instructions; and
at least one processor configured to execute the instructions to:
receive, from a first external system via a network, a plurality of
durations associated with at least one orderable item and
associated metadata, the durations based on past history of
producing the orderable items;
store the plurality of durations associated with the at least one
orderable item in a data store, the durations based on past
history of producing the orderable items;
retrieve, from the data store, the stored plurality of durations associated
with the at least one item;
feed the stored plurality of durations associated with the at least one
orderable item and associated metadata to a machine learning
algorithm;
receive an estimated preparation time for the at least one orderable
item;
determine, based on the estimated preparation time, an assigned
delivery worker associated with a second external system; and
forward a request to the second external system to fulfill a delivery of
the at least one orderable item.
2. The system of claim 1, wherein the associated metadata includes one or more
of:

a day;
a time of day;
a customization;
an inventory of the at least one orderable item;
resources available at the merchant at the time of the order; or
a merchant-provided estimated preparation time.

3. The system of claim 1, wherein determining an assigned delivery worker comprises:
 - receiving, from signals transmitted by a plurality of second external systems associated with a plurality of delivery workers, locations associated with the plurality of second external systems;
 - determining an assigned second external system based on:
 - at least one estimated travel time between a location associated with the first external system and the locations associated with the plurality of second external systems; and
 - the estimated preparation time.
4. The system of claim 3, wherein determining an assigned second external system comprises:
 - determining, for each second external system in the plurality of second external systems, a first cost associated with the estimated travel time; and
 - determining, for each second external system in the plurality of second external systems, a second cost associated with the difference between the at least one estimated travel time and the estimated preparation time.

5. The system of claim 4; wherein determining an assigned second external system further comprises:
 - calculating, for each second external system in the plurality of second external systems, a sum of the first costs and the second costs;
 - comparing the sums associated with each second external system in the plurality of second external systems; and
 - determining an assigned second external system based on the comparison.
6. The system of claim 3, wherein the at least one estimated travel time between locations is calculated by:
 - determining a straight-line distance between two locations;
 - selecting a constant speed;
 - determining the estimated travel time along the straight-line distance at the selected constant speed.
7. The system of claim 1, wherein the instructions further comprise:
 - receive, from a third external system via a network, a request for at least one orderable item, and store a timestamp in a data store;
 - determine an arrival estimate based on a first estimated travel time between locations associated with the first external system and the third external system, and one of:
 - the estimated preparation time for the at least one item, or
 - a second estimated travel time between locations associated with the first external system and a plurality of second external systems;
 - forward the arrival estimate to the third external system.

8. The system of claim 1, wherein the instructions further comprise:
- receive, from a third external system via a network, a request for at least one orderable item, and store a timestamp in a data store;
 - receive, from the assigned second external system via the network, an acceptance of an order associated with the first external system, the order comprising at least one item;
 - determine a second arrival estimate based on a first estimated travel time between locations associated with the first external system and the third external system, and one of:
 - the estimated preparation time for the at least one item, or
 - a second estimated travel time between locations associated with the first external system and the assigned second external system;
 - forward the second arrival estimate to the third external system.
9. The system of claim 1, wherein the instructions further comprise:
- receive, from a merchant device or an assigned delivery device, confirmation that the order has been retrieved, and in response thereto;
 - determine a third arrival estimate based on the first estimated travel time; and
 - forward the third arrival estimate to the third external system.
10. A computer-implemented method for multi-point destination arrival time analysis, the method comprising:

receiving, from a first external system via a network, a plurality of durations associated with at least one orderable item and associated metadata, the durations based on past history of producing the orderable items; storing the plurality of durations associated with the at least one orderable item in a data store, the durations based on past history of producing the orderable items; retrieving, from the data store, the stored plurality of durations associated with the at least one item; feeding the stored plurality of durations associated with the at least one orderable item and associated metadata to a machine learning algorithm; receiving an estimated preparation time for the at least one orderable item; determining, based on the estimated preparation time, an assigned delivery worker associated with a second external system; and forwarding a request to the second external system to fulfill a delivery of the at least one orderable item.

11. The method of claim 10, wherein the associated metadata includes one or more of:
- a day;
 - a time of day;
 - a customization;
 - an inventory of the at least one orderable item;
 - resources available at the merchant at the time of the order; or
 - a merchant-provided estimated preparation time.

12. The method of claim 10, wherein determining an assigned delivery worker comprises:
- receiving, from signals transmitted by a plurality of second external systems associated with a plurality of delivery workers, locations associated with the plurality of second external systems;
- determining an assigned second external system based on:
- at least one estimated travel time between a location associated with the first external system and the locations associated with the plurality of second external systems; and
- the estimated preparation time.
13. The method of claim 12, wherein determining an assigned second external system comprises:
- determining, for each second external system in the plurality of second external systems, a first cost associated with the estimated travel time;
- and
- determining, for each second external system in the plurality of second external systems, a second cost associated with the difference between the at least one estimated travel time and the estimated preparation time;
14. The method of claim 13; wherein determining an assigned second external system further comprises:
- calculating, for each second external system in the plurality of second external systems, a sum of the first costs and the second costs
- comparing the sums associated with each second external system in the plurality of second external systems; and
- determining an assigned second external system based on the comparison.

15. The method of claim 12, wherein the at least one estimated travel time between locations is calculated by:
 - determining a straight-line distance between two locations;
 - selecting a constant speed;
 - determining the estimated travel time along the straight-line distance at the selected constant speed.
16. The method of claim 10, wherein the instructions further comprise:
 - receive, from a third external system via a network, a request for at least one orderable item, and store a timestamp in a data store;
 - determine an arrival estimate based on a first estimated travel time between locations associated with the first external system and the third external system, and one of:
 - the estimated preparation time for the at least one item, or
 - a second estimated travel time between locations associated with the first external system and a plurality of second external systems;
 - forward the arrival estimate to the third external system.
17. The method of claim 10, wherein the instructions further comprise:
 - receive, from a third external system via a network, a request for at least one orderable item, and store a timestamp in a data store;
 - receive, from the assigned second external system via the network, an acceptance of an order associated with the first external system, the order comprising at least one item;

determine a second arrival estimate based on a first estimated travel time between locations associated with the first external system and the third external system, and one of:
the estimated preparation time for the at least one item, or
a second estimated travel time between locations associated with the first external system and the assigned second external system;
forward the second arrival estimate to the third external system.

18. The method of claim 10, wherein the instructions further comprise:
receive, from a merchant device or an assigned delivery device, confirmation that the order has been retrieved, and in response thereto;
determine a third arrival estimate based on the first estimated travel time; and
forward the third arrival estimate to the third external system.
19. A computer-implemented system for multi-point destination arrival time analysis, the system comprising:
a memory storing instructions; and
at least one processor configured to execute the instructions to:
receive, from a merchant device via a network, a plurality of durations associated with at least one orderable item and associated metadata, the durations based on past history of producing the orderable items;

store the plurality of durations associated with at least one orderable item in a data store, the durations based on past history of producing the orderable items;

retrieve, from the data store, the stored plurality of durations associated with the at least one item;

feed the stored plurality of durations associated with the at least one item and associated metadata to a machine learning algorithm;

receive an estimated preparation time for the at least one item;

determine, based on the estimated preparation time, an assigned delivery worker associated with a delivery device; and

forward a request to the delivery device to fulfill a delivery of the at least one orderable item.

receive, from the assigned second external system via the network, an acceptance of an order associated with the first external system, the order comprising at least one item;

determine an arrival estimate based on a first estimated travel time between locations associated with the first external system and the third external system, and one of:

the estimated preparation time for the at least one item, or

a second estimated travel time between locations associated with the first external system and the assigned second external system; and

forward the arrival estimate to the third external system.

20. The system of claim 19, wherein the instructions further comprise:

receiving, from signals transmitted by a plurality of second external systems associated with a plurality of delivery workers, locations associated with the plurality of second external systems;

determining, for each second external system in the plurality of second external systems, a first cost associated with an estimated travel time; and

determining, for each second external system in the plurality of second external systems, a second cost associated with the difference between the at least one estimated travel time and the estimated preparation time;

calculating, for each second external system in the plurality of second external systems, a sum of the first costs and the second costs

comparing the sums associated with each second external system in the plurality of second external systems; and

determining an assigned second external system based on the comparison.