US010135764B2

(12) **United States Patent**
**Ghafourifar et al.**

(10) **Patent No.: US 10,135,764 B2**
(45) **Date of Patent: Nov. 20, 2018**

(54) **UNIVERSAL INTERACTION PLATFORM FOR PEOPLE, SERVICES, AND DEVICES**

(71) Applicant: **Entefy Inc.**, Palo Alto, CA (US)

(72) Inventors: **Alston Ghafourifar**, Los Altos Hills, CA (US); **Mehdi Ghafourifar**, Los Altos Hills, CA (US); **Philip Nathan Greenberg**, San Diego, CA (US); **Neil Achtman**, Mountain View, CA (US); **Brienne Ghafourifar**, Los Altos Hills, CA (US)

(73) Assignee: **Entefy Inc.**, Palo Alto, CA (US)

( * ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 283 days.

(21) Appl. No.: **14/986,111**

(22) Filed: **Dec. 31, 2015**

(65) **Prior Publication Data**

US 2017/0195267 A1 Jul. 6, 2017

(51) **Int. Cl.**
***H04L 12/58*** (2006.01)
***H04L 29/06*** (2006.01)

(52) **U.S. Cl.**
CPC ..... ***H04L 51/066*** (2013.01); ***H04L 51/20*** (2013.01); ***H04L 51/36*** (2013.01); ***H04L 69/18*** (2013.01); *H05K 999/99* (2013.01)

(58) **Field of Classification Search**
CPC ..... H04L 51/066; H04L 51/20; H04L 51/22; H04L 51/36; H04L 69/18; H05K 999/99
USPC ..... 709/206, 207
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | |
|---|---|---|---|---|
| 5,481,597 | A | 1/1996 | Given | |
| 5,951,638 | A * | 9/1999 | Hoss | H04L 51/36 709/206 |
| 6,101,320 | A | 8/2000 | Schuetze | |
| 6,950,502 | B1 | 9/2005 | Jenkins | |
| 7,450,937 | B1 | 11/2008 | Claudatos | |
| 7,673,327 | B1 | 3/2010 | Polis | |
| 7,886,000 | B1 | 2/2011 | Polis | |
| 7,908,647 | B1 | 3/2011 | Polis | |
| 8,090,787 | B2 | 1/2012 | Polis | |
| 8,095,592 | B2 | 1/2012 | Polis | |
| 8,108,460 | B2 | 1/2012 | Polis | |
| 8,112,476 | B2 | 2/2012 | Polis | |
| 8,122,080 | B2 | 2/2012 | Polis | |
| 8,156,183 | B2 | 4/2012 | Polis | |

(Continued)

FOREIGN PATENT DOCUMENTS

| | | |
|---|---|---|
| WO | 9931575 | 6/1999 |
| WO | 2013112570 A1 | 8/2013 |

OTHER PUBLICATIONS

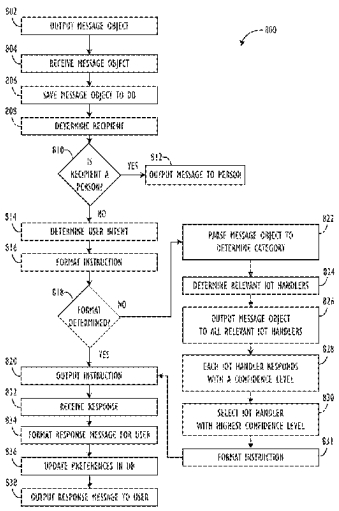
Guangyi Xiao et al., "User Interoperability With Heterogeneous IoT Devices Through Transformation," pp. 1486-1496, 2014.

*Primary Examiner* — Michael C Lai
(74) *Attorney, Agent, or Firm* — Blank Rome LLP

(57) **ABSTRACT**

A universal interaction platform that communicates with service providers and smart devices by receiving a message object that includes information indicative of a user intent for one of the service providers or smart devices to perform a function, determines the service provider or smart device that the user intends to perform the function, determines a protocol and format for communicating with the service provider or smart device, formats an instruction for the service provider or smart device, and outputs the instruction to the service provider or smart device.

**21 Claims, 21 Drawing Sheets**



(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | |
|---|---|---|---|---|
| 8,281,125 | B1 | 10/2012 | Briceno | |
| 8,296,360 | B2 | 10/2012 | Polis | |
| 8,433,705 | B1 | 4/2013 | Dredze | |
| 8,438,223 | B2 | 5/2013 | Polis | |
| 8,458,256 | B2 | 6/2013 | Polis | |
| 8,458,292 | B2 | 6/2013 | Polis | |
| 8,458,347 | B2 | 6/2013 | Polis | |
| 8,468,202 | B2 | 6/2013 | Polis | |
| 8,959,156 | B2 | 2/2015 | Polis | |
| 2002/0133509 | A1 | 9/2002 | Johnston | |
| 2002/0152091 | A1* | 10/2002 | Nagaoka | G06Q 30/02 705/1.1 |
| 2002/0178000 | A1 | 11/2002 | Aktas | |
| 2002/0194322 | A1 | 12/2002 | Nagata | |
| 2004/0117507 | A1 | 6/2004 | Torma | |
| 2004/0137884 | A1 | 7/2004 | Engstrom | |
| 2004/0243719 | A1 | 12/2004 | Roselinsky | |
| 2004/0266411 | A1* | 12/2004 | Galicia | H04M 3/5307 455/414.4 |
| 2005/0015443 | A1 | 1/2005 | Levine | |
| 2005/0080857 | A1 | 4/2005 | Kirsch | |
| 2005/0198159 | A1 | 9/2005 | Kirsch | |
| 2006/0193450 | A1 | 8/2006 | Flynt | |
| 2007/0054676 | A1* | 3/2007 | Duan | H04W 64/00 455/456.2 |
| 2007/0116195 | A1 | 5/2007 | Thompson | |
| 2007/0130273 | A1 | 6/2007 | Huynh | |
| 2007/0237135 | A1 | 10/2007 | Trevallyn-Jones | |
| 2007/0299796 | A1 | 12/2007 | MacBeth | |
| 2008/0062133 | A1 | 3/2008 | Wolf | |
| 2008/0088428 | A1 | 4/2008 | Pitre | |
| 2008/0112546 | A1 | 5/2008 | Fletcher | |
| 2008/0236103 | A1 | 10/2008 | Lowder | |
| 2008/0261569 | A1 | 10/2008 | Britt | |
| 2009/0016504 | A1* | 1/2009 | Mantell | H04L 51/066 379/101.01 |
| 2009/0119370 | A1 | 5/2009 | Stern | |
| 2009/0177484 | A1 | 7/2009 | Davis | |
| 2009/0177744 | A1 | 7/2009 | Marlow | |
| 2009/0181702 | A1* | 7/2009 | Vargas | H04L 51/14 455/466 |
| 2009/0271486 | A1 | 10/2009 | Ligh | |
| 2009/0292814 | A1 | 11/2009 | Ting | |
| 2009/0299996 | A1 | 12/2009 | Yu | |
| 2010/0057872 | A1 | 3/2010 | Koons | |
| 2010/0210291 | A1 | 8/2010 | Lauer | |
| 2010/0220585 | A1 | 9/2010 | Poulson | |
| 2010/0223341 | A1 | 9/2010 | Manolescu | |
| 2010/0229107 | A1* | 9/2010 | Turner | A63F 13/12 715/757 |
| 2010/0250578 | A1 | 9/2010 | Athsani | |
| 2010/0312644 | A1 | 12/2010 | Borgs | |
| 2010/0323728 | A1 | 12/2010 | Gould | |
| 2010/0325227 | A1* | 12/2010 | Novy | H04L 51/066 709/206 |
| 2011/0010182 | A1 | 1/2011 | Turski | |
| 2011/0051913 | A1 | 3/2011 | Kesler | |
| 2011/0078247 | A1 | 3/2011 | Jackson | |
| 2011/0078256 | A1 | 3/2011 | Wang | |
| 2011/0130168 | A1 | 6/2011 | Vendrow | |
| 2011/0194629 | A1 | 8/2011 | Bekanich | |
| 2011/0219008 | A1 | 9/2011 | Been | |
| 2011/0265010 | A1 | 10/2011 | Ferguson | |
| 2011/0276640 | A1 | 11/2011 | Jesse | |
| 2011/0295851 | A1 | 12/2011 | El-Saban | |
| 2012/0016858 | A1 | 1/2012 | Rathod | |
| 2012/0209847 | A1 | 8/2012 | Rangan | |
| 2012/0210253 | A1 | 8/2012 | Luna | |
| 2012/0221962 | A1 | 8/2012 | Lew | |
| 2013/0018945 | A1 | 1/2013 | Vendrow | |
| 2013/0024521 | A1 | 1/2013 | Pocklington | |
| 2013/0067345 | A1 | 3/2013 | Das | |
| 2013/0097279 | A1 | 4/2013 | Polis | |
| 2013/0111487 | A1 | 5/2013 | Cheyer | |
| 2013/0127864 | A1 | 5/2013 | Nevin, III | |
| 2013/0151508 | A1 | 6/2013 | Kurabayashi | |
| 2013/0262385 | A1 | 10/2013 | Kumarasamy | |
| 2013/0262852 | A1 | 10/2013 | Roeder | |
| 2013/0267264 | A1 | 10/2013 | Abuelsaad | |
| 2013/0268516 | A1 | 10/2013 | Chaudhri | |
| 2013/0304830 | A1* | 11/2013 | Olsen | H04L 51/32 709/206 |
| 2013/0325343 | A1 | 12/2013 | Blumenberg | |
| 2013/0332308 | A1* | 12/2013 | Linden | G06Q 30/0631 705/26.7 |
| 2014/0020047 | A1 | 1/2014 | Liebmann | |
| 2014/0032538 | A1 | 1/2014 | Arngren | |
| 2014/0149399 | A1 | 5/2014 | Kurzion | |
| 2014/0270131 | A1 | 9/2014 | Hand | |
| 2014/0280460 | A1 | 9/2014 | Nemer | |
| 2014/0297807 | A1 | 10/2014 | Dasgupta | |
| 2015/0039887 | A1 | 2/2015 | Kahol | |
| 2015/0095127 | A1 | 4/2015 | Patel | |
| 2015/0186455 | A1 | 7/2015 | Horling | |
| 2015/0278370 | A1* | 10/2015 | Stratvert | G06F 17/30867 707/766 |
| 2015/0281184 | A1 | 10/2015 | Cooley | |
| 2015/0286747 | A1 | 10/2015 | Anastasakos | |
| 2015/0286943 | A1* | 10/2015 | Wang | G06F 3/04842 706/11 |
| 2015/0339405 | A1 | 11/2015 | Vora | |
| 2016/0078030 | A1 | 3/2016 | Brackett | |
| 2016/0087944 | A1 | 3/2016 | Downey | |
| 2016/0092959 | A1 | 3/2016 | Gross | |
| 2017/0206276 | A1 | 7/2017 | Gill | |

* cited by examiner

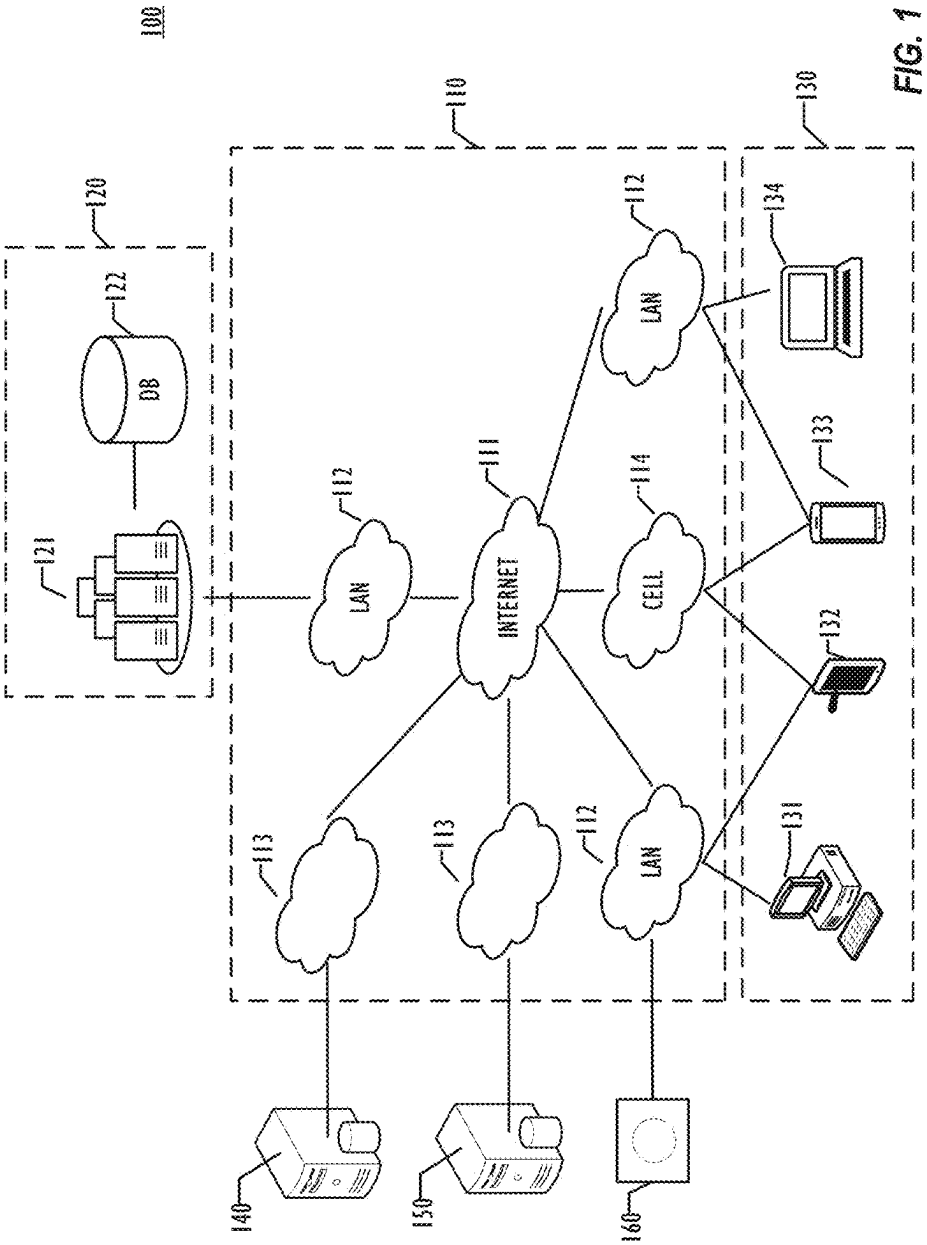

100
110
120
130
DB
122
121
LAN
112
INTERNET
111
CELL
114
LAN
112
LAN
112
113
113
134
133
132
131
140
150
160

FIG. 1

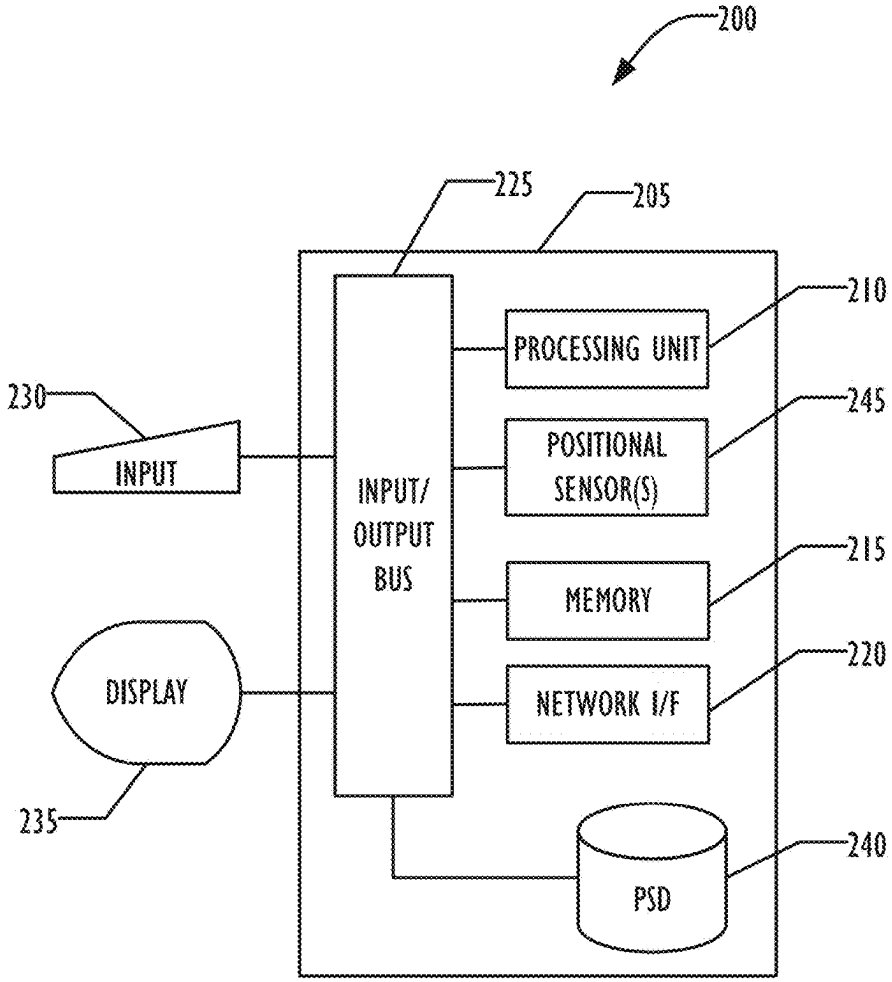

200
225
205
210
PROCESSING UNIT
230
INPUT
245
POSITIONAL SENSOR(S)
INPUT/ OUTPUT BUS
215
MEMORY
DISPLAY
220
NETWORK I/F
235
240
PSD

FIG. 2A

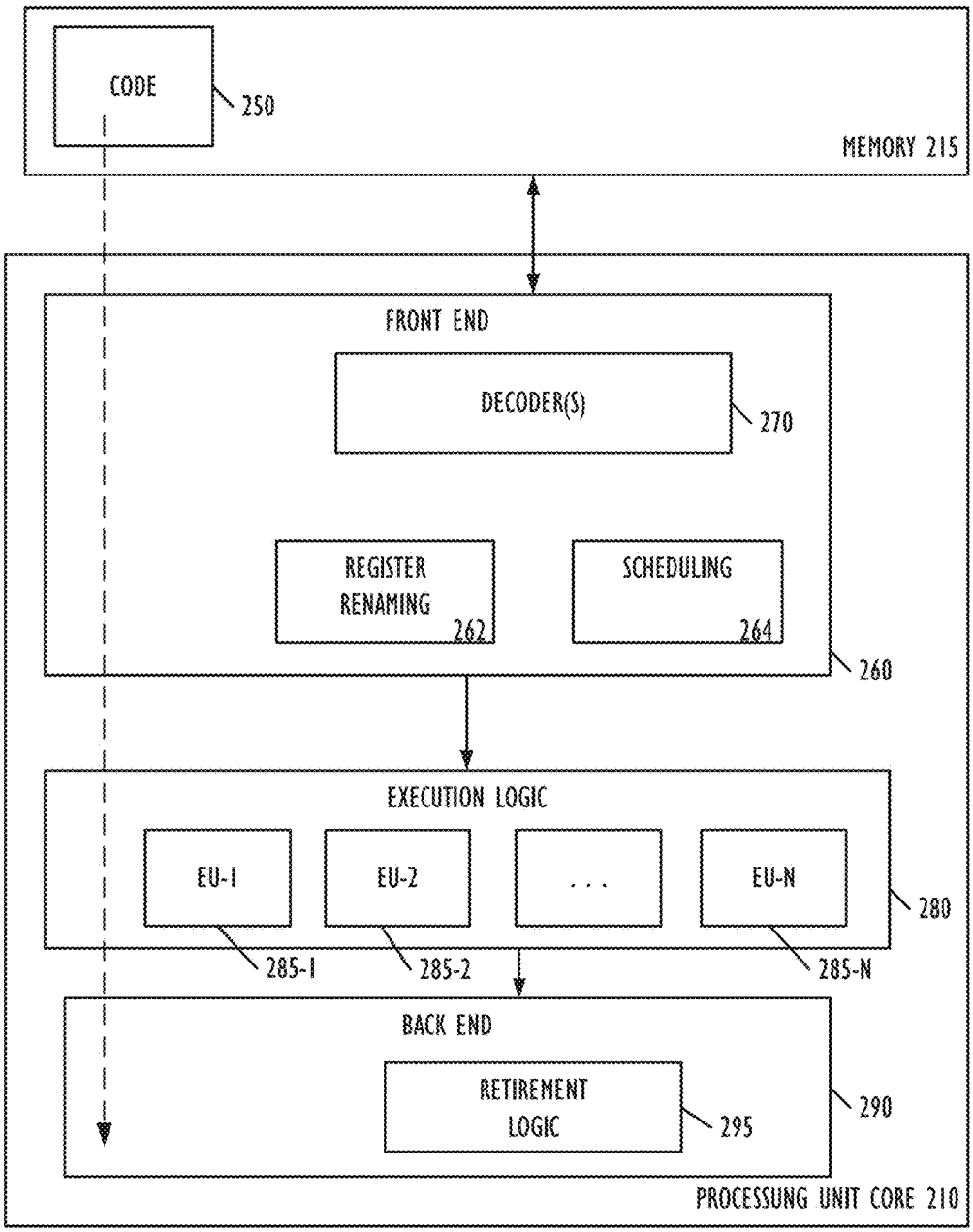

CODE
250
MEMORY 215
FRONT END
DECODER(S)
270
REGISTER RENAMING
262
SCHEDULING
264
260
EXECUTION LOGIC
EU-1
EU-2
. . .
EU-N
280
285-1
285-2
285-N
BACK END
RETIREMENT LOGIC
295
290
PROCESSUNG UNIT CORE 210

FIG. 2B

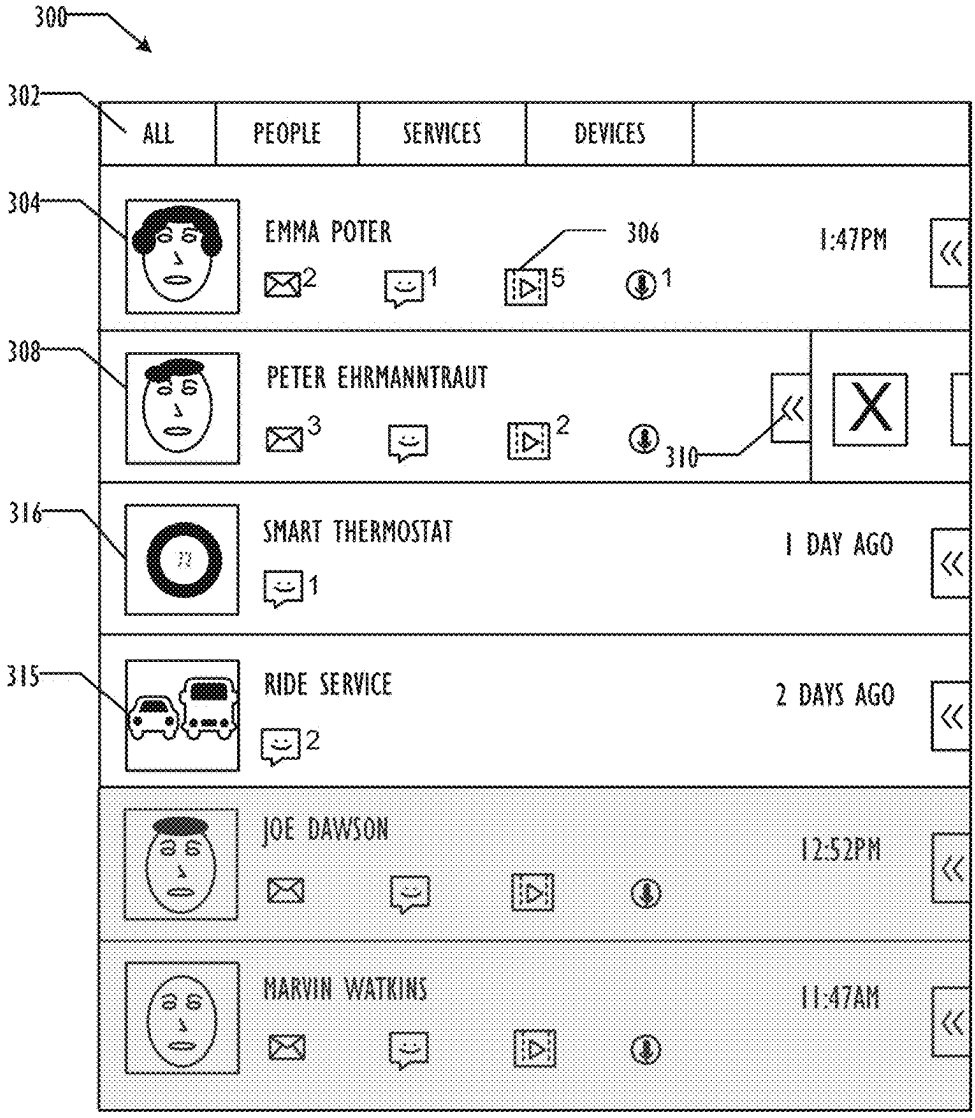

300
302
ALL
PEOPLE
SERVICES
DEVICES
304
EMMA POTER
306
1:47PM
2
1
5
1
308
PETER EHRMANNTRAUT
3
2
310
316
SMART THERMOSTAT
1 DAY AGO
1
315
RIDE SERVICE
2 DAYS AGO
2
JOE DAWSON
12:52PM
MARVIN WATKINS
11:47AM

FIG. 3A

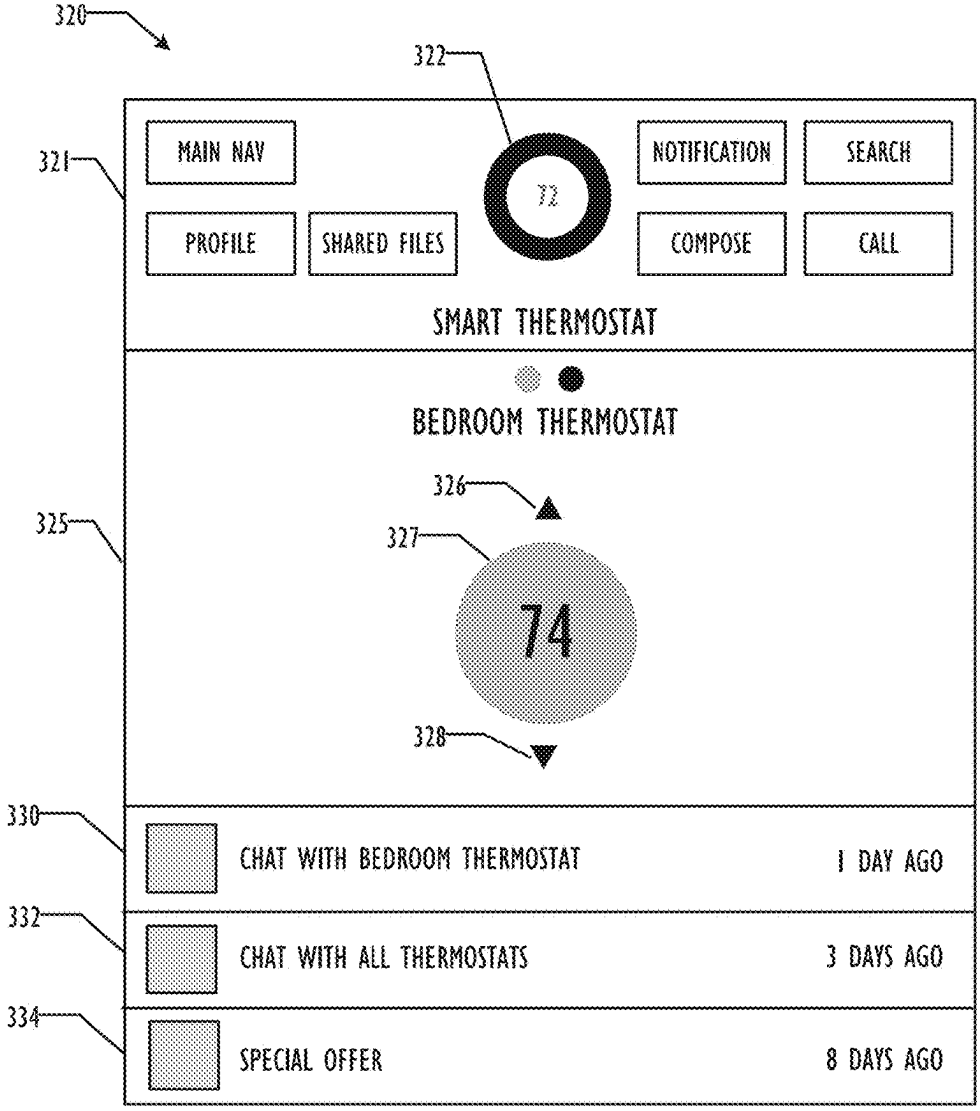

320
322
321
MAIN NAV
72
NOTIFICATION
SEARCH
PROFILE
SHARED FILES
COMPOSE
CALL
SMART THERMOSTAT
BEDROOM THERMOSTAT
326
325
327
74
328
330
CHAT WITH BEDROOM THERMOSTAT
1 DAY AGO
332
CHAT WITH ALL THERMOSTATS
3 DAYS AGO
334
SPECIAL OFFER
8 DAYS AGO

FIG. 3B

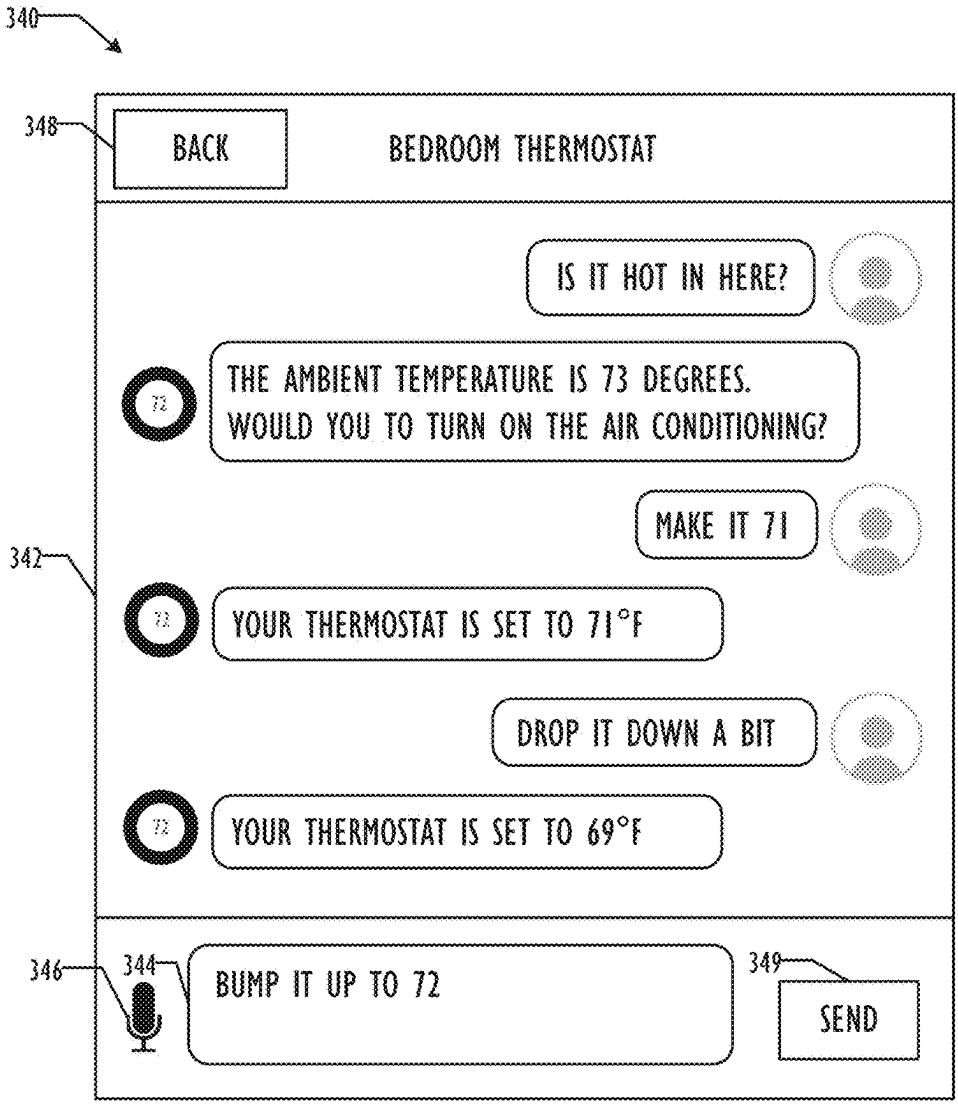

340
348
BACK
BEDROOM THERMOSTAT
IS IT HOT IN HERE?
THE AMBIENT TEMPERATURE IS 73 DEGREES.
WOULD YOU TO TURN ON THE AIR CONDITIONING?
MAKE IT 71
342
YOUR THERMOSTAT IS SET TO 71°F
DROP IT DOWN A BIT
YOUR THERMOSTAT IS SET TO 69°F
346
344
BUMP IT UP TO 72
349
SEND

FIG. 3C

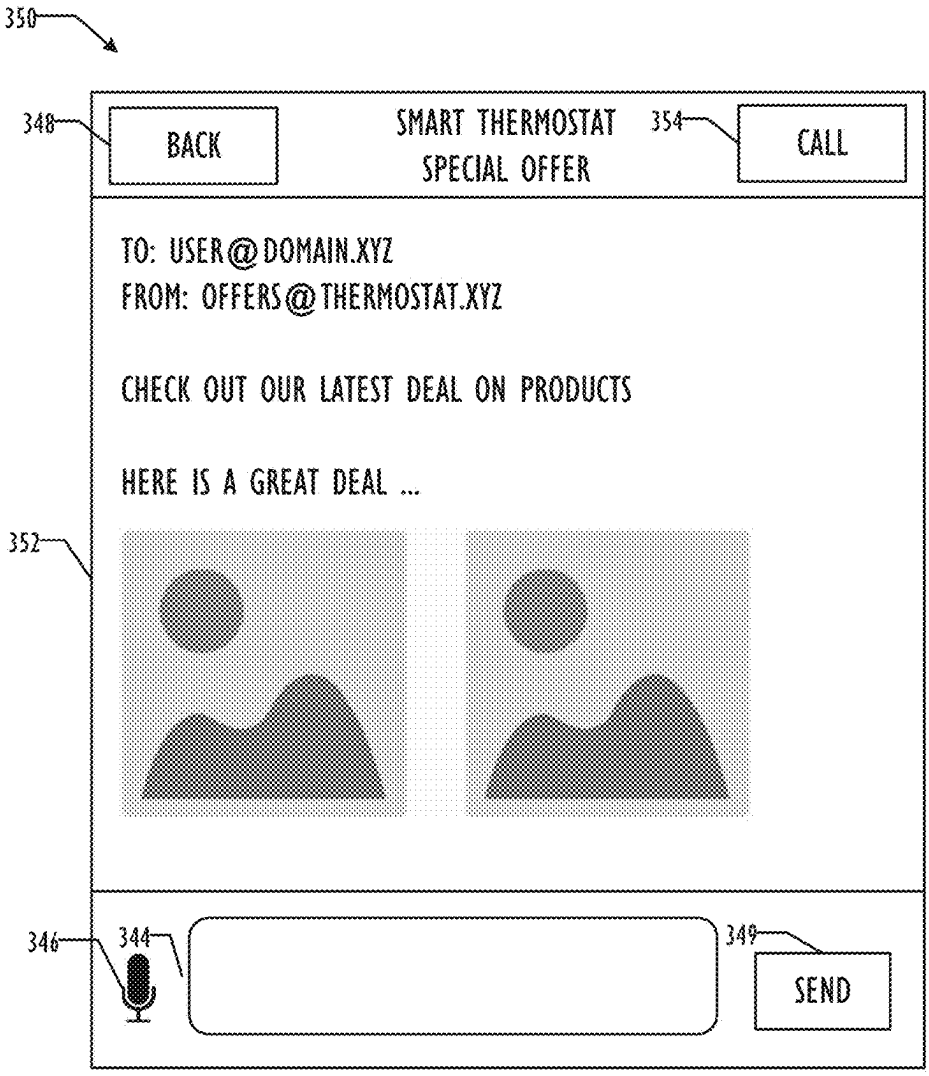

350
348
BACK
SMART THERMOSTAT
SPECIAL OFFER
354
CALL
TO: USER@DOMAIN.XYZ
FROM: OFFERS@THERMOSTAT.XYZ
CHECK OUT OUR LATEST DEAL ON PRODUCTS
HERE IS A GREAT DEAL ...
352
346
344
349
SEND

FIG. 3D

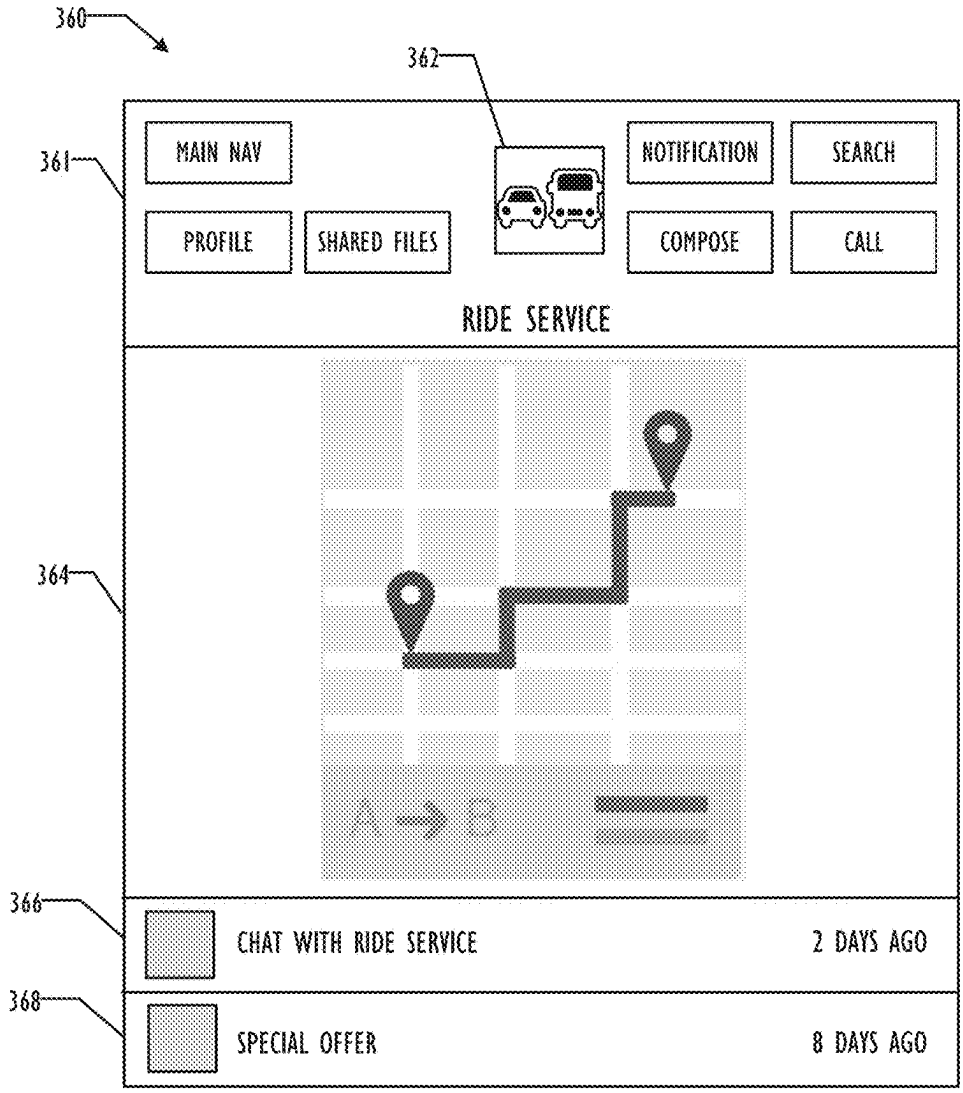

360
362
361
MAIN NAV
NOTIFICATION
SEARCH
PROFILE
SHARED FILES
COMPOSE
CALL
RIDE SERVICE
364
366
CHAT WITH RIDE SERVICE
2 DAYS AGO
368
SPECIAL OFFER
8 DAYS AGO

FIG. 3E

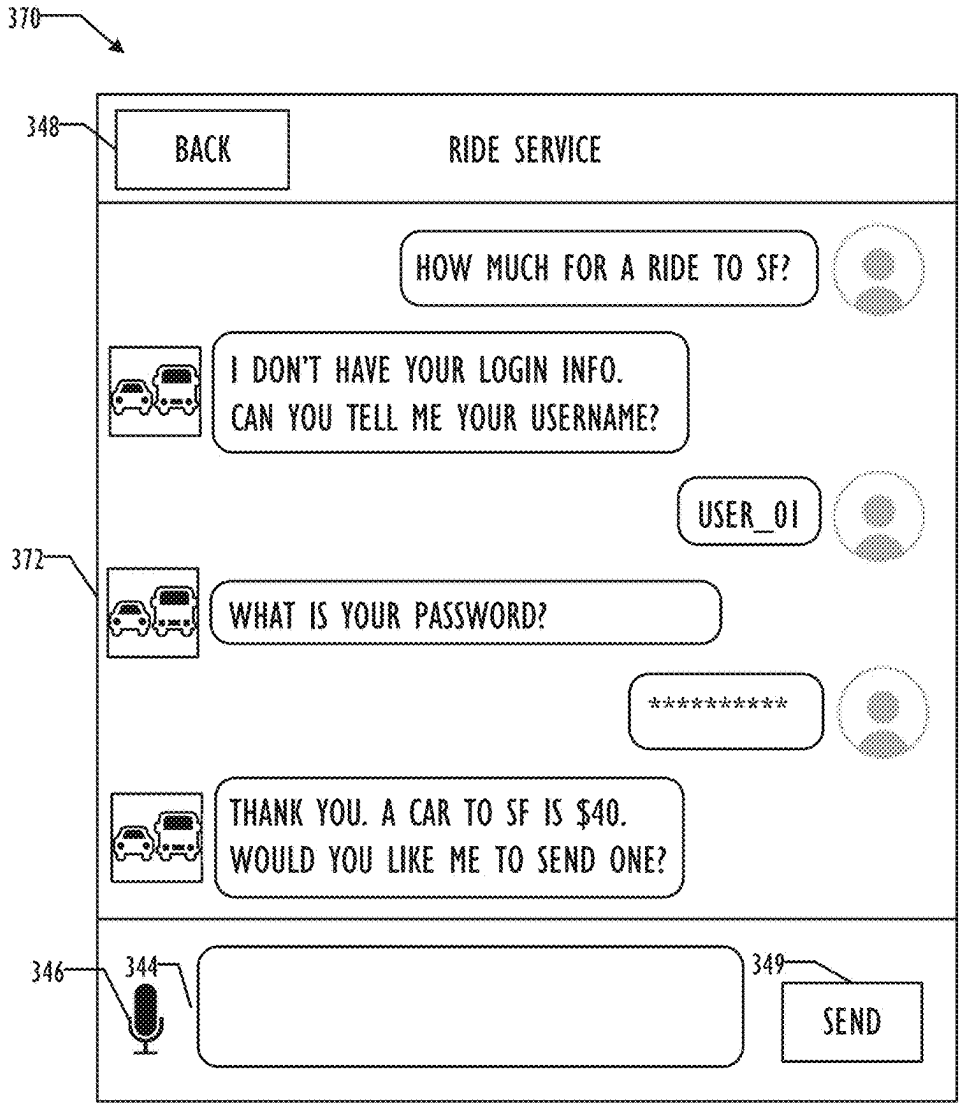

370
348
BACK
RIDE SERVICE
HOW MUCH FOR A RIDE TO SF?
I DON'T HAVE YOUR LOGIN INFO.
CAN YOU TELL ME YOUR USERNAME?
USER_01
372
WHAT IS YOUR PASSWORD?
**********
THANK YOU. A CAR TO SF IS $40.
WOULD YOU LIKE ME TO SEND ONE?
346
344
349
SEND

FIG. 3F

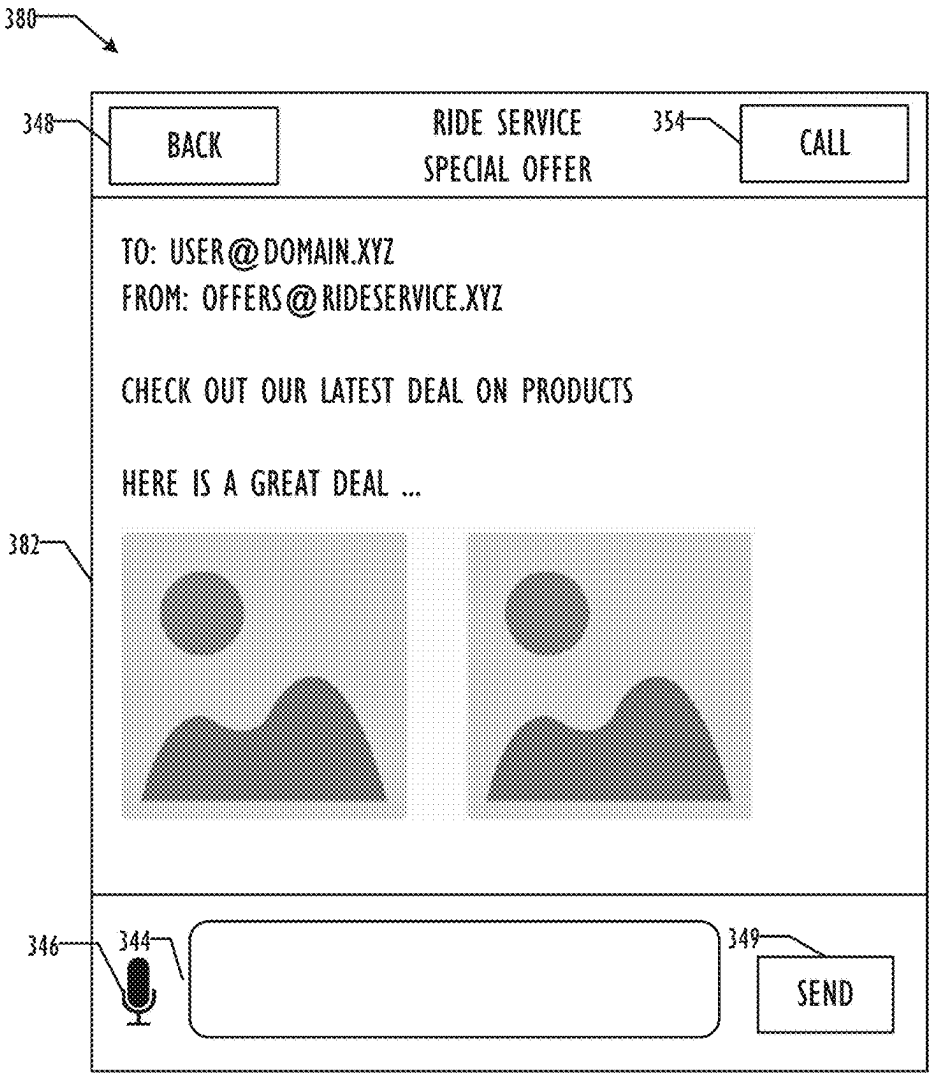

380
348
BACK
RIDE SERVICE
SPECIAL OFFER
354
CALL
TO: USER@DOMAIN.XYZ
FROM: OFFERS@RIDESERVICE.XYZ
CHECK OUT OUR LATEST DEAL ON PRODUCTS
HERE IS A GREAT DEAL ...
382
346
344
349
SEND

FIG. 3G

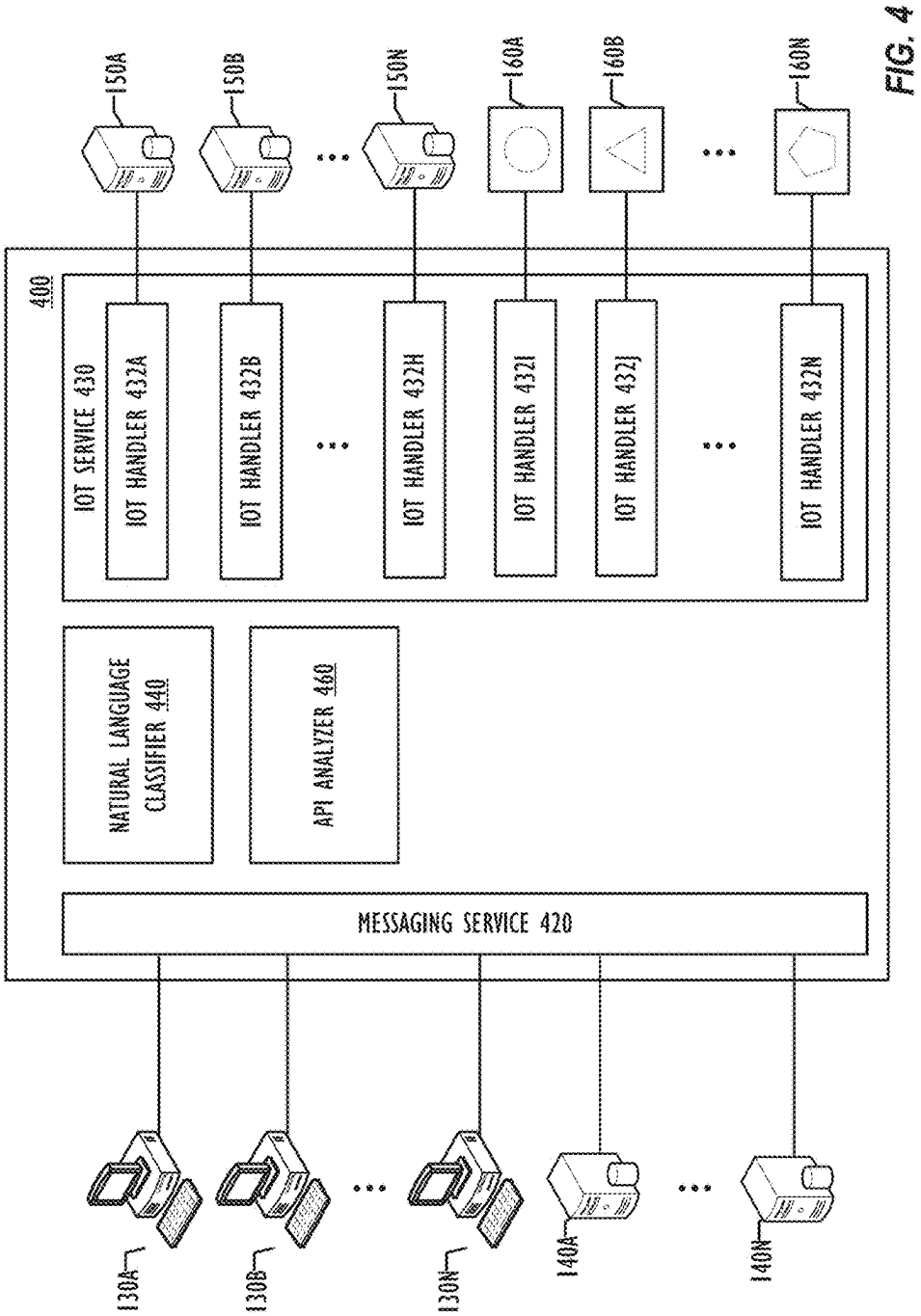

150A
150B
150N
160A
160B
160N
400
IOT SERVICE 430
IOT HANDLER 432A
IOT HANDLER 432B
IOT HANDLER 432H
IOT HANDLER 432I
IOT HANDLER 432J
IOT HANDLER 432N
NATURAL LANGUAGE CLASSIFIER 440
API ANALYZER 460
MESSAGING SERVICE 420
130A
130B
130N
140A
140N

FIG. 4

| Northbound Trains | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zone | Stations | 309 | 211 | 313 | 215 | 217 | 319 | 221 | 323 | 225 | 227 | 329 | 231 | 233 | 135 |
| 6 | Gilroy | | | | | 6:07 | | 6:28 | | | 7:05 | | | | |
| 6 | San Martin | 7150 MONTEREY ST. | | | | 6:16 | | 6:37 | | | 7:14 | | | | |
| 6 | Morgan Hill | GILROY 95020 | | | | 6:22 | | 6:43 | | | 7:20 | | | | |
| 5 | Blossom Hill | | | | | 6:35 | | 6:56 | | | 7:33 | | | | |
| 5 | Capitol | | | | | 6:41 | | 7:02 | | | 7:39 | | | | |
| 4 | Tamien | 5:56 | — | — | — | 6:49 | 6:56 | 7:10 | — | — | 7:47 | 7:56 | — | 8:33 | — |
| 4 | San Jose Diridon | 6:03 | 6:20 | 6:45 | 6:50 | 6:57 | 7:03 | 7:18 | 7:45 | 7:50 | 7:55 | 8:03 | 8:20 | 8:40 | 9:15 |
| 4 | College Park | — | — | — | — | — | — | — | — | — | 7:58 | — | — | — | — |
| 4 | Santa Clara | — | 6:25 | — | — | 7:02 | — | 7:23 | — | — | 8:02 | — | 8:25 | 8:45 | 9:20 |
| 4 | Lawrence | — | — | — | — | 7:12 | — | 7:28 | — | — | 8:12 | — | — | 8:50 | 9:25 |
| 3 | Sunnyvale | 6:13 | 6:32 | — | 7:00 | 7:18 | 7:13 | 7:32 | — | 8:00 | 8:18 | 8:14 | 8:32 | 8:54 | 9:29 |
| 3 | Mountain View | — | 6:37 | 6:57 | 7:05 | 7:23 | — | 7:37 | 7:57 | 8:05 | 8:23 | — | 8:37 | 9:00 | 9:34 |
| 3 | San Antonio | — | — | — | — | 7:27 | — | — | — | — | 8:27 | — | — | 9:04 | 9:38 |
| 3 | California Ave | — | — | — | 7:11 | 7:31 | — | — | — | 8:11 | 8:31 | — | — | 9:08 | 9:42 |
| 3 | Palo Alto | 6:23 | — | 7:05 | 7:16 | 7:36 | 7:23 | — | 8:05 | 8:16 | 8:36 | 8:25 | — | 9:14 | 9:46 |
| 3 | Menlo Park | — | 6:45 | — | — | 7:39 | — | 7:45 | — | — | 8:39 | — | 8:45 | 9:17 | 9:49 |
| 2 | Redwood City | 6:30 | 6:51 | — | — | 7:45 | 7:30 | 7:51 | — | — | 8:45 | 8:33 | 8:51 | 9:23 | 9:54 |
| 2 | San Carlos | — | 6:55 | — | 7:24 | — | — | 7:55 | — | 8:24 | — | — | 8:55 | 9:27 | 9:58 |
| 2 | Belmont | — | 6:58 | — | — | — | — | 7:58 | — | — | — | — | 8:58 | 9:30 | 10:01 |
| 2 | Hillsdale | — | 7:02 | 7:16 | 7:28 | 7:51 | — | 8:02 | 8:16 | 8:28 | 8:51 | — | 9:02 | 9:33 | 10:04 |

FIG. 5A

Real Time
Choose a station and click Select
Mountain View
Select
SOUTHBOUND
NORTHBOUND
220 Limited 22 min. 227 Limited 6 min.
322 Baby Bullet 28 min. 231 Limited 19 min.
324 Baby Bullet 42 min. 233 Limited 42 min.

FIG. 5B

| Function | Method | Endpoint | Parameters |
|---|---|---|---|
| List products | GET | /v1/products | latitude |
| | | | longitude |
| Get price estimates | GET | /v1/estimates/price | start_latitude |
| | | | start_longitude |
| | | | end_latitude |
| | | | end_longitude |
| Get time estimates | GET | /v1/estimates/time | start_latitude |
| | | | start_longitude |
| | | | customer_uuid (optional) |
| | | | product_id (optional) |
| Create ride request | POST | /v1/requests | product_id |
| | | | start_latitude |
| | | | start_longitude |
| | | | end_latitude (optional) |
| | | | end_longitude (optional) |
| | | | surge_confirmation_id (optional) |
| ... | ... | ... | ... |

FIG. 6A

```
STATUS-CODE: 200 OK

{
  "PRODUCTS": [
    {
       "CAPACITY": 4,
       "DESCRIPTION": "THE LOW-COST UBER",
       "PRICE_DETAILS": {
          "DISTANCE_UNIT": "MILE",
          "COST_PER_MINUTE": 0.26,
          "SERVICE_FEES": [
             {
                "FEE": 1.0,
                "NAME": "SAFE RIDES FEE"
             }
          ],
          "MINIMUM": 5.0,
          "COST_PER_DISTANCE": 1.3,
          "BASE": 2.2,
          "CANCELLATION_FEE": 5.0,
          "CURRENCY_CODE": "USD"
       },
       "IMAGE": "HTTP://D1A3F4SPAZZRP4.CLOUDFRONT.NET/CAR.JPG",
       "DISPLAY_NAME": "CARX",
       "PRODUCT_ID": "A1111C8C-C720-46C3-8534-2FCDD730040D"
    },
    {
       "CAPACITY": 6,
       "DESCRIPTION": "LOW-COST RIDES FOR LARGE GROUPS",
       "PRICE_DETAILS": {
          "DISTANCE_UNIT": "MILE",
          "COST_PER_MINUTE": 0.45,
          "SERVICE_FEES": [
             {
                "FEE": 1.0,
                "NAME": "SAFE RIDES FEE"
             }
          ],
          "MINIMUM": 8.0,
          "COST_PER_DISTANCE": 2.15,
          "BASE": 5.0,
          "CANCELLATION_FEE": 5.0,
          "CURRENCY_CODE": "USD"
       },
       "IMAGE": "HTTP://D1A3F4SPAZZRP4.CLOUDFRONT.NET/CAR.JPG",
       "DISPLAY_NAME": "CARXL",
       "PRODUCT_ID": "821415D8-3BD5-4E27-9604-194E4359A449"
    }
  ]
}
```

FIG. 6B

| Metadata | | Example |
|---|---|---|
| access_token | | c.FmDPkzyzaQe... |
| client_version | | 17 |
| | | |
| **Data Values** | **Permission** | **Example** |
| device_id | read | peyiJNo0IldT2YlIVtYaGQ |
| locale | read | en-US |
| software_version | read | 4.0 |
| structure_id | read | VqFabWH21nwVyd4... |
| name | read | Hallway (upstairs) |
| name_long | read | Hallway Thermostat (upstairs) |
| last_connection | read | 2015-12-31T23:59:59.000Z |
| is_online | read | TRUE |
| can_cool | read | TRUE |
| can_heat | read | TRUE |
| is_using_emergency_heat | read | TRUE |
| has_fan | read | TRUE |
| fan_timer_active | read | TRUE |
| fan_timer_timeout | read | 2015-12-31T23:59:59.000Z |
| has_leaf | read | FALSE |
| temperature_scale | read | F |
| target_temperature_f | read/write | 72 |
| target_temperature_c | read/write | 21.5 |
| target_temperature_high_f | read/write | 80 |
| target_temperature_high_c | read/write | 24.5 |
| target_temperature_low_f | read/write | 65 |
| target_temperature_low_c | read/write | 19.5 |
| away_temperature_high_f | read | 80 |
| away_temperature_high_c | read | 24.5 |
| away_temperature_low_f | read | 65 |
| away_temperature_low_c | read | 19.5 |
| hvac_mode | read/write | heat-cool |
| ambient_temperature_f | read | 72 |
| ambient_temperature_c | read | 21.5 |
| humidity | read | 35 |
| hvac_state | read | heating |
| where_id | read | d6reb_OZTM... |

FIG. 7

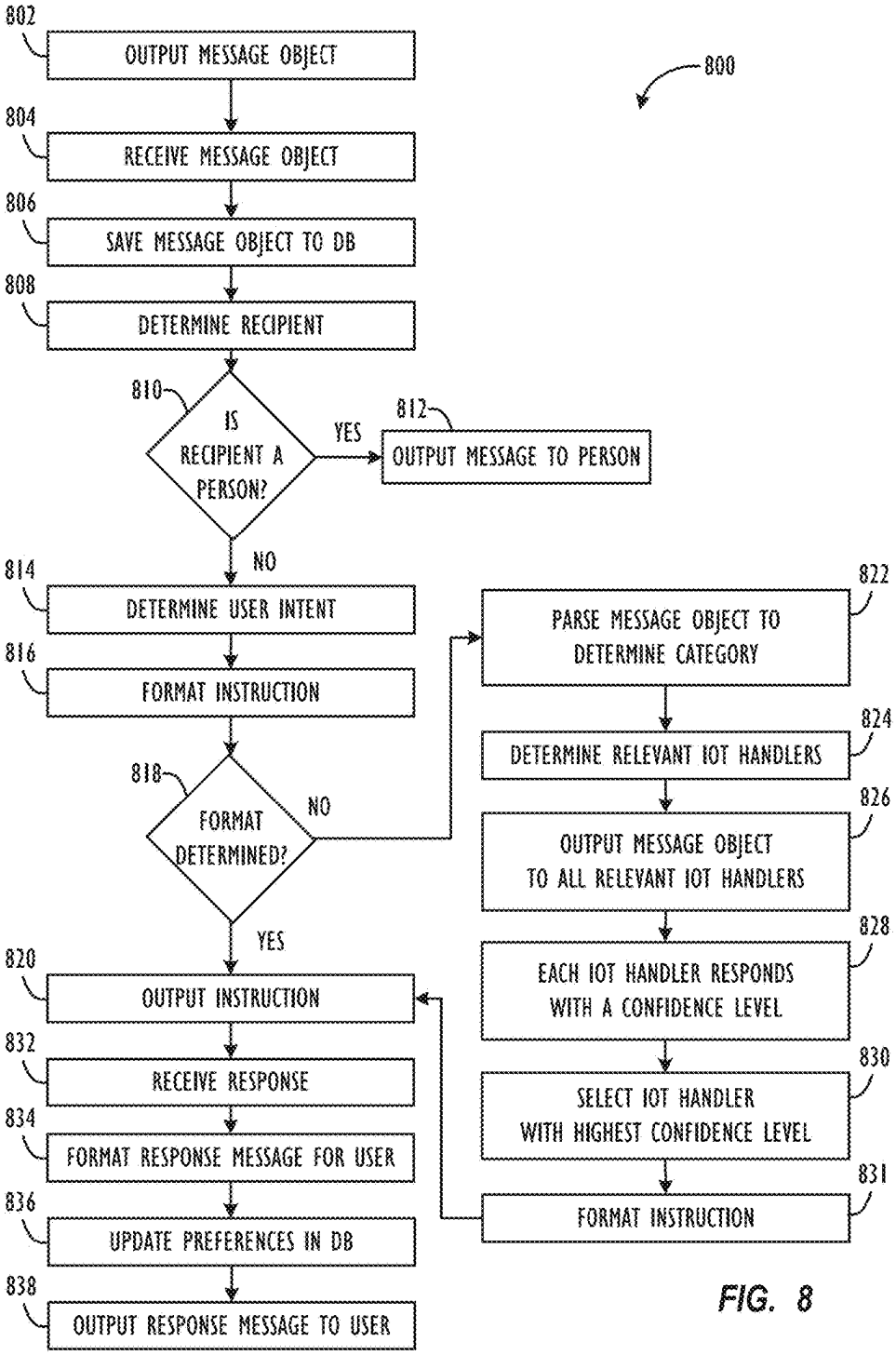

800
802
OUTPUT MESSAGE OBJECT
804
RECEIVE MESSAGE OBJECT
806
SAVE MESSAGE OBJECT TO DB
808
DETERMINE RECIPIENT
810
IS RECIPIENT A PERSON?
YES
812
OUTPUT MESSAGE TO PERSON
NO
814
DETERMINE USER INTENT
816
FORMAT INSTRUCTION
818
FORMAT DETERMINED?
NO
YES
820
OUTPUT INSTRUCTION
832
RECEIVE RESPONSE
834
FORMAT RESPONSE MESSAGE FOR USER
836
UPDATE PREFERENCES IN DB
838
OUTPUT RESPONSE MESSAGE TO USER
822
PARSE MESSAGE OBJECT TO DETERMINE CATEGORY
824
DETERMINE RELEVANT IOT HANDLERS
826
OUTPUT MESSAGE OBJECT TO ALL RELEVANT IOT HANDLERS
828
EACH IOT HANDLER RESPONDS WITH A CONFIDENCE LEVEL
830
SELECT IOT HANDLER WITH HIGHEST CONFIDENCE LEVEL
831
FORMAT INSTRUCTION

FIG. 8

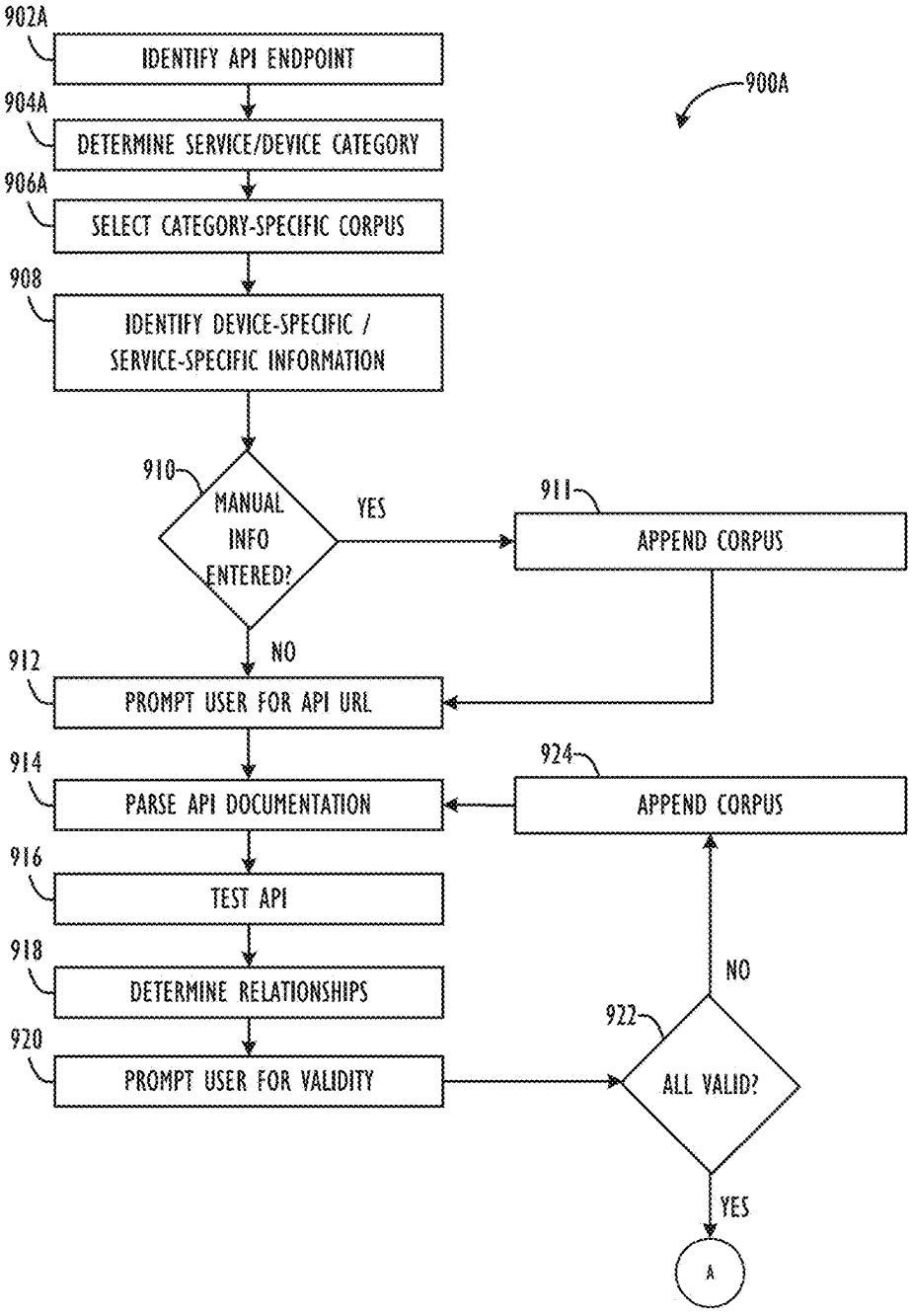

900A
902A
IDENTIFY API ENDPOINT
904A
DETERMINE SERVICE/DEVICE CATEGORY
906A
SELECT CATEGORY-SPECIFIC CORPUS
908
IDENTIFY DEVICE-SPECIFIC / SERVICE-SPECIFIC INFORMATION
910
MANUAL INFO ENTERED?
YES
911
APPEND CORPUS
NO
912
PROMPT USER FOR API URL
914
PARSE API DOCUMENTATION
924
APPEND CORPUS
916
TEST API
918
DETERMINE RELATIONSHIPS
920
PROMPT USER FOR VALIDITY
922
ALL VALID?
NO
YES
A

FIG. 9A

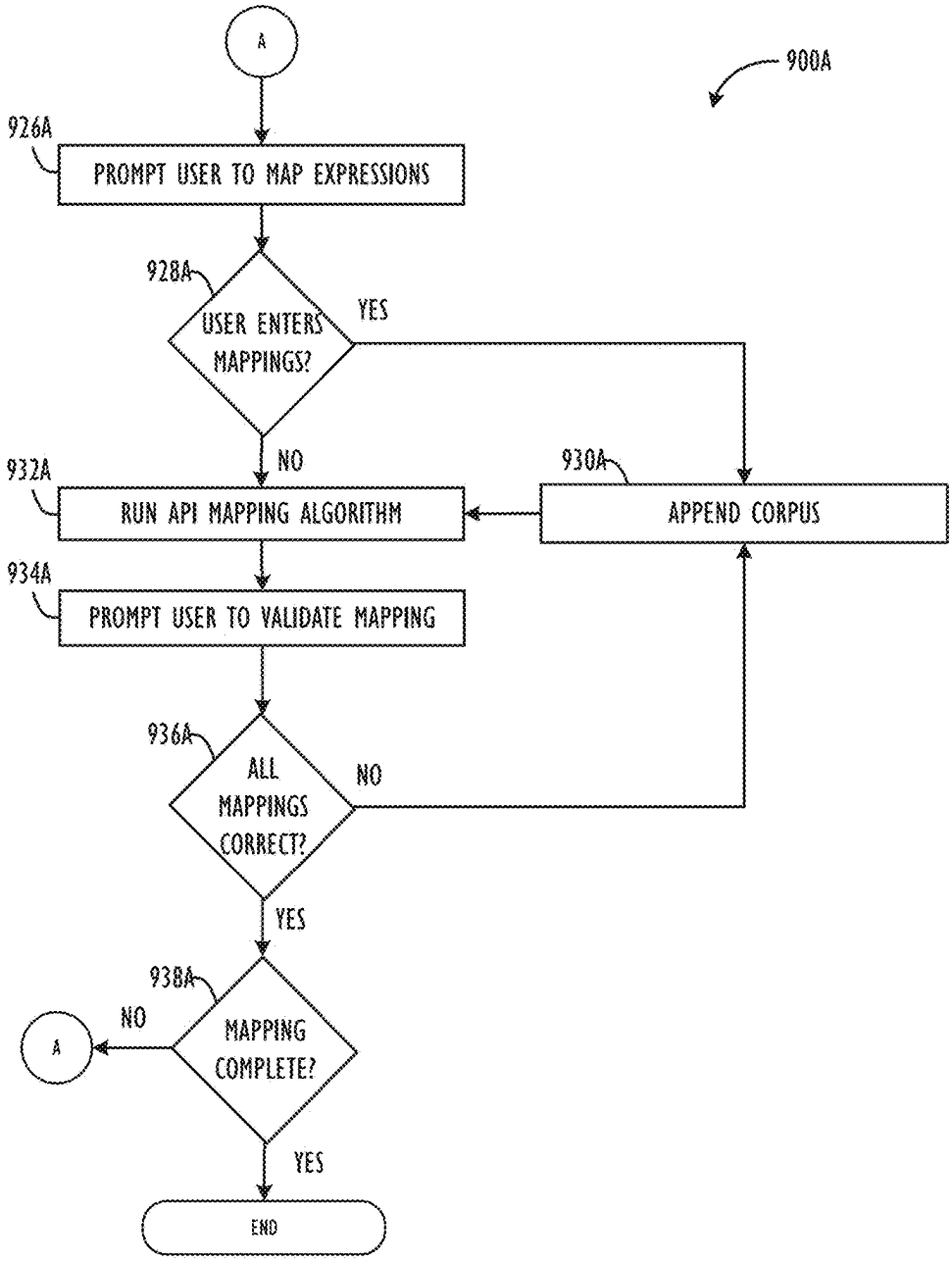

A
900A
926A
PROMPT USER TO MAP EXPRESSIONS
928A
USER ENTERS MAPPINGS?
YES
NO
930A
APPEND CORPUS
932A
RUN API MAPPING ALGORITHM
934A
PROMPT USER TO VALIDATE MAPPING
936A
ALL MAPPINGS CORRECT?
NO
YES
938A
MAPPING COMPLETE?
NO
A
YES
END

FIG. 9B

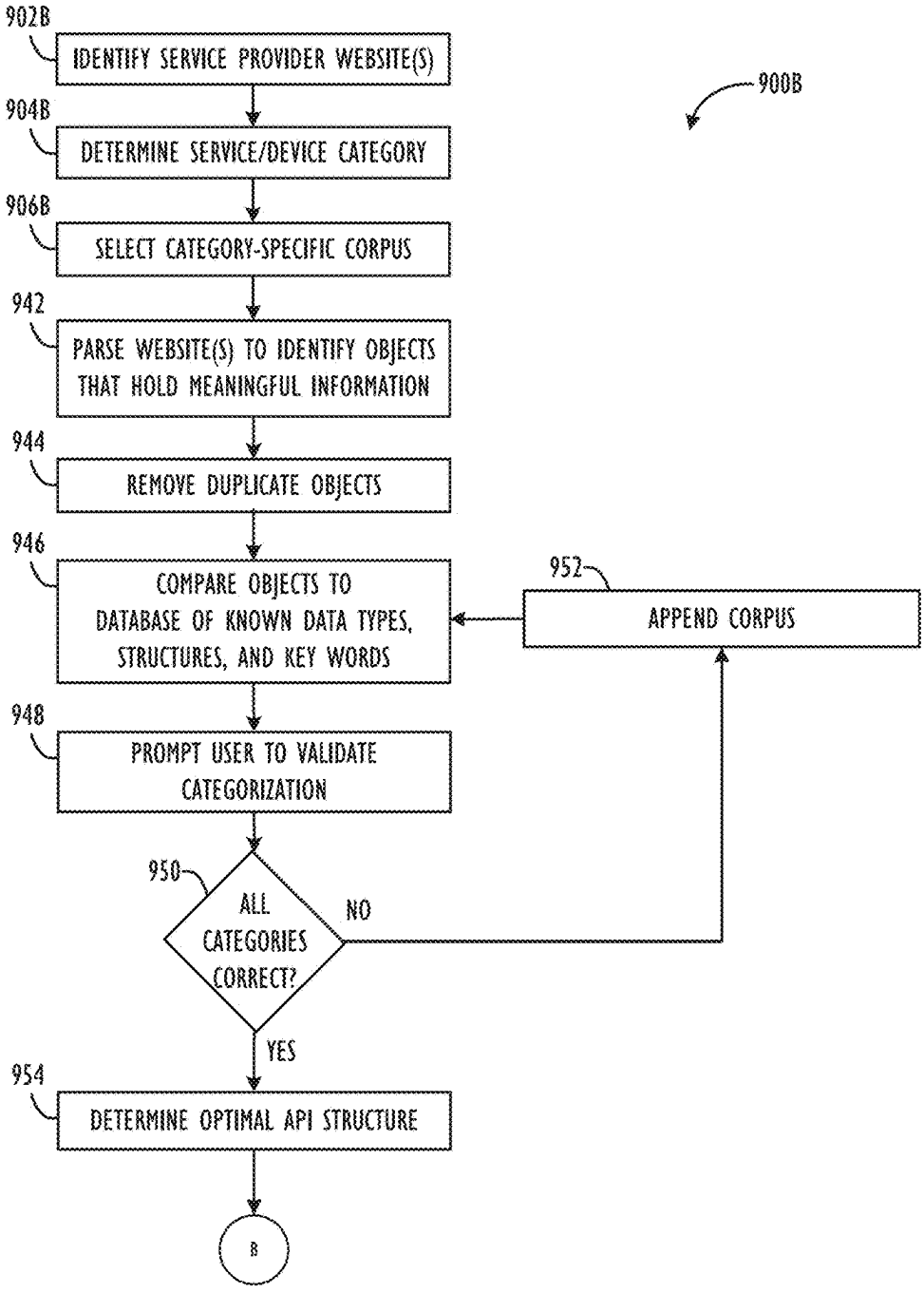

900B
902B
IDENTIFY SERVICE PROVIDER WEBSITE(S)
904B
DETERMINE SERVICE/DEVICE CATEGORY
906B
SELECT CATEGORY-SPECIFIC CORPUS
942
PARSE WEBSITE(S) TO IDENTIFY OBJECTS THAT HOLD MEANINGFUL INFORMATION
944
REMOVE DUPLICATE OBJECTS
946
COMPARE OBJECTS TO DATABASE OF KNOWN DATA TYPES, STRUCTURES, AND KEY WORDS
952
APPEND CORPUS
948
PROMPT USER TO VALIDATE CATEGORIZATION
950
ALL CATEGORIES CORRECT?
NO
YES
954
DETERMINE OPTIMAL API STRUCTURE
B

FIG. 9C

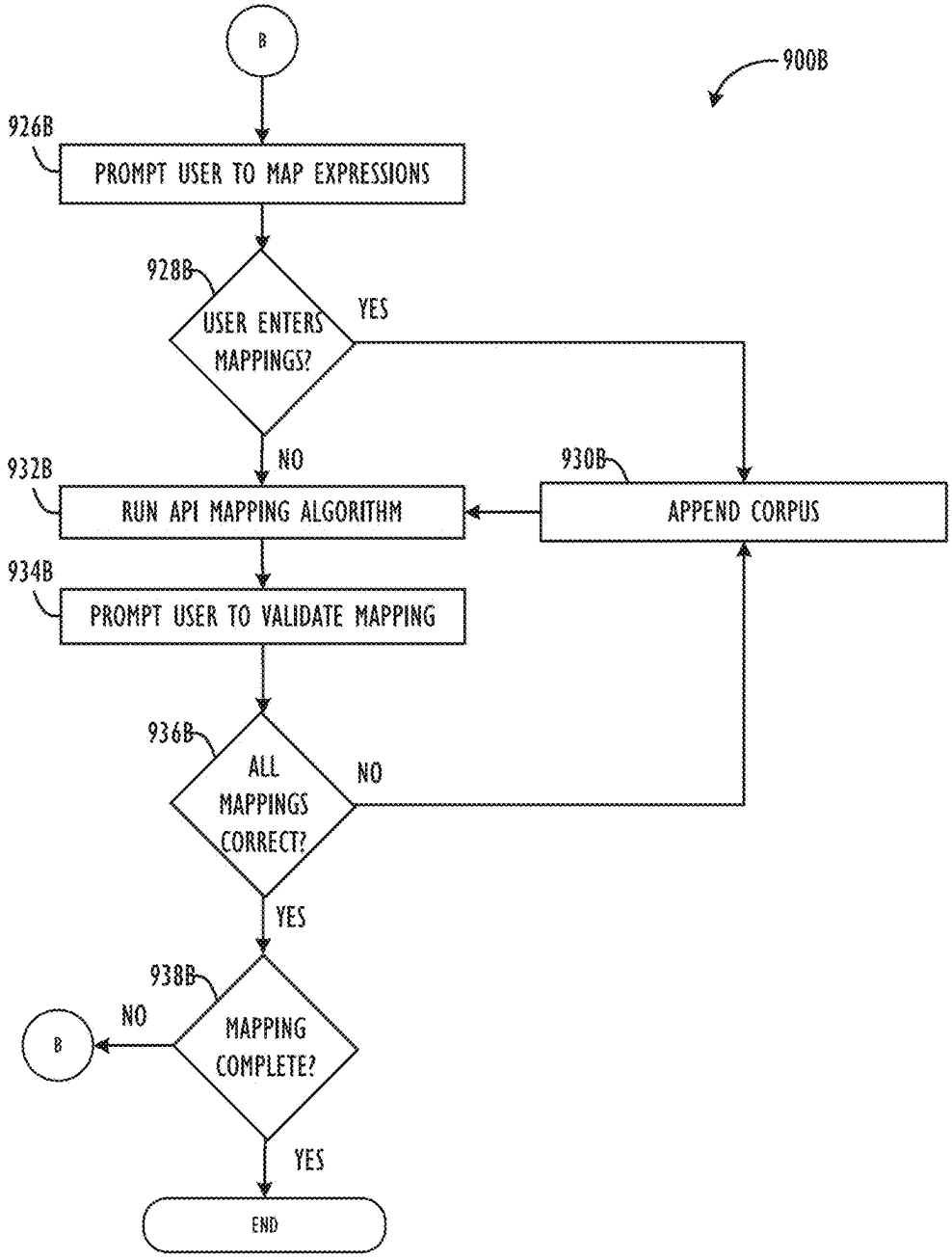

B
900B
926B
PROMPT USER TO MAP EXPRESSIONS
928B
USER ENTERS MAPPINGS?
YES
NO
930B
APPEND CORPUS
932B
RUN API MAPPING ALGORITHM
934B
PROMPT USER TO VALIDATE MAPPING
936B
ALL MAPPINGS CORRECT?
NO
YES
938B
MAPPING COMPLETE?
NO
B
YES
END

FIG. 9D

# UNIVERSAL INTERACTION PLATFORM FOR PEOPLE, SERVICES, AND DEVICES

## TECHNICAL FIELD

This disclosure relates generally to apparatuses, methods, and computer readable media for interacting with people, services, and devices across multiple communications formats and protocols.

## BACKGROUND

A growing number of service providers allow users to request information or services from those service providers via a third party software applications. Additionally, a growing number of smart devices allow users to obtain information from and control those smart devices via a third party software application. Meanwhile, individuals communicate with each other using a variety of protocols such as email, text, social messaging, etc. In an increasingly chaotic digital world, it's becoming increasingly difficult for users to manage their digital interactions with service providers, smart devices, and individuals. A user may have separate software applications for requesting services from a number of service providers, for controlling a number of smart devices, and for communicating with individuals. Each of these separate software applications may have different user interfaces and barriers to entry.

The subject matter of the present disclosure is directed to overcoming, or at least reducing the effects of, one or more of the problems set forth above. To address these and other issues, techniques that enable seamless, multi-format, multi-protocol communications are described herein.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram illustrating a network architecture infrastructure according to one or more disclosed embodiments.

FIG. **2**A is a block diagram illustrating a computer which could be used to execute the multi-format/multi-protocol communication approaches described herein according to one or more of disclosed embodiments.

FIG. **2**B is a block diagram illustrating a processor core, which may reside on a computer according to one or more of disclosed embodiments.

FIGS. **3**A through **3**G show examples of a multi-protocol, multi-format inbox, according to one or more disclosed embodiments.

FIG. **4** is a block diagram of a universal interaction platform, according to one or more disclosed embodiments.

FIGS. **5**A and **5**B are examples of publicly available information regarding a service provider that may be downloaded by the universal interaction platform, according to one or more disclosed embodiments.

FIG. **6**A shows exemplary protocols and formats required to output an instruction to a service provider via an API.

FIG. **6**B shows an exemplary format of a response from a service provider.

FIG. **7** shows an exemplary format of an object sent to and from a smart device

FIG. **8** shows a flowchart of a method for communicating with a smart device or a service provider, according to one or more disclosed embodiments.

FIGS. **9**A and **9**B show a flowchart of a method for determining the protocols and formats required by a smart device or service provider to interact with the smart device or service provider via an API, according to one or more disclosed embodiments.



FIGS. **9**C and **9**D show a flowchart of a process for determining the protocols and formats to obtain information regarding a service provider that provides the information in an unstructured format or in an unknown structure, according to one or more disclosed embodiments.

## DETAILED DESCRIPTION

Disclosed are apparatuses, methods, and computer readable media for integrating communications for computing devices across multiple formats and multiple protocols. More particularly, but not by way of limitation, this disclosure relates to apparatuses, methods, and computer readable media to permit computing devices, e.g., smartphones, tablets, laptops, wearables, and the like, to present users with a multi-protocol, multi-format inbox for communicating with people and service providers and for controlling devices via multiple formats and communication protocols.

Referring now to FIG. **1**, a network architecture infrastructure **100** is shown schematically. The infrastructure **100** includes computer networks **110**, interaction platform devices **120**, client devices **130**, third party communications devices **140**, third party service provider devices **150**, and smart devices **160**.

The computer networks **110** may include any communications network that allows computers to exchange data, such as the internet **111**, local area networks **112**, corporate networks **113**, cellular communications networks **114**, etc. Each of the computer networks **110** may operate using any number of network protocols (e.g., TCP/IP). The computer networks **110** may be connected to each other and to the various computing devices described herein (e.g., the interaction platform devices **120**, the client devices **130**, the third party communications devices **140**, the third party service provider devices **150**, and the smart devices **160**) via hardware elements such as gateways and routers.

The interaction platform devices **120** may include one or more servers **121** and one or more storage devices **122**. The one or more servers **121** may include any suitable computer hardware and software configured to provide the features disclosed herein. The storage devices **122** may include any tangible computer-readable storage media including, for example, read-only memory (ROM), random-access memory (RAM), magnetic disc storage media, optical storage media, solid state (e.g., flash) memory, etc.

The client devices **130** may include any number of computing devices that enable an end user to access the features disclosed herein. For example, the client devices **130** may include, for example, desktop computers **131**, tablet computers **132**, mobile phone **133**, notebook computers **134**, etc.

The third party communications devices **140** may include email servers such as a GOOGLE® or YAHOO!® email server (GOOGLE is a registered service mark of Google Inc. YAHOO! is a registered service mark of Yahoo! Inc.), third party instant message servers such as a YAHOO!® Messenger or AOL® Instant Messaging server (AOL is a registered service mark of AOL Inc.), third party social network servers such as a FACEBOOK® or TWITTER® server (FACEBOOK is a registered trademark of Facebook, Inc. TWITTER is a registered service mark of Twitter, Inc.), cellular service provider servers that enable the sending and receiving of messages such as email messages, short message service (SMS) text messages, multimedia message

service (MMS) messages, or any other device that enables individuals to communicate using any protocol and/or format.

The third party service devices **150** may include any number of computing devices that enable an end user to request one or more services via network communication.

The smart devices **160** may include any number of hardware devices that communicate via any of the computer networks **110** and are capable of being controlled via network communication.

As described in more detail below, the universal interaction platform allows users to interact with individuals, service providers, and smart devices **160** by sending a message (in the form of a message object) from a client device **130**. The message object is output by the client device **130** for transmittal to the server **121**. When the user is interacting with a service provider, the universal interaction platform formats an instruction for the third party service device **150** associated with the service provider and outputs the instruction from the server **121** for transmittal to the third party service device **150**. Similarly, when the user is interacting with a smart device **160**, the universal interaction platform formats an instruction for the smart device **160** and outputs the instruction from the server **121** for transmittal to the smart device **160**. The server **121** may also receive a response from the third party service device **150** or smart device **160**, format a response message (in the form of a response message object) for the user, and output the response message object for transmittal to the client device **130**.

Referring now to FIG. **2**A, an example processing device **200** for use in the communication systems described herein according to one embodiment is illustrated in block diagram form. Processing device **200** may serve in, e.g., a server **121** or a client device **130**. Example processing device **200** comprises a system unit **205** which may be optionally connected to an input device **230** (e.g., keyboard, mouse, touch screen, etc.) and display **235**. A program storage device (PSD) **240** (sometimes referred to as a hard disk, flash memory, or non-transitory computer readable medium) is included with the system unit **205**. Also included with system unit **205** may be a network interface **220** for communication via a network (either cellular or computer) with other mobile and/or embedded devices (not shown). Network interface **220** may be included within system unit **205** or be external to system unit **205**. In either case, system unit **205** will be communicatively coupled to network interface **220**. Program storage device **240** represents any form of non-volatile storage including, but not limited to, all forms of optical and magnetic memory, including solid-state storage elements, including removable media, and may be included within system unit **205** or be external to system unit **205**. Program storage device **240** may be used for storage of software to control system unit **205**, data for use by the processing device **200**, or both.

System unit **205** may be programmed to perform methods in accordance with this disclosure. System unit **205** comprises one or more processing units, input-output (I/O) bus **225** and memory **215**. Access to memory **215** can be accomplished using the communication bus **225**. Processing unit **210** may include any programmable controller device including, for example, a mainframe processor, a mobile phone processor, or, as examples, one or more members of the INTEL® ATOM™, INTEL® XEON™, and INTEL® CORE™ processor families from Intel Corporation and the Cortex and ARM processor families from ARM. (INTEL, INTEL ATOM, XEON, and CORE are trademarks of the Intel Corporation. CORTEX is a registered trademark of the ARM Limited Corporation. ARM is a registered trademark of the ARM Limited Company). Memory **215** may include one or more memory modules and comprise random access memory (RAM), read only memory (ROM), programmable read only memory (PROM), programmable read-write memory, and solid-state memory. As also shown in FIG. **2**A, system unit **205** may also include one or more positional sensors **245**, which may comprise an accelerometer, gyrometer, global positioning system (GPS) device, or the like, and which may be used to track the movement of user client devices.

Referring now to FIG. **2**B, a processing unit core **210** is illustrated in further detail, according to one embodiment. Processing unit core **210** may be the core for any type of processor, such as a micro-processor, an embedded processor, a digital signal processor (DSP), a network processor, or other device to execute code. Although only one processing unit core **210** is illustrated in FIG. **2**B, a processing element may alternatively include more than one of the processing unit core **210** illustrated in FIG. **2**B. Processing unit core **210** may be a single-threaded core or, for at least one embodiment, the processing unit core **210** may be multithreaded, in that, it may include more than one hardware thread context (or "logical processor") per core.

FIG. **2**B also illustrates a memory **215** coupled to the processing unit core **210**. The memory **215** may be any of a wide variety of memories (including various layers of memory hierarchy), as are known or otherwise available to those of skill in the art. The memory **215** may include one or more code instruction(s) **250** to be executed by the processing unit core **210**. The processing unit core **210** follows a program sequence of instructions indicated by the code **250**. Each instruction enters a front end portion **260** and is processed by one or more decoders **270**. The decoder may generate as its output a micro operation such as a fixed width micro operation in a predefined format, or may generate other instructions, microinstructions, or control signals which reflect the original code instruction. The front end **260** may also include register renaming logic **262** and scheduling logic **264**, which generally allocate resources and queue the operation corresponding to the convert instruction for execution.

The processing unit core **210** is shown including execution logic **280** having a set of execution units **285-1** through **285**-N. Some embodiments may include a number of execution units dedicated to specific functions or sets of functions. Other embodiments may include only one execution unit or one execution unit that can perform a particular function. The execution logic **280** performs the operations specified by code instructions.

After completion of execution of the operations specified by the code instructions, back end logic **290** retires the instructions of the code **250**. In one embodiment, the processing unit core **210** allows out of order execution but requires in order retirement of instructions. Retirement logic **295** may take a variety of forms as known to those of skill in the art (e.g., re-order buffers or the like). In this manner, the processing unit core **210** is transformed during execution of the code **250**, at least in terms of the output generated by the decoder, the hardware registers and tables utilized by the register renaming logic **262**, and any registers (not shown) modified by the execution logic **280**.

Although not illustrated in FIG. **2**B, a processing element may include other elements on chip with the processing unit core **210**. For example, a processing element may include memory control logic along with the processing unit core

210. The processing element may include I/O control logic and/or may include I/O control logic integrated with memory control logic. The processing element may also include one or more caches.

Multi-Protocol, Multi-Format Inbox

FIG. 3A shows an example of a multi-protocol, person-centric, multi-format inbox 300, according to one or more disclosed embodiments. The inbox 300 shown in FIG. 3A may, for example, be displayed on the display of any of the client devices 130 such as a desktop computer 131, a tablet computer 132, a mobile phone 133, a notebook computer 134, or other computing device. In certain embodiments, elements of the inbox 300 may be interacted with by a user utilizing a touchscreen interface or any other suitable input interface.

The inbox 300 enables user to interact with people across multiple formats and multiple protocols (e.g., email, text, voice, video, social messaging, etc.) as described, for example, in U.S. patent application Ser. No. 14/141,551, filed Dec. 27, 2013; U.S. patent application Ser. No. 14/168,815, filed Jan. 30, 2014; U.S. patent application Ser. No. 14/461,967, filed Aug. 18, 2014; and U.S. patent application Ser. No. 14/579,712, filed Dec. 22, 2014. The disclosure of each of the foregoing patent applications (collectively referred to herein as "The Entefy personal communications patent applications") are hereby incorporated by reference. Each person is represented on a row. In the example of FIG. 3A, rows 304 and 308 represent people, specifically exemplary individuals 'Emma Poter' and 'Peter Ehrmanntraut.'

As is shown across the top row 302 of the inbox 300 also enables users to interact with service providers and devices via multiple formats and communication protocols. All messages may be combined together into a single, unified inbox, as is shown in FIG. 3A.

In the example of FIG. 3A, row 316 represents a smart device 160, for example a smart thermostat.

In the example of FIG. 3A, row 315 represents a service provider, for example an on-demand ride service.

Referring now to FIG. 3B, an example of an interface 320 to interact with a particular smart device 160 is shown, according to one or more disclosed embodiments. The interface 320 is output to the user, for example, if the user selects row 316 of the interface 300.

The top portion 321 of the interface 320 includes a pictorial icon 322 and the name of the particular smart device 160 (in this example, a smart thermostat) as well as buttons to view and/or change settings related to the smart device 160. The interface 320 also includes a device interface 325 to control the smart device 160. In this instance, up arrow 326 increases the target temperature 327 of the smart thermostat and the down arrow 328 decreases the target temperature 327. As described in more detail below, the universal interaction platform allows a user to interact with the smart device 160 by sending messages to the smart device 160 using natural language. In the example shown in FIG. 3B, row 330 represents messages to and from one smart thermostat and row 332 represents messages to and from all of the user's smart thermostats. The universal interaction platform also allows a user to interact with a provider of the smart device 160. In the example shown in FIG. 3B, row 334 represents promotional messages from the provider of the smart thermostat.

Referring now to FIG. 3C, an example of an interface 340 for messages to and from a particular smart device 160 is shown, according to one or more disclosed embodiments. The interface 340 is output to the user, for example, if the user selects row 330 of the interface 320.

As described in more detail below, the interface 340 allows users to interact with the smart device 160 by sending messages using natural language. The universal interaction platform also receives responses from the smart device 160, formats the responses in the form of messages for the user from the smart device 160, and outputs the messages to the user via the interface 340. The interface 340 includes message history 342 showing messages from the user to the smart device 160 and responses from the smart device 160 in the form of messages to the user from the smart device 160. Messages to the smart device 160 may include text (input, for example, by a keyboard or virtual 'on screen' keyboard output by a touchscreen) or sound (input, for example, by a microphone). The interface 340 may include a text entry box 344 and a microphone icon 346 to record sound or convert speech to text. A back button 348 may be used to return to the interface 320 and a send button 349 may be used to send the message to the smart device 160.

Referring now to FIG. 3D, an example of an interface 350 for promotional messages from the provider of a smart device 160 is shown, according to one or more disclosed embodiments. The interface 350 is output to the user, for example, if the user selects row 334 of the interface 320.

The interface 350 includes a message area 352 where messages from the provider of the smart device 160 are displayed to the user. The interface 350 may also include a call button 354 to place a telephone call to the provider of the smart device 160. Similar to the interface 340, the interface 350 may also include a text entry box 344 to enter text-based response to the provider of the smart device 160, a send button 349 to send the text-based response, a microphone icon 346 to record sound or convert speech to text, and a back button 348 to return to the interface 320.

Referring now to FIG. 3E, an example of an interface 360 to interact with a particular service provider is shown, according to one or more disclosed embodiments. The interface 360 is output to the user, for example, if the user selects row 315 of the interface 300.

The top portion 361 of the interface 360 includes a pictorial icon 362 and the name of the particular service provider (in this example, a ride service) as well as buttons to view and/or change settings related to the service provider. The interface 360 also includes a service provider interface 362 to interact with the service provider. As described in more detail below, the universal interaction platform allows a user to request services from a service provider by sending messages using natural language. In the example shown in FIG. 3E, row 366 represents messages requesting services from the service provider and messages from the service provider regarding those services. In the example shown in FIG. 3E, row 368 represents promotional messages from the service provider.

Referring now to FIG. 3F, an example of an interface 370 for messages to and from a particular service provider is shown, according to one or more disclosed embodiments. The interface 370 is output to the user, for example, if the user selects row 366 of the interface 360.

As described in more detail below, the interface 370 allows users to interact with the service provider by sending messages using natural language. The universal interaction platform also receives responses from the service provider, formats the responses in the form of messages for the user from the service provider, and outputs the messages to the user via the interface 370. The interface 370 includes message history 372 showing messages from the user to the service provider and responses from the service provider in the form of messages to the user from the smart device 160.

Messages to the service provider may include text (input, for example, by a keyboard or virtual 'on screen' keyboard output by a touchscreen) or sound (input, for example, by a microphone). Similar to the interface **340**, the interface **370** may include a text entry box **344** to enter text-based messages to the service provider, a microphone icon **346** to record sound or convert speech to text, a back button **348** to return to the interface **360** and a send button **349** to send the message to service provider. Each service provider may have more than one protocol for requesting services from that service provider and/or for outputting responses to service requests. For example, sending a message requesting a car may require outputting instructions to an API while the ride service may send responses by SMS and email. SMS messages may be received from more than one phone number. Email messages may be received from more than one email address (e.g., receipts@rideservice.xyz, support@rideservice.xyz, etc.). Regardless of protocol or format, the universal interaction platform described herein combines all messages to and from each service provider regarding service requests into a single interface **370**.

Referring now to FIG. **3**G, an example of an interface **380** for promotional messages from a particular service provider is shown, according to one or more disclosed embodiments. The interface **380** is output to the user, for example, if the user selects row **368** of the interface **360**.

Similar to the interface **350**, the interface **380** includes a message area **352** where messages from the service provider are displayed to the user, a call button **354** to place a telephone call to the service provider, a text entry box **344** to enter text-based response to the service provider, a send button **349** to send the text-based response, a microphone icon **346** to record sound or convert speech to text, and a back button **348** to return to the interface **360**.

Referring now to FIG. **4**, the universal interaction platform **400** is illustrated in further detail, according to one or more disclosed embodiments. The universal interaction platform **400** includes a messaging service **420**, an IoT (Internet of Things) service **430**, a natural language classifier **440**, and an API analyzer **460**. The IoT service **430** includes a number of IoT handlers **432**. The messaging service **420**, the IoT service **430**, the IoT handlers **432**, the natural language classifier **440**, and the API analyzer **460** may be implemented as software modules stored on the storage device **122** and executed by the server **121**.

The messaging service **420** sends and receives messages to and from the client devices **130** (via the inbox **300** and the interfaces **360**, **380**, etc. as described above). The messaging service **420** also communicates with the third party communications devices **140** as described, for example, in the Entefy personal communications patent applications, which are referenced above and incorporated by reference.

The IoT service **430** includes an IoT handler **432** for each service provider or smart device **160** supported by the universal interaction platform **400**. Each IoT handler **432** may interact with a particular service provider or type (e.g., brand, model, etc.) of smart device **160**. For example, IoT handler **432***a* may interact with the ride service described above while IoT handler **432***i* may interact with the smart thermostat described above.

The natural language classifier **440** is a machine learning tool that derives meaning from natural language by applying rules developed by analyzing a large corpora of real-world examples. As described in more detail below, the corpora may include publicly-available data sets as well as natural language documents collected by the universal interaction platform **400** such as messages output by users, descriptions of the services provided by the service providers, documentation regarding the services and the smart devices **160**, etc.

The universal interaction platform **400** enables users to interact with smart devices **160** and service providers via the multi-protocol, multi-format inbox **300** illustrated in FIGS. **3**A-**3**G.

In some instances, the universal interaction platform **400** obtains information regarding a service provider by downloading publicly-available information regarding the service provider and storing that information in a structured data set such that the universal interaction platform **400** is able to respond to user queries.

FIGS. **5**A and **5**B are examples of publicly available information regarding a service provider (in this example, a commuter train system) that may be downloaded by the universal interaction platform **400**, according to one or more disclosed embodiments. As shown in FIG. **5**A, the universal interaction platform **400** may download information from the commuter train system website including, for example, the departure times of trains from stations and the locations of each of the stations. The universal interaction platform **400** stores the downloaded information in a structured data set such that the universal interaction platform **400** is able to provide the information in response to user queries. For example, in response to a query at 7:30 am regarding the next northbound train from Mountain View, the universal interaction platform **400** is able to respond that the next northbound train is scheduled to depart from Mountain View at 7:37.

The universal interaction platform **400** may periodically download information from service providers so as to provide real-time or near real-time information to users. Referring to FIG. **5**B, for example, the commuter train system website is periodically updated with predicted departure information at each of the stations within the commuter train system. The universal interaction platform **400** may, for example, periodically download the predicted departure information, store the predicted departure information as part of the structured data set, and output the predicted departure information in response to user queries. For example, in response to a user query regarding the next train to from Palo Alto to Menlo Park, the universal interaction platform **400** determines that the 231 and 233 trains stop at Menlo Park based on the information in FIG. **5**A and determines that the 231 train is predicted to depart in 19 minutes based on the information in FIG. **5**B.

In other instances, a service provider may maintain an application programming interface (API) that enables the universal interaction platform **400** to receive information regarding the services offered by the service provider and/or send instructions to the service provider. In this instance, the API documentation may specify the services provided by the service provider and the protocols and formats required by the service provider to request information regarding those services and/or to request those services.

FIG. **6**A shows exemplary protocols and formats required to output an instruction to a service provider via an API (in this example, the ride service described above). The API may be configured to allow the universal interaction platform **400** to perform a function (i.e., request information or request a service) by outputting an instruction using a specified method to a specified endpoint with specified parameters. The methods, endpoints, and parameters may be specified in the API documentation. As shown in FIG. **6**A, the ride service maintains an API that allows the universal interaction platform **400** to request, for example, a list of available services ("List products") at a particular location

by specifying the longitude and latitude of the particular location and outputting an instruction to the specified endpoint (/v1/products) using the specified method (GET). The rider service API also allows the universal interaction platform **400** to request a service ("Create ride request") by outputting an instruction specifying the service (i.e., "product_id") and the start location (i.e., "start_latitude" and "start_longitude") and other optional parameters and to the specified endpoint (/v1/requests) using the specified method (POST).

An API may also specify the protocol for receiving information from the service provider and the format of the information output by the service provider. FIG. **6**B shows an exemplary format of a response from a service provider (in this instance, a response from Uber to a request for a list of available services). As shown in FIG. **6**B, the Uber API outputs a status code (200 OK) to indicate that the request was successfully processed and details regarding available services. In this instance, an non-luxury car ("display_name": "CarX"; "capacity": 4) and a sport utility vehicle ("display_name": "CarXL"; "capacity": 6) are available. The protocol for receiving information from the service provider and the format of the information output by the service provider may also be specified by the service provider in the API documentation.

In other instances, a smart device **160** may have an API that enables the universal interaction platform **400** to receive information stored in the smart device **160** and/or send instructions to the smart device **160** by sending and receiving an object to and from the smart device **160**. The object may be, for example, in JavaScript Object Notation (JSON) format, extensible markup language (XML) format, etc. The protocol for communicating with the smart device **160** and the format of the object may be specified by the provider of the smart device **160** in the API documentation.

FIG. **7** shows an exemplary format of an object sent to and from a smart device **160** (in this example, the smart thermostat described above) to receive information from and control the smart device **160**. For example, the universal interaction platform **400** may receive an object from the thermostat with the data values shown in FIG. **7**, store the data shown in FIG. **7**, and output the information shown in FIG. **7** in response to a query from a user regarding the thermostat. For example, if a user submits a query regarding the ambient temperature, the universal interaction platform **400** outputs a message indicating that the ambient temperature is 72 degrees Fahrenheit based on the message object received from the thermostat.

In order to control the smart thermostat, the thermostat requires an object with the same data values shown in FIG. **7** and the relevant metadata for the particular thermostat. Accordingly, in response to a request from a user to set the target temperature to 68 degrees Fahrenheit, the universal interaction platform **400** outputs an object in the format shown in FIG. **7** (with the target temperature_f value set to 68) for transmittal to the smart device **160** via, for example, the LAN **112**, the internet **111**, and the LAN **112**.

FIG. **8** shows a flowchart **800** of a method for communicating with a smart device **160** or a service provider, according to one or more disclosed embodiments.

A client device **130** outputs a message object in step **802**. The message object may be, for example, a universal message object in JavaScript Object Notation (JSON) format. The message object may include the body of the message input by the user, for example, via a message interface (e.g., **360**, **380**) and information indicative of the recipient (i.e., a smart device **160** or service provider) selected by the user via the inbox **300**.

The messaging service **420** receives the message object in step **804** and saves a copy of the message in a database in step **806**. The database may be stored, for example, in the storage device **122**. The messaging service **420** determines the identity of the recipient in step **808**. If the recipient is a person (Step **810**: Yes), the messaging service **420** outputs the message to the recipient in step **812** (as described, for example, in "the Entefy personal communications patent applications, which are referenced above and incorporated by reference).

If the recipient is a smart device **160** or a service provider (Step **810**: No), the natural language classifier **440** parses the message content to determine the intent of the user in step **814**. The natural language classifier **440** determines user intent by making a probabilistic determination based on a large data set of information including previous messages output by the user and other users, documentation regarding the selected smart device **160** or service provider, publicly available and other natural language data sets. For each smart device **160** and service provider supported by the universal interaction platform **400**, for example, the universal interaction platform **400** may store a map in the storage device **122** that associates natural language expressions previously sent by users (or that could potentially be sent by users) with user intents relevant to the smart device **160** or service provider. The natural language classifier **440** determines the user intent by finding the natural language expression that is most similar to the message sent by the user and selecting the user intent associated with the natural language expression. Using a smart thermostat (e.g., Next) as an example, an exemplary map is shown in Table 1.

TABLE 1

| User Intent | Natural Language Expression |
|---|---|
| Set target temperature to <temp> | "Set the temperature to <temp>"<br>"Set temp to <temp>"<br>"Set thermostat to <temp>"<br>"I'd like it to be <temp> in here"<br>"Make it <temp>" |
| Increase target temperature by <delta_temp> | "Increase the temperature by <delta_temp>"<br>"Make it <delta_temp> hotter"<br>"Make it <delta_temp> warmer"<br>"Bump it up <delta_temp> degrees" |
| Decrease target temperature by <delta_temp> | "Decrease the temperature by <delta_temp>"<br>"Make it <delta_temp> cooler"<br>"Make it <delta_temp> colder"<br>"Drop it down <delta_temp> degrees" |
| Output target temperature | "What are you set to?" |
| Output ambient temperature | "What's the temperature?" |

If, for example, the universal interaction platform **400** receives a message from a user stating "I'd like it to be 68 in my house," the natural language classifier **440** compares the message received from the user with the natural language expressions stored in the map and determines the natural language expression ("I'd like it to be <temp> in here") that is most similar to the message received from the user ("I'd like it to be 68 in my house") and selects the user intent (in this instance, to set the temperature to 68) associated with the most similar natural language expression.

The universal interaction platform **400** also determines user intent based on other factors, such as the location of the client device **130** and/or the time the message object was output by the client device **130** (or received by the server **121**). Returning to the ride service example above, a user

may output a message requesting a ride and the universal interaction platform **400** may determine that the user intent is to request a ride from the current location of the client device **130**. Returning to the commuter train system example above, a user near may output a message asking about the next train to San Francisco. The universal interaction platform **400** may determine that the client device **130** is closest to Palo Alto and, therefore, may determine that, in this instance, the user intent is to request the departure time for the next train to San Francisco from Palo Alto. Furthermore, the universal interaction platform **400** may determine that the client device **130** is closest to Palo Alto but is not close enough for the user to board the next train to San Francisco. Accordingly, the universal interaction platform **400** may determine that the user intent, in this instance, is to request the departure time for the second train to San Francisco from Palo Alto.

The universal interaction platform **400** also determines user intent based on previous messages output by the user via the inbox **300**. Accordingly, universal interaction platform **400** may also store a map of natural language expressions for a particular user. Returning to the smart thermostat example above, an exemplary map of natural language expressions for a particular user is shown in Table 2.

TABLE 2

| User Intent | Natural Language Expression |
|---|---|
| degrees Fahrenheit | "degrees" |
| 2 degrees Fahrenheit | "a few degrees"<br>"a bit" |
| Increase temperature by <delta_temp> | "Bump it up <delta_temp> degrees" |
| Decrease temperature by <delta_temp> | "Drop it down <delta_temp> degrees" |
| Output ambient temperature | "Is it hot in here?" |
| Increase temperature by 2 degrees F. | "I'm cold" |
| Set target temperature to 68 degrees F. | "Brian is coming over" |

If, for example, the universal interaction platform **400** receives a message from the user associated with Table 2 stating "Make it a bit warmer", the natural language classifier **440** compares the message received from the user with the natural language expressions stored in Tables 1 and 2, determines the natural language expressions ("Make it <delta_temp> warmer" and "a bit") that are most similar to the messages received from the user ("Make it a bit warmer"), and determines the intent of the user. In this example, the intent of the user to increase the temperature is found in Table 1 and the exact value of the increase is found in Table 2.

The universal interaction platform **400** develops the map of natural language expressions for a particular user based on previous messages output by the user via the inbox **300**. For example, the first time a user outputs a message to the universal interaction platform **400** for transmittal to the smart thermostat and the universal interaction platform **400** cannot determine the user intent based on the map used for all users shown in Table 1 (for example, when the user says "a bit" or "I'm cold" or "Brian is coming over"), the universal interaction platform **400** may ask the user to clarify how the user would like the smart thermostat to respond and then store that user intent for future use when the user outputs another message using similar language. Returning to the ride service example above, if the user requests a ride from "Brian's house", the universal interaction platform **400** may ask "Where is Brian's house?" (or "Are you currently at Brian's house?") and then map the user's response (or the location of the client device **130**) to "Brian's house" for future use.

Because there is a finite number of relevant instructions for each smart device **160** or service provider, there is a finite number of relevant user intents. Accordingly, the universal interaction platform **400** is able to map each user intent to any number of natural language expressions. The natural language classifier **440** is then able to quickly and accurately determine the user intent based on the natural language expressions used by the user.

The IoT handler **432** associated with the selected service provider or smart device **160** formats an instruction for the smart device **160** or service provider in step **816**. The universal interaction platform **400** stores the formats and protocols required by each of the smart devices **160** and service providers supported by the platform in the storage device **122**. Additionally, the universal interaction platform stores a map associating each of the user intents described above with a properly formatted instruction for the smart device **160** and service provider.

Using a smart thermostat again as an example, a map associating each of the user intents described above with a properly formatted instruction is shown in exemplary Table 3.

TABLE 3

| User Intent | Instruction |
|---|---|
| Set temperature to <temp> | target_temperature_f: <temp> |
| Increase temperature by <delta_temp> | target_temperature_f: target_temperature_f + <delta_temp> |
| Decrease temperature by <delta_temp> | target_temperature_f: target_temperature_f − <delta_temp> |
| Output target temperature | RETURN target_temperature_f |
| Output ambient temperature | RETURN ambient_temperature_f |

In the smart thermostat example above, the IoT handler **432** associated with the type of smart thermostat formats an instruction to set the temperature to 68 degrees Fahrenheit by building a JSON object with the metadata for the specific smart thermostat and the required data values (for example, device_id: peyiJNo0IldT2Y1IVtYaGQ; locale: en-US; . . . target_temperature_f: 68) and outputting the JSON object for transmittal to the thermostat.

Using the ride service again as an example, the IoT handler **432** associated with the ride service request formats an instruction to request a ride by including all of the required parameters specified in the API documentation (for example, start_latitude: 37.334381; start_longitude: −121.89432; end_latitude: 37.77703; end_longitude: −122.419571; product_id: a1111c8c-c720-46c3-8534-2fcdd730040d) and outputting the instruction to the API endpoint (/v1/requests) specified in the API documentation.

In other instances, the IoT service **430** may determine that the most probable way to interact with a service provider is to send an email to the service provider. For example, a user may input a query requesting a quote for new electric service from XYZ Electric. The universal interaction platform **400**, having previously downloaded information from the XYZ website, may not have the information necessary to respond to the user query but may have determined that requests for services may be sent by email to bob@xyzelectric.com. Accordingly, the IoT Service **430** may determine that the method that will most probably return an answer to the user query is to have the messaging service **420** format an email with the fields required for that particular service provider (for example, to: bob@xyzelectric.com) and a body of the

email indicative of the user intent (for example, body: "A user has requested a quote for a new electric service.") and output the email message to the service provider.

If the IoT handler **432** associated with the device **160** or service provider selected by the user is unable to format the instruction for the smart device **160** or service provider (Step **818**: No), the natural language classifier **440** parses the message object (received from the user in step **804**) to determine the relevant device category or service category in step **822**. For example, the relevant category may be transit.

The IoT service **430** determines the IoT handlers **432** that are relevant to the device category or service category in step **824**. The relevant IoT handlers **432** may be selected from among the IoT handlers **432** associated with smart devices or services set up by the user.

The IoT service **430** outputs the message object to all of the relevant IoT handlers **432** in step **826**. Each of the IoT handlers **834** respond to the message object with a given confidence level that the message object is relevant to the smart device **160** or service provider associated with that IoT handler **432** in step **828**. The IoT service **430** selects the IoT service **432** with the highest confidence level in step **830**. The selected IoT handler **432** formats an instruction in step **831** as described above with reference to step **816**.

The IoT handler **432** (or the messaging service **420**) outputs the instruction for transmittal to the smart device **160** or third party service provider device **150** in step **820**.

The IoT handler **432** may receive a response from the service provider device **150** or the smart device **160** in step **832**. The response may be in the form of an object, an email message, an SMS message, etc. As described above with reference to FIGS. **6**B and **7**B, responses from service provider devices **150** and start devices **160** have a format that is known to the universal interaction platform **400**. For example, the format of response messages may be specified in the API documentation. In another example, the format of response messages may be determined by parsing previous response messages from the same smart device **160** or service provider device **150**. Accordingly, the universal interaction platform **400** is able to parse the response for information relevant to the user and output a message to the user. As shown in FIGS. **3**C and **3**E, the response message to the user is output by the universal interaction platform **400** via the multi-format, multi-protocol inbox **300** as if the response message is from the smart device **160** or service provider.

The messaging service **422** formats the response message for the user in step **834**. The response message is output using natural language. The tone of the natural language may be based on user preferences stored, for example, in the storage device **122**. The user preferences may specify a different tone for different services. For example, a user may specify a more formal tone (e.g., "Sir, your car has arrived" and "Thank you. We hope you enjoyed your trip") when the requested service is a luxury car and a more informal tone (e.g., "Your car is here" and "Trip complete" when the requested service is not a luxury car.

Additionally or alternatively, the tone of response messages output on behalf of a service provider or a smart device **160** may be specified by the service provider or provider of the smart device. A service provider or provider of a smart device may specify different tones for response messages based on the demographics of the user (age, gender, etc.). The preferences of the service providers and/or providers of smart devices **160** may be stored in the storage device **122**.

The universal interaction platform **400** updates the user preferences in the database in step **836**.

The messaging service **420** outputs the response message to the user in step **838**.

AI-Driven API Analyzer

As described above, the universal interaction platform **400** outputs instructions to third party smart devices **160** and service providers to perform certain functions. The protocols and formats required by a device or service provider to perform those functions may be determined manually. Additionally or alternatively, those protocols and formats may be determined by the API analyzer **460** as described below.

FIGS. **9**A and **9**B show a flowchart of a process **900***a* for determining the protocols and formats required by a smart device **160** or service provider to interact with the smart device **160** or service provider using natural language via an API, according to one or more disclosed embodiments.

An API endpoint for a service provider or smart device is identified in step **902***a*. In some instances, a user (for example, a developer for the service provider or provider of the smart device **160**) may identify an API endpoint by registering a device **160** or service with the universal interaction platform **400**. For example, the API analyzer **460** may include a user interface that allows a user to enter the universal resource locator (URL) of the API endpoint. In other instances, the universal interaction platform **400** may identify the API endpoint, for example by crawling the internet and identifying devices **160** or service providers to add to the universal interaction platform **400**.

A service category or device category is determined in step **904***a*. For example, the service category for a ride service may be "on-demand transit" while the device category for a smart thermostat may be "appliance" or "smart home." The service category or device category may be selected by the user. For example, the API analyzer **460** may include a user interface that allows a user to select the device category or service category. Additionally or alternatively, the natural language classifier **440** may determine a device category or service category by analyzing documentation (e.g., a website and/or API documentation) regarding the service provider or smart device **160**.

A category-specific corpus is selected in step **906***a* based on the service category or device category determined in step **904***a*. A corpus is a collection of information about the words and phrases of a language and about the lexical categories to which those words belong. The API analyzer **460** may store a category-specific corpus for each of a plurality of potential service categories and device categories in the storage device **122**. For each word and/or phrase in the category-specific corpus, the category-specific corpus may include, for example, definitions, parts of speech, synonyms, lexical connections to other words or phrases, etc. The category-specific corpus may also include weighted probabilities that each word or phrase in the category-specific corpus is related to other words or phrases in the category-specific corpus. As additional service providers and smart devices **160** are added to the universal interaction platform **400** over time, the category-specific corpuses may be modified to include additional words and phrases that are relevant to that particular category. The API analyzer **460** may also store a global corpus that may be used for all smart devices **160** and service providers or for the smart devices **160** and service providers that are unrelated to the category-specific corpuses.

As described in detail below, the API analyzer **460** forms a service-specific or device-specific corpus by appending the

category-specific corpus (or global corpus) to include words or phrases relevant to the specific smart device **160** or service.

The user is prompted to manually identify service-specific or device-specific information in step **908**. Service-specific or device-specific information may include words or phrases that are relevant to the specific service or smart device **160**. The API analyzer **460** may enable the user, for example, to manually describe service-specific or device-specific words or phrases, to upload a service-specific or device-specific dictionary, to identify an object (e.g., a JSON object, an XML object, etc.) that is relevant to the service-specific or device-specific API, etc. If the user manually identifies service-specific or device-specific information (Step: **910**: Yes), the API analyzer **460** appends the category-specific corpus (selected in step **906***a*) to include the service-specific or device-specific information in step **911**. Because the category-specific corpus may be appended to include service-specific or device-specific information, it is referred to below as a service-specific or device-specific corpus.

The user is prompted to enter a URL of API documentation in step **912**. The API analyzer **460** parses the API documentation in step **914**. The API analyzer **460** may determine, for example, the functions available via the API, and the API endpoints, methods, and parameters required to request those functions (as shown, for example, in FIG. **6**A). If the API requires that an object (as shown, for example, in FIG. **7**) be output to a smart device **160** or service provider device **150**, the API analyzer **460** may determine, for example, the data values of the object, whether a function may be performed by changing one or more of the data values, etc.

The API analyzer **460** tests the API in step **916**. Because the API documentation parsed in step **914** may be incomplete or inaccurate, the API analyzer **460** may determine, for example, whether the API may be used to perform additional functions (for example, by including different parameters than are identified in the API documentation). The API analyzer **460** may also receive and parse response messages received from the API.

The API analyzer **460** uses the service-specific or device-specific corpus described above to make probabilistic determinations of the relationships between words and phrases related to the service provider or smart device **160** (e.g., words or phrases used in the API documentation, the API endpoints, the API parameters, the data values of the object, etc.) in step **918**. For example, the API analyzer **460** may determine whether a word or phrase is a subset of another word or phrase, whether those words or phrases are synonymous, whether those words or phrases are unrelated, etc.

The API analyzer **460** may prompt the user to verify the previous determinations in step **920**. For example, the API analyzer **460** may display the API endpoints, methods, and parameters identified in step **914** via a graphical user interface and prompt the user to confirm whether those API endpoints, methods, and parameters are accurate and complete. The API analyzer **460** may also prompt the user to verify whether the relationships between words and phrases determined in step **918** are accurate. (For example, one API endpoint identified in step **914** may be/calendars/{calendarId}/events/{eventId}. Based on the API endpoint, the API analyzer **460** may determine that 'event' (or 'events') is not synonymous with 'calendar' or 'calendars' but is instead a separate referencable object. However, the API analyzer **460** may determine that there still exists a probability that 'calendar' and 'events' refer to the same thing. Accordingly, the API analyzer **460** may prompt the user to verify the previous determination that 'calendar' and 'events' are not synonymous but rather are a separate referencable objects.)

If the user indicates that one or more of the previous determinations were invalid (Step **922**: No), the API analyzer **460** appends the service-specific or device-specific corpus in step **924** and returns to step **914**. The API analyzer **460** may then re-parse the API documentation to determine API functions, endpoints, methods, and parameters (step **914**), re-test the API (step **916**, if necessary), make additional determinations regarding the relationships between words and phrases related to the service provider or smart device **160** (step **918**) and prompt the user to verify the additional determinations (step **920**) with the additional information in the device-specific or service-specific corpus.

In step **926***a*, the API analyzer **460** prompts the user to identify natural language expressions (i.e., instructions and/or queries) that are relevant to the smart device **160** or service provider (as described above, for example, with reference to Table 1) and the API functions and parameters necessary for the smart device **160** or service provider to respond to those instructions or queries (as described above, for example with reference to Table 3).

If the user maps API functions and parameters with natural language expressions (Step **928***a*: Yes) the API analyzer **460** appends the device-specific or service-specific corpus in step **930***a*.

In step **932***a*, the API analyzer **460** maps additional natural language expressions to the API functions and parameters identified in step **914**. The additional natural language expressions may be identified by parsing the device-specific or service-specific corpus. The additional natural language expressions may also be natural language expressions that were previously determined to be relevant to the same category of smart device **160** or service provider. Additionally, the additional natural language expressions may be identified based on messages sent by users via the universal interaction platform **400**. For example, the universal interaction platform **400** may store messages sent to other users, services or smart devices **160**, categorize each message as relevant to certain categories of services or smart devices **160**, and identify potentially-relevant natural language expressions from the messages that were identified as relevant to the category of services or smart devices **160**. (For the purposes of determining potentially-relevant natural language expressions, the messages are stored without personally identifiable information.)

In step **934***a*, the API analyzer **460** prompts the user to validate the API mapping performed in step **932***a*. If any of the mappings were invalid (Step **936***a*: No), the API analyzer **460** appends the device-specific or service-specific corpus in step **930***a* and re-runs the API mapping algorithm with the additional information in step **932***a*. The API analyzer **460** also prompts the user to validate that the API mapping is complete in step **934***a*. If the user wishes to map additional natural language expressions to API functions (Step **938***a*: No), the process returns to step **926***a*. Otherwise (step **938***a*: Yes), the process is complete.

FIGS. **9**C and **9**D show a flowchart of a process **900***b* for determining the protocols and formats to obtain information regarding a service provider that provides the information in an unstructured format or in an unknown structure, according to one or more disclosed embodiments. The process **900***b* may be used, for example, when a service provider does not maintain an API. The process **900***b* includes operations that are similar to the process **900***a*, which are referred to using like numbers.

Websites that describe the services provided by a service provider website are identified in step **902***b*. The websites may include the service provider website, a third party review website describing the service provider, etc. In some instances, a user (for example, the service provider) may identify the service provider websites via a user interface. In other instances, the universal interaction platform **400** may identify the service provider websites, for example by crawling the internet and identifying service providers to add to the universal interaction platform **400**.

A service category is determined (for example, by user selection or by the API analyzer **460** parsing the service provider websites) in step **904***b*. A category-specific corpus is selected in step **906***b* based on the service category determined in step **904***b*. The category-specific corpus is appended to form a service-specific corpus as described below.

The API analyzer **460** parses the content of the service provider websites to extract distinct objects that hold potentially meaningful information in step **942**. (If a service provider website says, for example, "We are available from 9 am to 10 pm at 215-569-5500 with friendly service" the API analyzer **460** may determine that '9 am,' '10 pm' and '215-569-5500' are potentially meaningful whereas "with friendly service" is not an object that includes potentially meaningful information.) The meaningful information may include any information relevant to the service provider or the services offered by the service provider. For example, the API analyzer **460** may parse a restaurant website and extract objects that include information regarding the service provider such as the name, address, telephone number, reviews, hours of operation, etc. as well as objects that include information regarding the services, such as the title, description, and price of each menu item. In the commuter train system example described above with reference to FIGS. **5**A and **5**B, the API analyzer **460** may parse the commuter train system website and extract objects that include the name and address of each station, the name of each train, and the departure times for each train, etc. The API analyzer **460** stores the objects, for example, in the storage device **122**. Each time the API analyzer **460** determines that a distinct object on the service provider websites includes relevant information, the API Analyzer **460** may store the location of that object so that the API analyzer **460** can periodically re-parse the service provider websites and quickly and easily update the information stored in the storage device **122**.

The API analyzer **460** removes duplicate objects in step **944**. The service provider websites may list certain information (for example, an address or phone number) in more than one location. Additionally, some of the same information may be included in both a service provider website and a third-party review website. Accordingly, the API analyzer **460** eliminates the duplicate objects.

The API analyzer **460** determines a probably category for each object by comparing the objects to a database of known data types, structures, and/or keywords in step **946**. In the example above, the API analyzer **460** may compare the object '215-569-5500' to the database of known data types, structures, and/or keywords and determine based on the comparison to the database that the most probable category of that object is a phone number.

The API analyzer **460** may prompt the user to validate the categorization of each object in step **948**. In the example above, the API analyzer **460** may prompt the user to confirm that '215-569-5500' is a phone number. If the user indicates that any of the categorizations are incorrect (Step **950**: No), the service-specific corpus is appended to include this additional information in step **952** and the API analyzer returns to step **946** and re-categorizes the objects.

Once the user indicates that all of the categorizations are correct (Step **950**: Yes), the API analyzer **460** determines an optimal API structure in step **954** for users to query the dataset of information regarding the service provider. The optimal API structure is a map linking the objects extracted from the service provider websites with queries for returning that meaningful information. The queries and the objects may have a many-to many relationship. Using the example above, the map may include the example queries and the objects as shown in Table 4.

TABLE 4

| Query | Object(s) |
|---|---|
| getPhoneNumber( ) | 215-569-5500 |
| getAddress( ) | One Logan Square<br>130 North 18th Street<br>Philadelphia, PA 19103-6998 |
| getBusinessInfo( ) | Blank Rome LLP<br>One Logan Square<br>130 North 18th Street<br>Philadelphia, PA 19103-6998<br>215-569-5500 |

Using the commuter train system example described above with reference to FIGS. **5**A and **5**B, the optimal API structure may include queries and parameters. For example, one query may be 'getDepartureTimes(startingStation, direction, currentTime)' where the query is a request for the departure times based on parameters that include the departure station ('startingStation'), the direction of travel ('direction') and the current time ('currentTime'). In another example, a query may be 'getTransitTime(startingStation, endingStation, currentTime)' where the query is a request for a travel time between a departure station and a destination ('endingStation') with an additional parameter of the current time used to identify the next available train to use when calculating the travel time.

The API analyzer **460** may determine the optimal API structure by comparing the dataset for the service provider to other API structures within the universal interaction platform **400** and selecting an API structure (for example, an API structure developed by a third party developer) that is used to output similar types of data. If none of the API structures within the universal interaction platform **400** are used to output similar types of data, the API analyzer **460** may simply store each object separately and create a separate query to return each of the objects. If the universal interaction platform **400** includes multiple APIs that are used to output similar types of data, the API analyzer **460** may select the API structure that is most commonly used to output similar types of data. The universal interaction platform **400** may also include an internal rating of some or all of the API structures and the API analyzer **460** may select the highest rated API structure from among the API structures that are used for similar types of data.

As described above with reference to FIG. **9**C, the API analyzer **460** extracts information regarding a service provider—information that may be in an unstructured format or in an unknown structure—and organizes that information in a structured format similar to the API structures developed by third parties as described above with reference to FIGS. **9**A and **9**B. The remaining steps of the process **900***b*, which are shown in FIG. **9**D, as similar to the process **900***a*, except that the process **900***a* maps natural language expressions to functions available via a third party API whereas the process

900*b* maps natural language expressions to queries identified by the API analyzer **460** in step **954**.

In step **926***b*, the API analyzer **460** prompts the user to map the queries identified by the API analyzer **460** in step **954** with natural language expressions (i.e., queries). Using the examples in Table 4 above, the map may include the example mappings shown in Table 5.

TABLE 5

| Query | Natural Language Expression |
|---|---|
| getPhoneNumber( ) | What is the phone number? |
| getAddress( ) | What is the address? |

Using the commuter train system example described above, the map may include the example mappings shown in Table 6.

TABLE 6

| Query | Natural Language Expression |
|---|---|
| getDepartureTimes(Palo Alto, North, currentTime) | When are the next northbound train from Palo Alto? |
| getTransitTime(Palo Alto, San Francisco, currentTime) | How long will it take to get from Palo Alto to San Francisco? |

If the user maps API functions and parameters with natural language expressions (Step **928***b*: Yes) the API analyzer **460** appends the service-specific corpus in step **930***b*.

In step **932***b*, the API analyzer **460** maps additional natural language expressions to the queries identified by the API analyzer **460** in step **954**. The additional natural language expressions may be identified by parsing the service-specific corpus. The additional natural language expressions may also be natural language expressions that were previously determined to be relevant to the same category of service provider. Additionally, the additional natural language expressions may be identified based on messages sent by users via the universal interaction platform **400**. For example, the universal interaction platform **400** may store messages sent to other users, services or smart devices **160**, categorize each message as relevant to certain categories of service providers, and identify potentially-relevant natural language expressions from the messages that were identified as relevant to the category of service providers. (For the purposes of determining potentially-relevant natural language expressions, the messages are stored without personally identifiable information.)

In step **934***b*, the API analyzer **460** prompts the user to validate the mappings performed in step **932***b*. If any of the mappings were invalid (Step **936***b*: No), the API analyzer **460** appends the service-specific corpus in step **930***b* and re-runs the API mapping algorithm with the additional information in step **932***b*. The API analyzer **460** also prompts the user to validate that the API mapping is complete in step **934***b*. If the user wishes to map additional natural language expressions to API functions (Step **938***b*: No), the process returns to step **926***b*. Otherwise (step **938***b*: Yes), the process is complete.

## EXAMPLES

The following examples pertain to further embodiments.

Example 1 is a computer-implemented method of interacting with a plurality of service providers and smart devices comprising: receiving a message object from a client device, the message object including information indicative of a user intent for an intended recipient to perform a function in response to the message object, the intended recipient being one of the plurality of service providers and smart devices; determining the intended recipient based on the message object; determining a protocol and format for communicating with the intended recipient; formatting an instruction, in the determined format, for the intended recipient to perform the function; and outputting the instruction to the intended recipient using the determined protocol.

Example 2 includes the subject matter of example 1, wherein the protocol and format are determined based on an application program interface maintained by the intended recipient.

Example 3 includes the subject matter of example 1, wherein the information indicative of the user intent is input by a user using natural language and the method further comprises determining a user intent by parsing the natural language.

Example 4 includes the subject matter of example 3, wherein the user intent is further determined based on a location of the client device, a time the message object is received, a time the message object is output by the client device, or a previous message object output by the user.

Example 5 includes the subject matter of example 1, wherein the intended recipient is a service provider and the user intent is for the service provider to perform a service or output information regarding a service.

Example 6 includes the subject matter of example 1, wherein the intended recipient is a smart device and the user intent is to control the smart device or for the smart device to output information.

Example 7 includes the subject matter of example 1, wherein the message object is output by the client device via an inbox configured to communicate with individuals and the plurality of service providers and smart devices.

Example 8 includes the subject matter of example 7, wherein the intended recipient is determined based on a user selection via the inbox.

Example 9 is a universal interaction platform, comprising: a messaging service that receives a message object from a client device, the message object including information indicative of a user intent for an intended recipient to perform a function in response to the message object, the intended recipient being one of the plurality of service providers and smart devices; and determines the intended recipient based on the message object; and an internet of things service that: determines a protocol and format for communicating with the intended recipient; formats an instruction, in the determined format, for the intended recipient to perform the function; and outputs the instruction to the intended recipient using the determined protocol.

Example 10 includes the subject matter of example 9, wherein the protocol and format are determined based on an application program interface maintained by the intended recipient.

Example 11 includes the subject matter of example 9, wherein the information indicative of the user intent is input by a user using natural language and the universal interaction platform further comprises a natural language classifier that determines the user intent by parsing the natural language.

Example 12 includes the subject matter of example 11, wherein the user intent is further determined based on a location of the client device on a time the message object is

received, a time the message object is output by the client device, or a previous message object output by the user.

Example 13 includes the subject matter of example 9, wherein the intended recipient is a service provider and the user intent is for the service provider to perform a service or output information regarding a service.

Example 14 includes the subject matter of example 9, wherein the intended recipient is a smart device and the user intent is to control the smart device or for the smart device to output information.

Example 15 includes the subject matter of example 9, wherein the message object is output by the client device via an inbox configured to communicate with individuals and the plurality of service providers and smart devices.

Example 16 includes the subject matter of example 15, wherein the intended recipient is determined based on a user selection via the inbox.

Example 17 is a non-transitory computer readable storage medium (CRSM) comprising computer executable instructions stored thereon to cause one or more processing units to receive a message object from a client device, the message object including information indicative of a user intent for an intended recipient to perform a function in response to the message object, the intended recipient being one of the plurality of service providers and smart devices; determine the intended recipient based on the message object; determine a protocol and format for communicating with the intended recipient; format an instruction, in the determined format, for the intended recipient to perform the function; and output the instruction to the intended recipient using the determined protocol.

Example 18 includes the subject matter of example 17, wherein the protocol and format are determined based on an application program interface maintained by the intended recipient.

Example 19 includes the subject matter of example 17, wherein the information indicative of the user intent is input by a user using natural language and the instructions further cause the one or more processing units to determine a user intent by parsing the natural language.

Example 20 includes the subject matter of example 19, wherein the user intent is further determined based on a location of the client device, a time the message object is received, a time the message object is output by the client device, or a previous message object output by the user.

Example 21 includes the subject matter of example 17, wherein the intended recipient is a service provider and the user intent is for the service provider to perform a service or output information regarding a service.

Example 22 includes the subject matter of example 17, wherein the intended recipient is a smart device and the user intent is to control the smart device or for the smart device to output information.

Example 23 includes the subject matter of example 17, wherein the message object is output by the client device via an inbox configured to communicate with individuals and the plurality of service providers and smart devices.

Example 24 includes the subject matter of example 23, wherein the intended recipient is determined based on a user selection via the inbox.

In the foregoing description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, to one skilled in the art that the disclosed embodiments may be practiced without these specific details. In other instances, structure and devices are shown in block diagram form in order to avoid obscuring the disclosed embodiments. References to numbers without subscripts or suffixes are understood to reference all instance of subscripts and suffixes corresponding to the referenced number. Moreover, the language used in this disclosure has been principally selected for readability and instructional purposes, and may not have been selected to delineate or circumscribe the inventive subject matter, resort to the claims being necessary to determine such inventive subject matter. Reference in the specification to "one embodiment" or to "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiments is included in at least one disclosed embodiment, and multiple references to "one embodiment" or "an embodiment" should not be understood as necessarily all referring to the same embodiment.

It is also to be understood that the above description is intended to be illustrative, and not restrictive. For example, above-described embodiments may be used in combination with each other and illustrative process steps may be performed in an order different than shown. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description. The scope of the invention therefore should be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. In the appended claims, terms "including" and "in which" are used as plain-English equivalents of the respective terms "comprising" and "wherein."

What is claimed is:

**1**. A computer-implemented method of interacting with a plurality of service providers and smart devices, the method comprising:

storing a protocol and a format for instructions to each of the plurality of service providers and smart devices, the protocols and formats being identified based on publicly available data or application program interfaces offered by the plurality of service providers and smart devices;

receiving a message object from a client device, the message object including information indicative of a user intent for an intended recipient to perform a function in response to the message object, the intended recipient being one of the plurality of service providers and smart devices;

determining the intended recipient based on the message object;

selecting the protocol and the format for communicating with the intended recipient from among the stored protocols and formats;

formatting an instruction, in the selected format, for the intended recipient to perform the function; and

outputting the instruction to the intended recipient using the selected protocol.

**2**. The method of claim **1**, wherein the information indicative of the user intent is input by a user using natural language, the method further comprising:

determining the user intent by parsing the natural language.

**3**. The method of claim **2**, wherein the user intent is further determined based on a location of the client device, a time the message object is received, a time the message object is output by the client device, or a previous message object output by the user.

**4**. The method of claim **1**, wherein the intended recipient is a service provider and the user intent is for the service provider to perform a service or output information regarding a service.

5. The method of claim 1, wherein the intended recipient is a smart device and the user intent is to control the smart device or for the smart device to output information.

6. The method of claim 1, wherein the message object is output by the client device via an inbox configured to communicate with individuals and the plurality of service providers and smart devices.

7. The method of claim 6, wherein the intended recipient is determined based on a user selection via the inbox.

8. A universal interaction platform, comprising:

non-transitory computer readable media that store a protocol and a format for instructions to each of a plurality of service providers and smart devices, the protocols and formats being identified based on publicly available data or application program interfaces offered by the plurality of service providers and smart devices;

a messaging service software module, stored on the non-transitory computer readable media and executed by a server, that:

receives a message object from a client device, the message object including information indicative of a user intent for an intended recipient to perform a function in response to the message object, the intended recipient being one of the plurality of service providers and smart devices; and

determines the intended recipient based on the message object; and

an internet of things service software module, stored on the non-transitory computer readable media and executed by the server, that:

selects the protocol and the format for communicating with the intended recipient from among the stored protocols and formats;

formats an instruction, in the selected format, for the intended recipient to perform the function; and

outputs the instruction to the intended recipient using the selected protocol.

9. The universal interaction platform of claim 8, wherein:

the information indicative of the user intent is input by a user using natural language; and

the universal interaction platform further comprises a natural language classifier that determines the user intent by parsing the natural language.

10. The universal interaction platform of claim 9, wherein the user intent is further determined based on a location of the client device, a time the message object is received, a time the message object is output by the client device, or a previous message object output by the user.

11. The universal interaction platform of claim 8, wherein the intended recipient is a service provider and the user intent is for the service provider to perform a service or output information regarding a service.

12. The universal interaction platform of claim 8, wherein the intended recipient is a smart device and the user intent is to control the smart device or for the smart device to output information.

13. The universal interaction platform of claim 8, wherein the message object is output by the client device via an inbox configured to communicate with individuals and the plurality of service providers and smart devices.

14. The universal interaction platform of claim 13, wherein the intended recipient is determined based on a user selection via the inbox.

15. A non-transitory computer readable storage medium (CRSM) comprising computer executable instructions stored thereon to cause one or more processing units to:

store a protocol and a format for instructions to each of a plurality of service providers and smart devices, the protocols and formats being identified based on publicly available data or application program interfaces offered by the plurality of service providers and smart devices;

receive a message object from a client device, the message object including information indicative of a user intent for an intended recipient to perform a function in response to the message object, the intended recipient being one of the plurality of service providers and smart devices;

determine the intended recipient based on the message object;

select the protocol and the format for communicating with the intended recipient from among the stored protocols and formats;

format an instruction, in the selected format, for the intended recipient to perform the function; and

output the instruction to the intended recipient using the selected protocol.

16. The CRSM of claim 15, wherein the information indicative of the user intent is input by a user using natural language, the computer executable instructions further causing the one or more processing units to:

determine the user intent by parsing the natural language.

17. The CRSM of claim 16, wherein the user intent is further determined based on a location of the client device, a time the message object is received, a time the message object is output by the client device, or a previous message object output by the user.

18. The CRSM of claim 15, wherein the intended recipient is a service provider and the user intent is for the service provider to perform a service or output information regarding a service.

19. The CRSM of claim 15, wherein the intended recipient is a smart device and the user intent is to control the smart device or for the smart device to output information.

20. The CRSM of claim 15, wherein the message object is output by the client device via an inbox configured to communicate with individuals and the plurality of service providers and smart devices.

21. The CRSM of claim 20, wherein the intended recipient is determined based on a user selection via the inbox.

* * * * *