MOTOROLA SOLUTIONS

Method of answer preparation by Virtual Intelligence Partner in offline mode, based on knowledge of officers available on site

By Paweł Wilkosz, Jakub Hałun, Paweł Niemiec
Motorola Solutions

ABSTRACT

The paper *Method of answer preparation by Virtual Intelligence Partner in offline mode, based on knowledge of officers available on site* presents the solution how to guarantee the continuity of service when Virtual Intelligence Partner (VIP) is going to work in offline mode[1]. Solution presented here assumes to improve human-machine cooperation in the context of getting by VIP the knowledge about human expertise in a given area and calculate the probability of delivering correct answer by him.

Short example assumes that VIP analyzes the query triggered by human, sending it over e.g. VIP MESH network to other VIPs with the request of sending back scores of prediction of delivering correct answer, select VIP with the highest score and finally contact via direct mode with the owner of selected VIP. Such solution allows to identify the best person to answer the question when VIPs could not connect with Knowledge Database (where VIP's skills are stored).

PROBLEM

First let's define some terms which are crucial to understand content presented in this publication:

1. **Virtual Intelligence Partner** (Virtual Partner, Virtual Assistant) - software platform that leverages natural-language processing technology to let field personnel access database information with intuitive voice commands
2. **Knowledge Database (Server) -** Artificial Intelligence (AI)/Machine Learning (ML)/Data Science (DS) remote platform that is able to analyze request from VIP, form response and send it back to VIP.

The main differences between Public Safety Virtual Intelligence Partner and solution offers for enterprise market (like Amazon Alexa, Siri etc.) is that Public Safety industry requires to guarantee continuity of service even when VIP goes to the offline mode[2].

[1] Offline mode means there's no connection between VIP and the Knowledge Database Server.

[2] Enterprise VIPs in most cases have to connect to the centralized knowledge database located in e.g. cloud so that can work only in online mode.

Having look on the Public Safety experience, during the incident officer acts routinely which means under stress he shouldn't look for alternatives when VIP is in offline mode and is not able to deliver an answer on time.

Also let's assume that some enterprise implementation allows to gather knowledge while VIP is working in offline mode (means without direct connection to the Knowledge Database Server). The issue is: how to synchronize such knowledge to not miss important information?

SOLUTION

When VIP is in the offline mode and is unable to answer the question of its user, it sends the question to other VIP instances within the range of broadcast. Each VIP that received the query performs analysis based on known facts and conversations of its user, to assess how much its user is competent to answer this specific question. The estimated assessment is determined and sent back to the querying VIP in a numerical form that can be compared. Based on the provided assessments the querying VIP selects the person most qualified to answer the question. The question is then forwarded to a selected officer via a virtual partner, which asks a question on behalf of its user and then provide her/him a received answer. A querying VIP can also just set up a communication channel to let involved officers direct talk with each other.

A simplified diagram of the solution flow is presented in Figure 1.

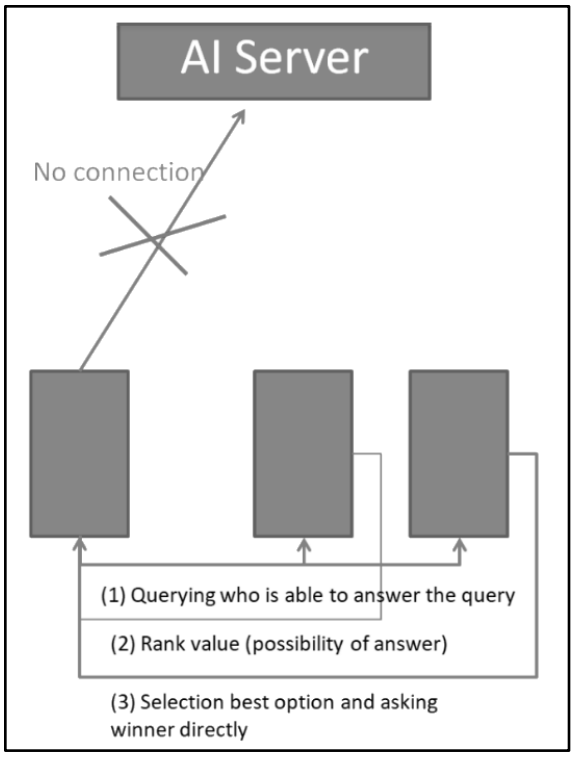


Figure 1 - simplified diagram of the flow

OPERATION

Each VIP collects information about the expertise of its user using analytical algorithms and/or machine learning methods, analyzing voice conversations, SMSes, text messages, emails etc. During the process it learns its user's capabilities and preferences. A copy of such information or its part is stored on the end device which has VIP installed. The copy is synchronized before and after a field operation or at regular intervals whenever VIP is online. When VIP is back online it uploads new information that it acquired during the field operation.

When VIPs are not connected to AI server (offline mode) they communicate with each other via a mesh network, bluetooth of even internet if only AI server is down[3].

When the Officer A asks VIP some question while VIP is in the offline mode then:

- VIP analyzes a query from the officer,
- VIP asks all other VIPs available on site about the level of expertise of its user in the field regarding the query,
- Each VIP runs the query against its own model representing its user's expertise and provides the score,
- VIP of the Officer A collects the scores from other VIPs,
- User with highest score is chosen as most qualified to answer the question (let's assume in this case the most qualified person is a Officer B),
- VP on behalf of the Officer A contacts with Officer B (via voice or text) with the request to answer this question,
- Officer B responds to VP,
- VP presents the answer to Officer A.

Figure 2 shows a corresponding message sequence chart.

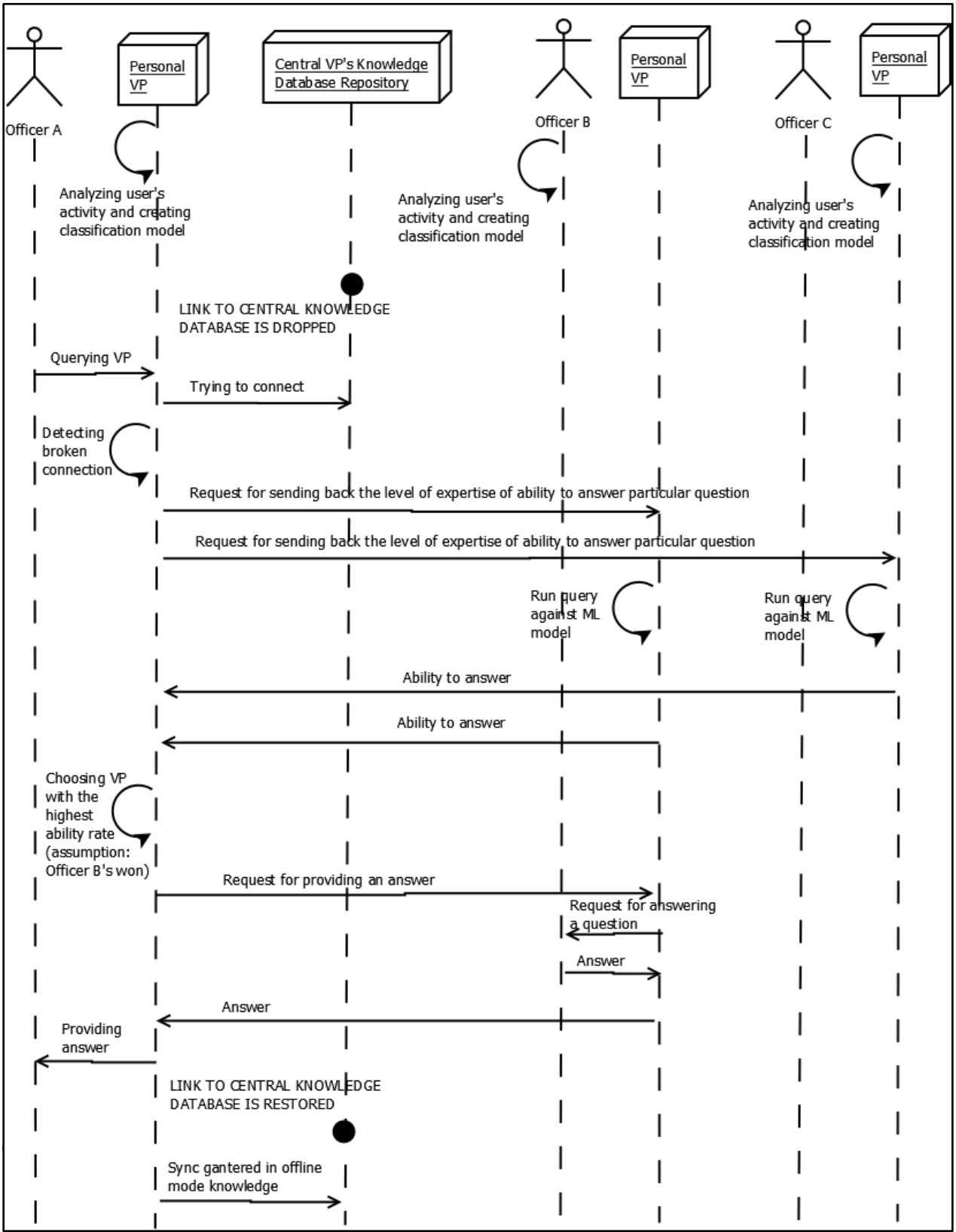
Alternatively, the VIP can, using this method, only select the officer to answer the question and set a communication channel between Officer A and Officer B, so that they can talk to each other directly.

The assessment of the ability of a user to answer the question is

[3] Creation and maintenance of a mesh network or any other method of local communication between VIP instances is not a subject of this invention.

carried out each time a new query is broadcasted. Every VIP which is within range of broadcast of querying VIP performs its own analysis, based on known facts and conversations of its user. The VIP's network operating using such a method dynamically adapts to the changing composition of the unit, both to the appearance of a new person and the unavailability of a previously recognized expert.

Figure 2 - message sequence chart



CONCLUSION

LTE population coverage is currently around 55% and forecast to grow to more that 80% but in 2022[4]. So the problem of losing connection to the remote system seems to be still actual. Described method may be particularly useful in areas with no wireless communications or during natural disaster which are often encounter by first responders.

Following benefits can also apply to the approach mentioned in this publication:

1. No need to store a copy of the central repository locally which can trigger high memory/storage consumption;
2. Dynamic adaptation to changes in ecosystem caused by appearance of a new person and building substantive knowledge from participants of the conversation;
3. Supplementing Knowledge Database based on the information gathered in offline mode;
4. Only person that know the answer is involved with the conversation;
5. Daily routine assurance, i.e. person only ask VIP and the source of the answer deliverable (whatever it is: ML Model or human) is transparent for him.

REFERENCES

1. Motorola Crime Analysis & Prediction - CommandCentral Analytics: https://www.motorolasolutions.com/en_us/products/command-center-software/recordsandevidence/commandcentralanalytics.html
2. Motorola Solutions: Virtual Intelligence Partner prototype lets officers talk to database, Donny Jackson, Urgent Communications, 2015
3. Patent: US9961516 - System and method for obtaining supplemental information in group communication using artificial intelligence (owner: Motorola Solutions)
4. J. Hałun, P. Wilkosz, *Method for selecting Virtual Intelligence Partner skills to work in offline mode*, Motorola Solutions Technical Publication: DSC23227: https://www.motorolasolutions.com/content/dam/msi/docs/technical-publications/2018-papers/dsc23227_method-for-selecting-virtual-partners-skills.pdf

[4] https://www.ericsson.com/en/mobility-report/population-coverage