ISSN 2278-3091
Volume 9, No.4, July – August 2020
International Journal of Advanced Trends in Computer Science and Engineering
Available Online at http://www.warse.org/IJATCSE/static/pdf/file/ijatcse334942020.pdf
https://doi.org/10.30534/ijatcse/2020/334942020

Mobile Expert System for Diagnostic Human State in Emergency Situations

Oleksandr Kuzomin[1], Oleksandra Dudka[2], Oleksii Vasylenko[3], Radion Shylo[4], Vyacheslav Lyashenko[5]
[1]Department of Informatics, Kharkiv National University of RadioElectronics, Ukraine, a.oleksandr.kuzomin@gmail.com
[2]Department of Radio Technologies Information and Communication Systems, Kharkiv National University of RadioElectronics, Ukraine, oleksandra.dudka@nure.ua
[3]Manager of Architecture for the Big Data and Analytics department, Toyota corp., Sydney, Australia, b.ichbinerste@gmail.com
[4]Department of Radio Technologies Information and Communication Systems, Kharkiv National University of RadioElectronics, Ukraine, d.vadym.radchenko@nure.ua
[5]Department of Informatics, Kharkiv National University of RadioElectronics, Ukraine, lyashenko.vyacheslav@gmail.com

ABSTRACT

An obligatory stage of any purposeful activity in emergency situations (emergency) is to make decisions on elimination of the emergency consequences and assistance to the victims, and if necessary, their evacuation. Not only the wrong but also the ineffective decisions could lead to human losses or irrational use of financial, labor, environmental, energy and other resources. In this regard, the problem of developing a scientific methodology for making effective decisions is one of the pressing scientific problems. The purpose of the study is to enhance the first “rescue-victim” interaction when the rescuer or doctor asks the patient specific questions to make decisions. The biggest cost is the waste of time, which can be significantly reduced by using a chat bot conversation with emergency victim.

Key words: Emergency, Precedent, Elimination, Mobile Expert System, Diagnostic.

1. INTRODUCTION

Chat bot based expert systems have been used for the last 30 years [1]-[4]. A notable example is the famous 'Eliza' chat bot. Ontology-based chat-bots are an ongoing effort based on the semantic network and NLP (Natural Language Processing) models [5], [6], which are designed to support user-machine dialogues. The system works by using modules: Knowledge and Interpretation module and Natural Language Generation. The ontology is the formal naming and definition of the types, properties and relationships between entities that display symptoms. The temporal reasoning system invention is an important mile in chat based expert systems development.

Emergency response systems are a development of such systems [7]-[11]. The rescuer actions should follow the service instructions and usually include the following basic steps:

The review of the scene in an emergency area (EA) to receive an answer on following questions: «what threatens me? » and «what threatens Him (the victim)? ». If the rescuer understands that something is life-threatening and does not solve the problem of assisting the victim on their own, they should seek the help of the other specialists, since no dead rescuer has helped anyone.

If there is no danger, the rescuer approaches the victim. There is a "Primary Survey of the Victim". The consciousness of the victim is checked. When possible, we ask: "What happened?". If a person is conscious, he will tell you what to help him. If there is no answer, we influence the pain points: the pins near the ears, the pressure on the muscles on the shoulders, the bones of the fingers we press on the sternum, we hold up and down.

The Secondary Examination of the Victim occurs when WITNESS INTERVIEW is possible. We find out the mechanism of the event that occurred during the emergency. This information will help to suggest the presence of severe injuries and wounds, such as spinal injuries, cranial, internal organs.

The victim is examined and interviewed. Two hands to compare sensations, always starting from the head. Then - upper limbs, trunk, lower extremities. If we do not find injuries, injuries and wounds, then we turn the person into a restorative position. If we find injuries, wounds, injuries, then we provide "First Aid" and without changing the position of

the victim, ensure the airway, control the availability of breathing and pulse.

So, here it is necessary to act quickly and qualitatively diagnose the condition of the victim.

To do this, all the capabilities and, above all, modern mobile devices based on androids might be applied.

The basics of building such systems are discussed below.

2. THE ARCHITECTURE DIAGRAM OF THE AUTOMATED DECISION SUPPORT SYSTEM (ADSS)

The system architecture shows modules and interactions of the entire system between them at a glance (see Figure 1). Please note that the victim doesn't interact with the mobile decision support system. Their communication always occurs through a chat bot.

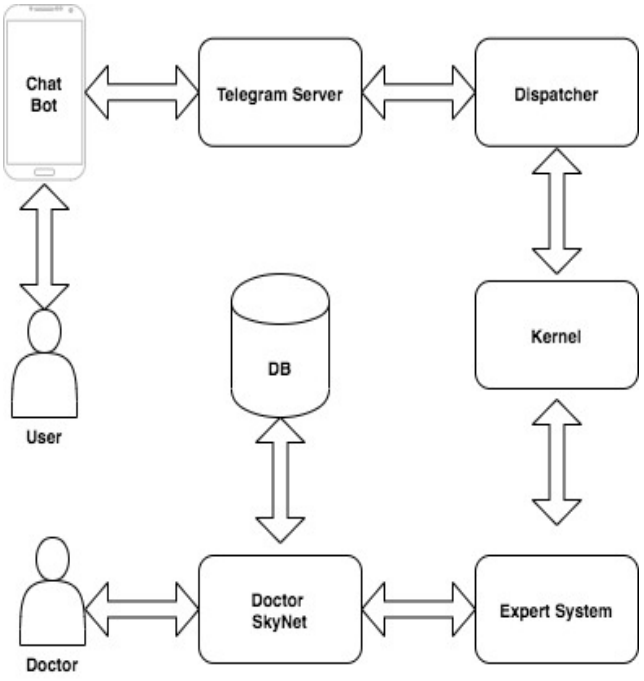


Figure 1: The architecture diagram of the ADSS

The diagram above shows the architecture of the whole system, along with the relationships between the various modules. The user initiates a conversation with the system by sending a message that is captured by the Telegram server and then sent through the various modules to the chat bot.

A conversation is initiated with the Rescuer User, which is subsequently terminated when the Rescuer receives an email from the Chat Bot about the User.

3. USE CASE DIAGRAM

The Use Case diagram shows the interaction between different subjects and modules of the system (Figure 2) [6], [9]. In that case use case diagram represents the major modules of the chat bot and actors.

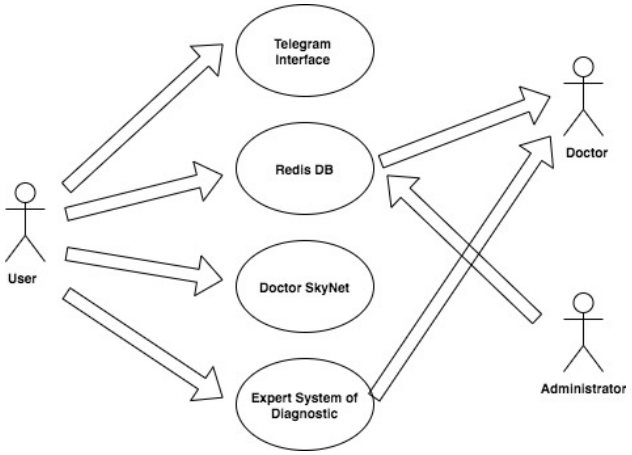
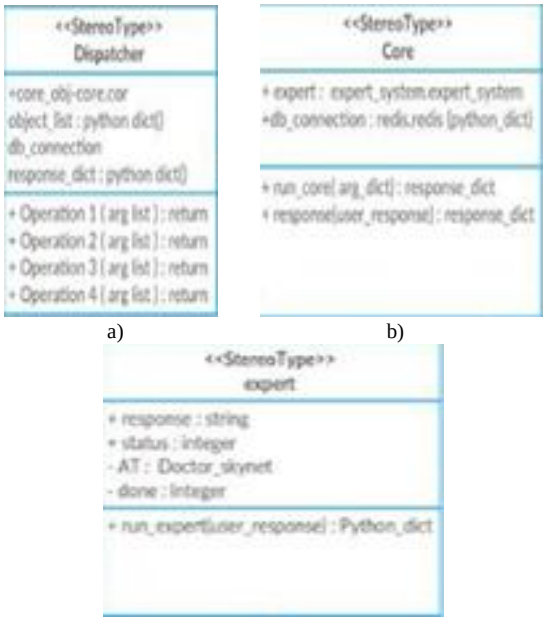


Figure 2: The Use Case Diagram

The Telegram interface, the Redis database, the SkyNet Physician Diagnosis and the expert system are the main modules of the system which the actors interact with. The main characters are user, rescuer and administrator.

4. THE INTERACTION SYSTEM CLASS

The interaction system class reveals the interaction between different classes and the data flows between them. Each class contains one-to-one or one-to-many relations and attributes and associations.These classes of interaction include: Patient, Server, Dispatcher, Core, Expert, Interface and Doctor. The structure of the individual classes is shown in Figure 3.



a) b)

c)

Figure 3: Structure of individual interaction classes

5. STATE DIAGRAMS

The state diagram of the patient represents states transition of the patient state while he/she continues the talk with the system (Figure 4). The states (fields) shows the patient activities in different states, the arrows show the action that patient might realize to achieve these state.

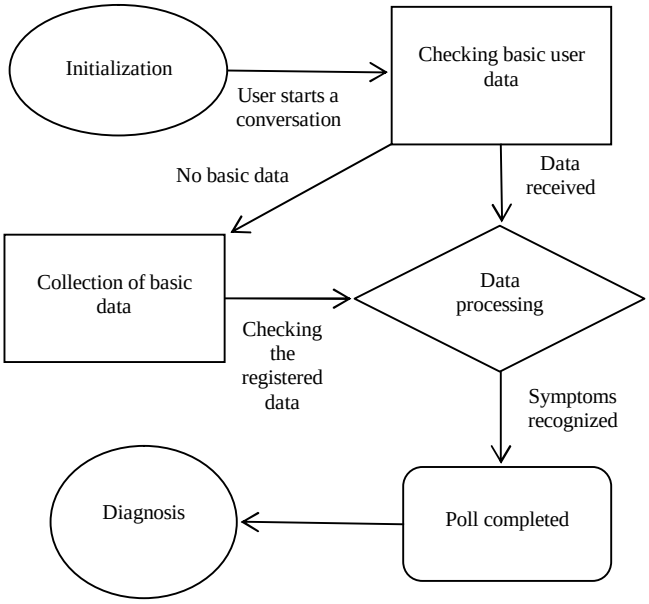


Figure 4: The state diagram

6. DEPLOYMENT DIAGRAM

The diagram (Figure 5) shows the system deployment process, it helps to understand the conditions of the system deployment and system components integration in the real world.

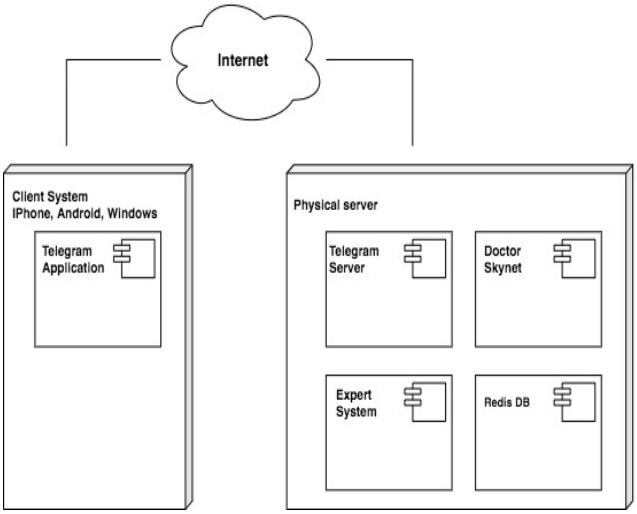


Figure 5: Deployment diagram

As we can see at the diagram above the system consists mainly of two nodes: client system and physical server. The client system runs the Telegram chat application it could be any device iPhone or PC with Windows OS. The physical server starts the chat bot itself and receives the client-rescuer input from the Telegram application. The both deployment environments are connected through the Internet. The client system could be any environments that maintain the Telegram chat application.

7. SEQUENCE DIAGRAM

The sequence diagram shows the steps of the user interaction with chat bot (Figure 6). The main modules consist of the applications: Telegram, server and expert system.

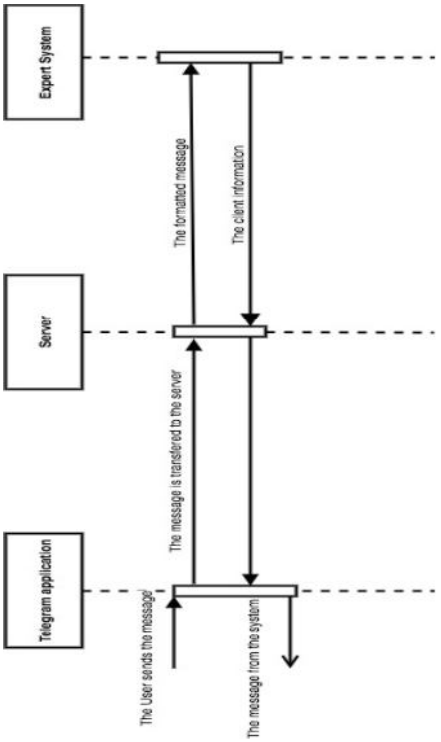


Figure 6: Sequence diagram

8. THE MAIN INTERFACE SCREENSHOTS

Figure 7 – Figure 9 show screenshots of the main interface. These screenshots depict the operation of the mobile expert system that we are considering. These screenshots will show the operation of a real human condition diagnostics system in an emergency.

Figure 7 shows the initialization of the bot dialogue for diagnostics of the human condition.

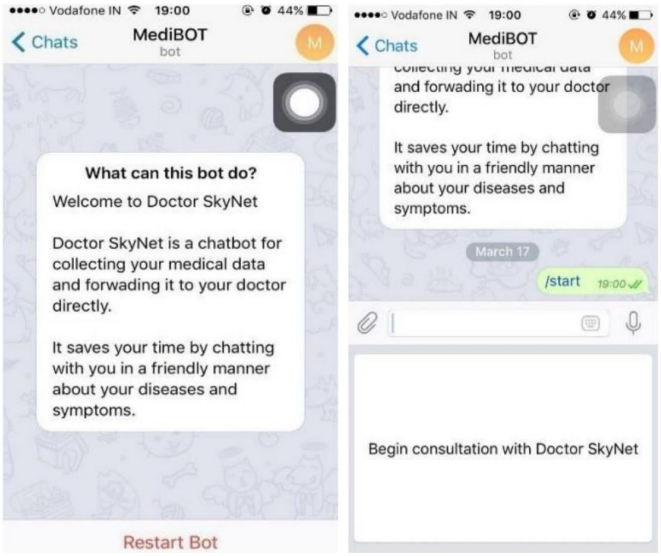


Figure 7: The bot dialog initialization

Figure 8 displays a dialogue with a bot for diagnosing a human condition. Figure 9 displays the symptom diagnosis module.

Figure 8: The dialog with the bot start

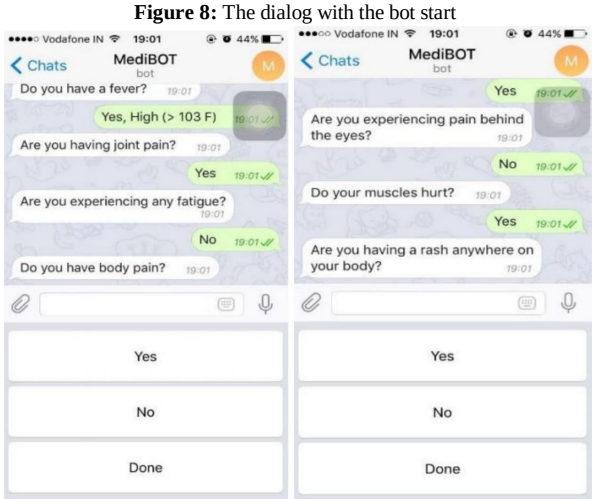


Figure 9: Symptoms clarification

Thus, we have considered a real mobile expert system for diagnostic human state in emergency situations

9. CONCLUSION

As a result of the research of various mobile expert systems with chat bot feature and basing on the feedback received from users, we can conclude that: a mobile expert system with a chat bot feature could be very helpful in reducing the time on elimination of emergency consequences; the ADSS using during the rescue activities in the emergency situation is aimed to improve the quality of the decisions made to eliminate the consequences of the emergency; the scope of the application of such system could be extended by expanding the base of questions and knowledge base with corresponding decisions.

REFERENCES

1. H. Khatoon, V. C. Prakash, J. K. R. Sastry, and B. T. Reddy. **An Expert System to build Cognitive Model of an IT Student using Artificial Neural Networks for Predicting Placements during Campus Recruitments**, *International Journal of Emerging Trends in Engineering Research*, Vol. 8, no. 3, pp. 838-846, 2020. https://doi.org/10.30534/ijeter/2020/38832020
2. A. D. M. Africa, S. A. Pasia, and J. A. Sy. **A Modeling system on the Implementation of Automated Vehicles**, *International Journal of Emerging Trends in Engineering Research*, Vol. 8, no. 7, pp. 2927-2933, 2020. https://doi.org/10.30534/ijeter/2020/08872020
3. Y. Chandra, R. Triana, G. Wang, and N. Legowo. **Utilizing Big Data Framework to Support Decision Making Process: Enterprise Architecture Approach**, *International Journal of Advanced Trends in Computer Science and Engineering*, Vol. 9, no. 3, pp. 2719-2723, 2020. https://doi.org/10.30534/ijatcse/2020/36932020
4. T. S. Safarov ,Sh. U. Urakov, G. T. Safarova, and R. A. Sobirov. **Methods and Models of a Multifunctional System Support for Decision Making for Differential Diagnosis of Diseases**, *International Journal of Advanced Trends in Computer Science and Engineering*, Vol. 9, no. 3, pp. 3350-3353-2723, 2020. https://doi.org/10.30534/ijatcse/2020/133932020
5. L. Luing. **Identification system**, *Science*, 2015.
6. Y. Y. Liubarski. **Intellectual information systems**, *Science*, 2013.
7. O. Kuzomin, V. Lyashenko, M. Tkachenko, M. A. Ahmad, and H. Kots. **Preventing of technogenic risks in the functioning of an industrial enterprise**, *International Journal of Civil Engineering and Technology*, Vol. 7, no. 3, pp. 262-270, 2016.
8. M. Shtukin, A. Paleha, and O. Kuzomin. **Provision acceptance solutions to prevent and management in**

emergency situations, *International Multidisciplinary Scientific GeoConference: SGEM*, Vol. 1, pp. 335-342, 2016.

9. O. Kuzomin, and O. Vasylenko. **Methods and models for building a distributed mobile emergency monitoring system**, *International Multidisciplinary Scientific GeoConference: SGEM*, Vol. 17, pp. 433-440, 2017. https://doi.org/10.5593/sgem2017/21
10. M. Ayaz, I. Tvoroshenko, J. H. Baker, and V. Lyashenko. **Modeling the Structure of Intellectual Means of Decision-Making Using a System-Oriented NFO Approach**, *International Journal of Emerging Trends in Engineering Research*, Vol. 7, no. 11, pp. 460-465, 2019. https://doi.org/10.30534/ijeter/2019/107112019
11. I. Tvoroshenko, M. A. Ahmad, S. K. Mustafa, V. Lyashenko, and A. R. Alharbi. **Modification of Models Intensive Development Ontologies by Fuzzy Logic**, *International Journal of Emerging Trends in Engineering Research*, Vol. 8, no. 3, pp. 939-944, 2020. https://doi.org/10.30534/ijeter/2020/50832020