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Method for selecting Virtual Intelligence Partner skills to work in offline mode

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ABSTRACT

The method presented in this publication allows for a continuous operation of Virtual Intelligence Partner (VIP) even when its user is outside of a network coverage. The continuity of service is particularly important in the public safety where people are often exposed to stressful or even life-threatening situations.

When a transition to offline mode is predicted, the Analytical System identifies skills and knowledge required for the ongoing operation. Then knowledge and experience of VIP's user are analyzed. If the user operates in a team then also knowledge of his/her team members is considered. Skills that duplicate knowledge of human team members are excluded from the list of skills required for the operation. Other skills, that complement the team's knowledge are distributed between team members and downloaded to their devices.

As machine learning (ML) based skills continually evolve adapting to their users, a skill downloaded to a device continue to learn. Whenever the connection to a central knowledge database can be established a local VIP synchronizes with it, uploading new experiences and downloading new data for the locally installed skills.

PROBLEM

Virtual Intelligence Partner (VIP) and solutions built on that approach seem to be a significant trend in the next-generation public safety business. VIP helps officers to monitor the environment, gather information and give hints which become extremely important especially when officers work under pressure. Such solution architecture includes two significant components:

1. VIP component (first gateway between human-to-machine interaction)
2. Analytical System (artificial intelligence system that performs complex algorithms to provide the most appropriate response to VIP).

A common problem for public safety officers that operate in a remote location is the probability of losing the connection between VIP and Analytical System due to the site characteristic (for example officer can operate in the place where data services are not guaranteed or intervention forces to enter into the building).

Simply workaround for such issue is to provision officer's device with the all components (skills) that VIP is using. It does not differ from the downloading knowledge database from the Analytical System to the VIP device. However, this approach can trigger the following issues:

1. it takes up memory space[1]
2. provisioning process can be highly time-consuming

Methods of prediction of incoming offline mode are known. For the purpose of this invention, it may be as simple as detection that the unit is assigned to some incident in a remote location (into the area where they may lose coverage) but more advanced trigger can also be used.

SOLUTION

The solution is to analyze, when the upcoming offline mode is predicted, what kind of VIP's skills are required during the ongoing operation (i.e. about what facts a user might ask). Then to gather information about personal skills of each team member, their knowledge, and also what kind of knowledge they can gain in interaction with each other. The final set of selected skills is the relative complement of the above. Only skills that can supplement missing team members' knowledge are selected for local copies of the officers' VIPs.

The selected skills are distributed among team members' VIPs. The distribution may depend on the size of available memory on the devices. When there is enough available memory then all selected skills are copied into each team member device. In other cases, the skills may be distributed such that there is only one local copy of each skill among team members devices. Distribution of the skills can also depend on the probability of use of each skill among team members.

While in offline mode, VIP uses locally downloaded skills. The local copy of a skill on a device is not static. VIP gathers knowledge about its user and the environment, evolving continually. When VIP returns to the online mode it

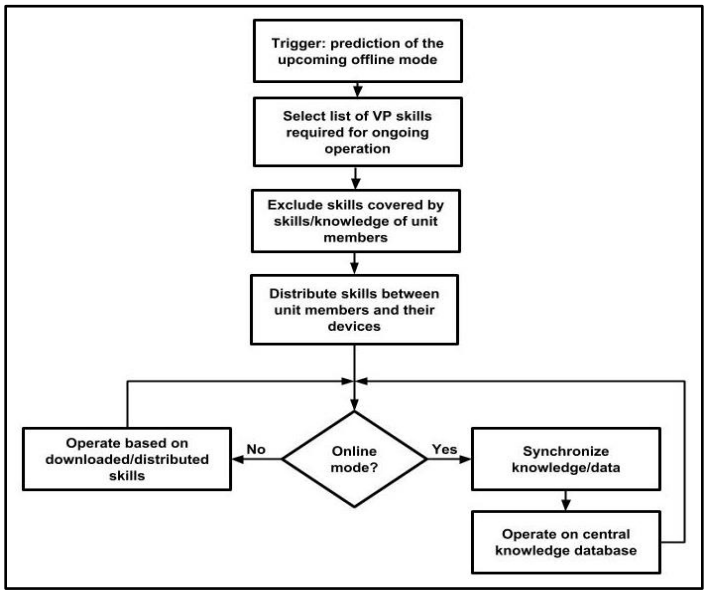

Figure 1 - Flow of the solution

[1] It's generally true that the mobile flash memory is getting bigger from one year to another but application requirements regarding the data storage are continuously increasing too.

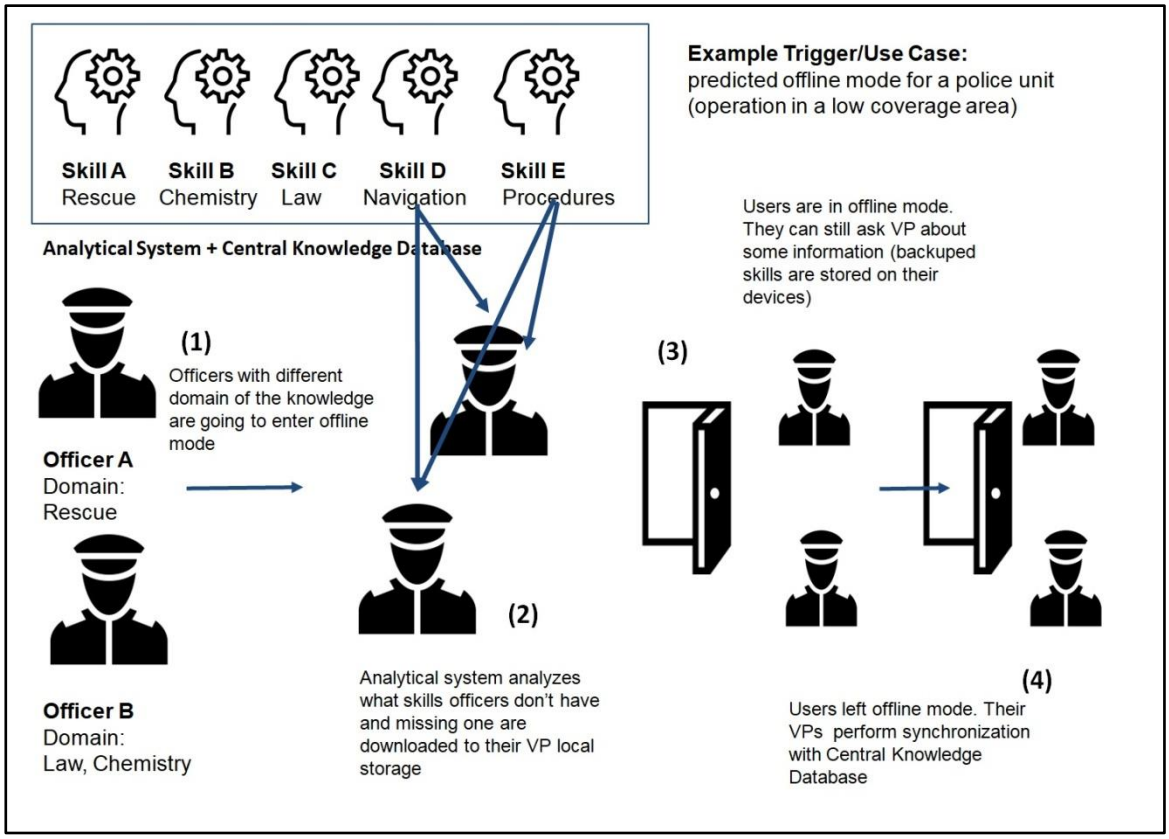

Figure 2 - conceptual diagram

synchronizes the data with the central knowledge database. Data is transferred in both directions. Latest updates to skill data (e.g. weather forecast or traffic information) are downloaded, but the VIP also uploads all the new knowledge it gathered about its user and the environment while working in the offline mode.

The flow of the solution is presented in Figure 1.

OPERATION

Figure 2 is a conceptual diagram of an exemplary communication system where Analytical System (AS) performs analysis on:

1. what kind of incident has been reported?
2. what kind of behavioral skills can be needed to handle it?
3. what kind of behavioral skills people already have?

Based on that system calculates delta to extract missing skills (Figure 3) and performs VIP provisioning.

Figure 4 is a corresponding message sequence chart. All together are useful for understanding the presented idea.

VIP (Motorola Virtual Intelligence Partner/Amazon Alexa) of every officer that operates on the scene sends the report to the Analytical System (for example Motorola Command & Central Analytics) over the LTE/WiFi links

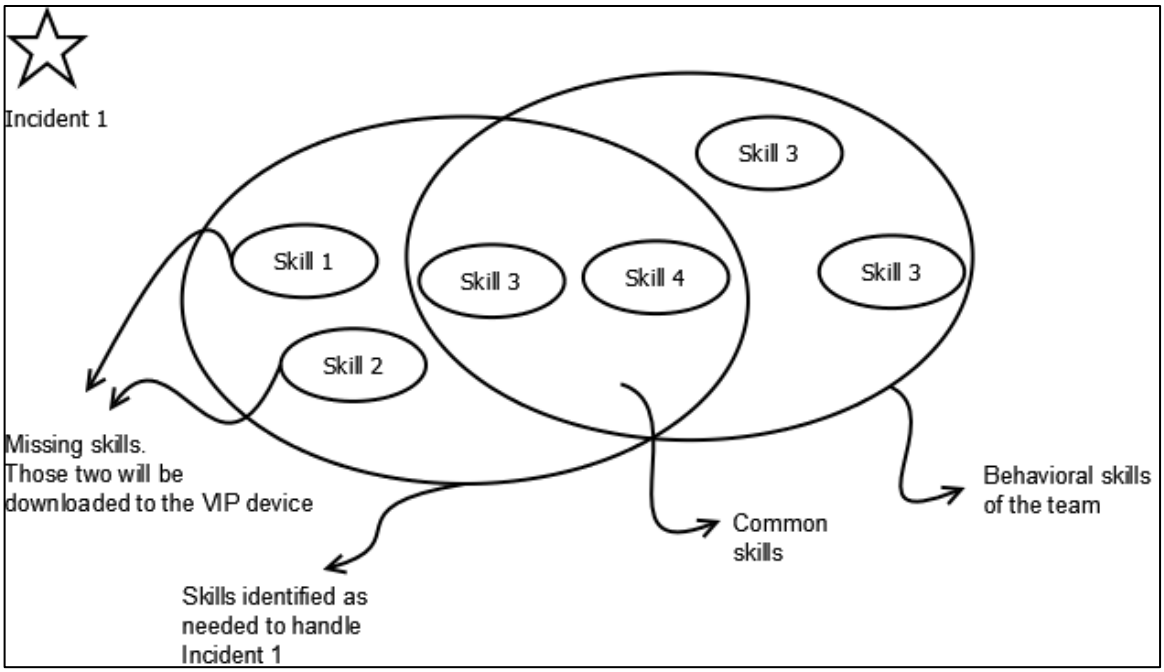

Figure 3 - Skills selection

about the behavioral skills that particular person has. Those skills can be gathered as:

1. Pre-defined software related to the user profile
2. Discovered by the machine learning model (VIP can learn based on the communication sources like email, messages, voice, the action he has taken in the past etc. in which area person an expert)
3. Assessment of other person and/or VIPs (directly indicated as an expert)

Analytical System stores in its database correlation between particular person and skills that he has. Description of the behavioral and machine skills are commonalized there. This system is also directly connected with Dispatcher Console, means it can monitor reports of crime, dispatcher's command & disposition automatically or on demand.

Recognizing the type of incident can be performed based on the well known Machine Learning and Data Science algorithms. Here Analytical System also keeps some correlation between the event and skills needed. For example, a car incident requires to have at least people with the following skills:

- road law
- artificial respiration procedures
- general assessment of the health of the injured

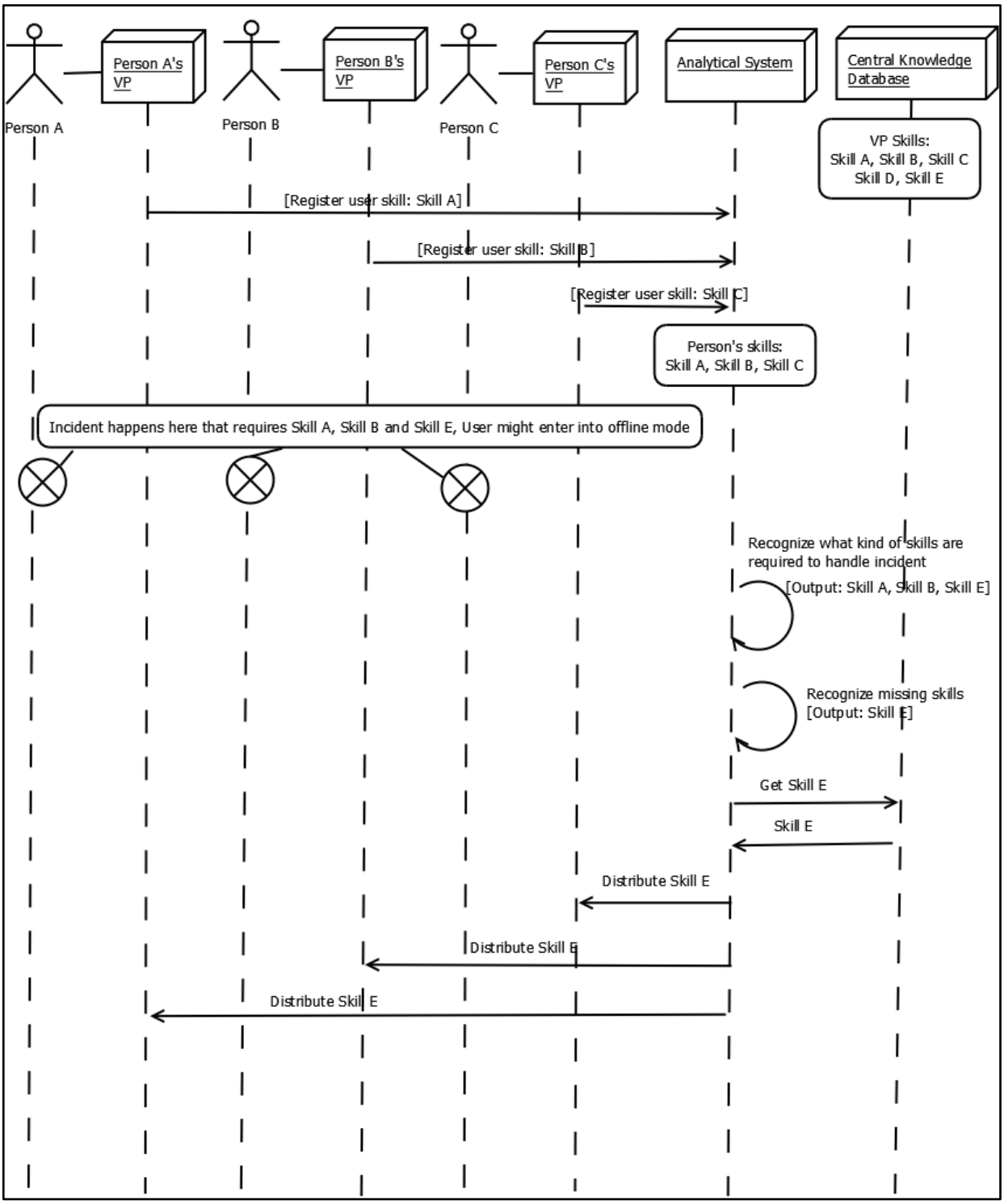

Figure 4 - corresponding message sequence chart

Having the knowledge about behavioral and needed skills Analytical System performs the selection of the missing components and transport them to the VIP device over LTE/WiFi network. Such skills are stored in local storage and used first when a user decides to ask VIP for some information.

Skill stored on VIP device can operate in offline mode and evaluate in that state. The evaluation process

is performed by Machine Learning algorithms, for example:

User asks VIP: *calculate the distance between point A and point B*
VIP answer: *Distance between point A and point B is 20 feet*

The user is not satisfied to this replay because he prefers to receive information in meters so he replays to VIP:

User replay: *What's the distance between point A and point B in meters*
VIP answer: *Distance between point A and point B is 6.09 meters*

Based on that VIP can learn that for this particular case it's better to deliver information in meter units. This knowledge complementary is stored as an additional information for such skill and can be synchronized (over LTE and/or WiFi links) when the link between VIP and Analytical System will be restored.

In that case, VIP skills can be defined as a service to create a more personalized experience. Contrary to the static knowledge, Machine Learning-based skills continually evolve, adapting to its user and learning for him. Also, new skill can be dynamically created based on the user experience and then share with each other via VIP communication as a machine skill.

CONCLUSION

The invention described in this publication addresses the problem of ensuring continuity of operation of Virtual Intelligence Partner in case of losing a connection between VIP and Analytical System by selecting and downloading skills required for ongoing operation, but only complementary to the user's knowledge.

The method may be particularly useful whenever continuity of operation is crucial like in public safety systems.

REFERENCES

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