

A knowledge based System for diagnosis of Varicella (Chickenpox) and Measles diseases in children at kindergarten age based on IOT

Nadia Mahmood Hussien¹, Huda Abdulaali Abdulbaqi², Yasmin Makki Mohialden³, Nael Ali Hussein⁴

¹Computer Science Department, Collage of Science, Mustansiriyah University, Baghdad-Iraq

²Computer Science Department, Collage of Science, Mustansiriyah University, Baghdad-Iraq

³Computer Science Department, Collage of Science, Mustansiriyah University, Baghdad-Iraq

⁴Pediatric surgeon/M.B.Ch.B/F.I.C.M.S/Alasskan central teaching Hospital of Pediatrics//Baghdad, IRAQ

nadia.cs89@uomustansiriyah.edu.iq¹, huda.it@uomustansiriyah.edu.iq²,

ymmiraq2009@uomustansiriyah.edu.iq³, @Nailataimish@gmail.com⁴

Article History: Received: 10 January 2021; Revised: 12 February 2021; Accepted: 27 March 2021; Published online: 20 April 2021

Abstract: In childhood diseases, the varicella (chickenpox) and measles diseases considered an important condition. In this research we have designed and implemented an expert knowledge-based system utilizing IOT for early diagnosis of these diseases for children in kindergarten. The system was developed according to an object-oriented software engineering paradigm using UML tools. Also it developed based specific roles in web domain using IoT environment. Furthermore the system able to send a message contains all details on the infection type and description on the disease to the parents. This system can be used by kindergartens or parents as a domestic application for early diagnosis of the disease through the symptoms that appear on the affected child. The knowledge – based system was implemented using python 3.8. The results observe a significant response for detecting and diagnosis the Varicella (Chickenpox) and Measles diseases.

Keywords: Cloud computing Internet of Things (IoT), diseases diagnoses, expert system

1. Introduction

There are many diseases that affect children, which share a number of symptoms, and early diagnosis may help early recovery. Measles and chickenpox are common diseases in childhood, which can be diagnosed depending on the symptoms associated with the disease. The recent propagation of information and communication technology Facilitate detecting the disease at initial stage can enable to overcome the infection and specify the treatment. Recognizing the treatment in early stage really increases the chances to treat the case successfully. This process depends on the way of diagnosing the diseases. Many systems developed to serve this concept, Diagnosis expert system (DEXS) is one of them. This system can provide a great deal with recognizing the diseases and present a method to treat the patient based on the user capability. The system enable the user to contact with the content information simply and clearly [2]. Infection among children is most common in crowded places such as nurseries and clubs, where a large number of children gather together in one place. Among the most infectious diseases transmitted between children of different ages of measles and varicella (f). Varicella is a diffuse vesicular rash which infect the children and considered a mild disease. The rash represent a pruritic state and involves a lesions at different stages of growth. The exanthema may be preceded by malaise, fever and myalgia.

[3]. varicella (chickenpox) is a contagious disease that is rapidly spreading and highly contagious. It is most common in children between 3 months and 10 years, but it is a disease that affects the body only once, because if your child previously had it, he will not catch it again. varicella (chickenpox) is caused by a virus called "Persia Zoster", a virus that is transmitted by breathing in polluted air and droplets, using infected tools such as clothing and shaking hands, and the incubation period is two to 3 weeks. Measles is an acute and infectious viral disease that affects children, and it is one of the most common diseases in childhood in particular, but it may affect adults. Measles, like smallpox, when infected once, it does not affect the body again, as it acquires immunity, the incubation period of the disease extends from 10 to 15 days. The general objective of this research is to develop a knowledge-based system for the early diagnosis of viral infectious diseases among children and to prevent their spread [2]. For more reliability and effectation, an Internet of Things (IoT) is used. IoT enables people and objects in the physical world as well as data and virtual environments to interact with each other [1].

Any system can be developed according to the traditional TA approach or the Object-oriented OOA approach. The system was developed by applying object-oriented concepts, and by developing a set of graphical system models during the software development life cycle. The specific goal is to extract knowledge from pediatricians to recognize symptoms and diagnose disease, model and represent knowledge acquired using appropriate knowledge representation technique, develop a model knowledge base system that can assist clinicians in

diagnosing disease, and ultimately evaluate the performance of the proposed knowledge base system. The reset of this paper include 3 section, Related works, The Proposed system with use case, result of proposed system and conclusion.

2. Related researches

proposed Proposed a knowledge based system used for assisting people with gums and teeth problems. The system able to diagnose the problems and present and recommend the treatment [4]

Presented ECG method for monitoring using internet of things (IoT) techniques. The ECG data collected by a wearable monitoring node and used by IoT by direct sending to the cloud using Wi-Fi. This method is reliable due to its capability to gather and view the data in real-time. This feature can serve the primary diagnosis of some heart diseases [5].

Abu El-Reesh et al, in 2017 presented an expert system for aiding newly graduated physician, Respiratory physician and children parents in diagnosing infants of children with twelve various shortness of breath. The present system can provide quicker and more exact diagnosis.[6]

Al Rekhawi et al, in 2017 proposed an expert system for rickets diagnosis. This sytem can provide the doctors with all the necessary information in rickets [7].

Mansour, A. I., & Abu-Naser, [8]: They design a Dengue Disease expert system to enable doctors in diagnosing Dengue Disease. The system can give an information of how to prevent and recognize the symptoms and signs of Dengue Disease. All materials which related to Dengue Disease are collected and organized in knowledge base system. This system evaluated by group of patients and specific doctors. This system is easy to use and observe a significant results. [8].waider et al in 2017 recognized seven ankle diseases by developing an expert system. They specified ankle sprain, rheumatoid fever, Rheumatoid arthritis, gout, fracture and osteoarthritis [9]. [Almadhoun, Husam R.,2020] Developed an expert system for laryngologists diagnose. The present system provide the capability to diagnose some throat problems symptoms such as raw, burning, scratchy, dry, irritated and tender. The system can present the disease cause and the way to treat it. The used languages in this system are CLIPS and Delphi [10]. Many authors in 2020 proposed an expert system to specify and diagnose COVID-19 disease. The system help the people to know whether they infected with coronavirus or not. Also, the system provide all the instructions to the patients to follow them. The used language in this system was SL5 which programed to ask the patients a true and false questions while the evaluation process complete [11].

Also in 2017 developed an expert system to aid internist physician in diagnosing and detecting the abdomen disease. In this system, the cause of disease are drew and the cure is show up when it is possible [12] Designed an expert system to help psychologist in diagnosing depression disease based on symptoms, the developed system involves the cause and effect of the depression disease which was very useful.[13]

Al-Shawwa et al in 2019 developed an expert system for skin cancer disease. The proposed system contains a set of cancer disease condition which enable the physician to specify and solve a critical disease problems. [14]

In 2019 presented an expert system to detect and treat silicosis disease. The system developed to get appropriate disease situation and specify and correct the treatment based on conversation condition and use. [15]. Aldaour et al, in 2019 developed a design of expert system for anemia disease. The system helps doctors to detect chest pain, fatigue, shortness of breath, pallor of skin and many other disease. The cause of diseases are outlined and the system evaluated by the specialists [16]. While in 2020 designed an expert system for dealing with corona virus disease. The rules of the system depends on the cough, fever, pneumonia in lung and shortness breath. The evaluation of the system observe a significant results [17]

proposed a knowledge base system for tooth treatment. They developed an expert system to explore the tooth problems and present the suitable treatment [18], And 2020 developed an expert system to help the users to diagnosis the oral problems. The present system present the treatment for tongue and stomatitis through correct diagnosis and treatment. [19]

New design proposed a of expert system that can help cold and flu diseases. The system was very useful for Medical Practitioners due to owing the cause of diseases and providing the significant treatment.[20]. New system design and implement an expert knowledge-based system to diagnose if the patient infected with flu virus or coronavirus, also the system can be sent a SMS message to the hospital with the location of the patient which

infected in coronavirus for fast response. The system is easy to use and reliable when applied on the group of patient and by specialized doctors [21].

3. The Proposed system

The proposed system consists of two parts, Sender Part (SP) and Receiver Part (RP). The system is developed based Knowledge-based System (KPS) that includes Facts, Rule-base and an inference module. The Facts represents the input which collected from the patient's response through the graphical user interface. A Rule-base represents a set of rules that developed in consultation with experts based doctor on Varicella (Chickenpox) And Measles characteristics. The inference module represents the matching process of the facts with a rule in the rule-base for identifying any abnormal state. Figure 1 illustrate the block diagram of the system.

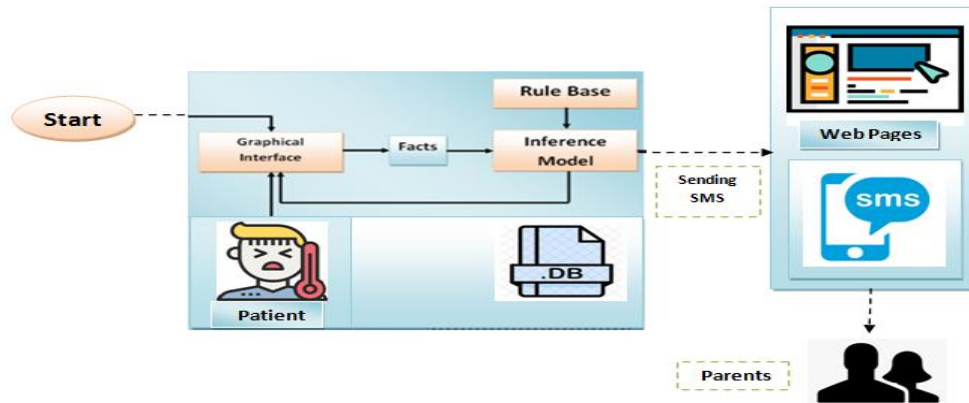


fig1: block diagram of the system.

The proposed system used an expert system to solve the diagnoses problem. The proposed system has two main components, the first is the knowledge base which represent the domain. The structure of the knowledge base involves some symptoms such as severe headache, itch, rashes, mild/high fever, small white dots, nasal, and eye irritation. The system uses this knowledge base as an input representation to the second step. The second step is the inference engine process. This step includes several rule to specify the reasoning of disease. The main used syntax is IF-THEN rules. The (IF) part represents the fact(s) that presented as a structure of the knowledge base. Its also called data driven or forward chaining. The (THEN) part represent the conclusion which contains the goal. For specific results requirements to achieve the system goal in recognizing and detecting the disease, the backward chaining approach is used in this system.

Rule 1: if the system matched (severe headache AND itch AND rashes AND mild/high fever AND small white dots AND nasal AND eye irritation, THEN the result will be (no disease found).

Rule 2: if the system matched (severe headache AND itch AND rashes AND mild fever, THEN the result will be (the diagnosis is chickenpox disease).

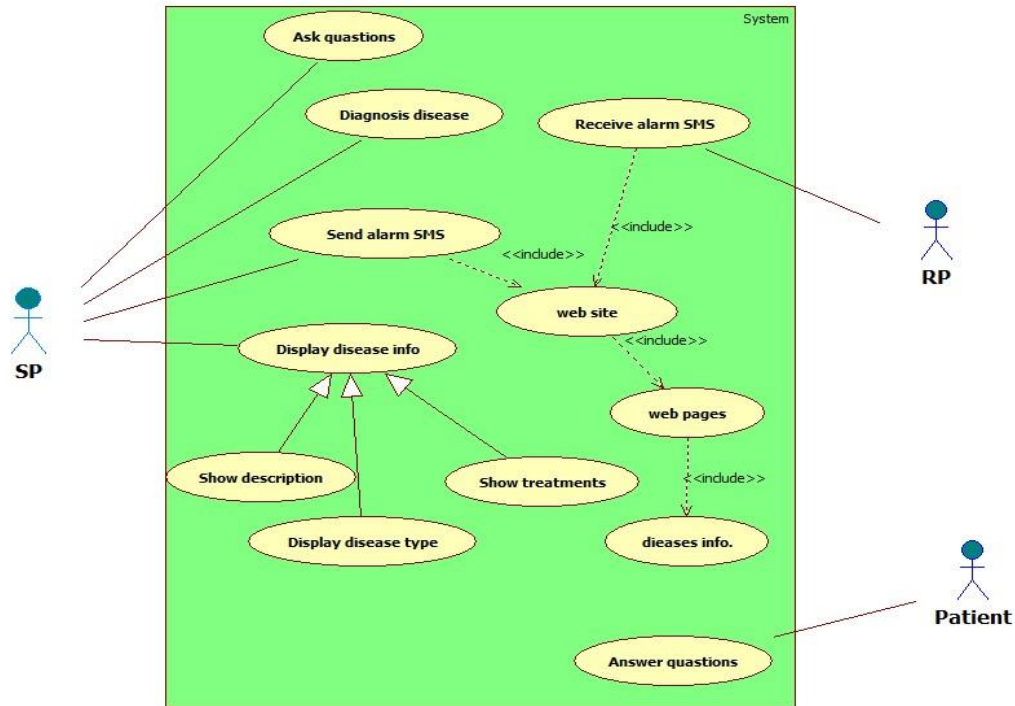
Rule 3: if the system matched (high fever AND small white dots AND nasal AND eye irritation, THEN the result will be (measles diseases).

The diagnosis process is started when a suspicious child is checked by KBS which gives some previous questions in the Graphical interface (GUI), and interacting with it depending on the symptoms that appear on the patient. After the medical examination is completed, the smart system display the final diagnosis on GUI and send it to RP. The system should be have a data base contains on the number phone of child's parents. RP part is develops based web design development that contains a multi-page sites includes full information on Varicella (Chickenpox) and Measles diseases. It receives an alarm message with website contains on the information about the child state. IoT is a connection tool between the two parts. Twillio IOT application is used as a transform medium to send the information to childs' parents.

3.1 Use case diagram

Figure 2 illustrates the use diagram which represents the functionality of the system. Use case diagram consists of actor/s and use case/s. Each use case is a task that stimulate by one or more actors and shows how the user interaction with the system. The system has three actors

(SP (sender part), RP (reciever part), and Patient) and 12 use cases with the (Association, Generalization, Inclusion) relations between use cases.



4. Results

The system is tested on many patients and gives a trusted results under medical supervision. It diagnosis if the patient has Varicella

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Hello! I am diagnosis System, For Varicella (Chickenpox) and
Measles infection diseases, I am here to help you make your
health better.
Do you feel any of the following symptoms:

Nasal : no
mild fever : yes
Itch : no
Severe loss of appetite : yes
Small white dots inside the mouth : no
Eye irritation and redness : no
cough : no
Excessive sensitivity to light : no
pain in throat : no
Rashes appear gradually yes
High fever : no
Severe headache : yes

Did not find any disease that matches your exact symptoms

The most probable disease that you have is Chickenpox

Take Care with your baby

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(Chickenpox) infection as shows in figure 3 or Measles infection as shows in figure 4.

fig3: example of Chickenpox infection.

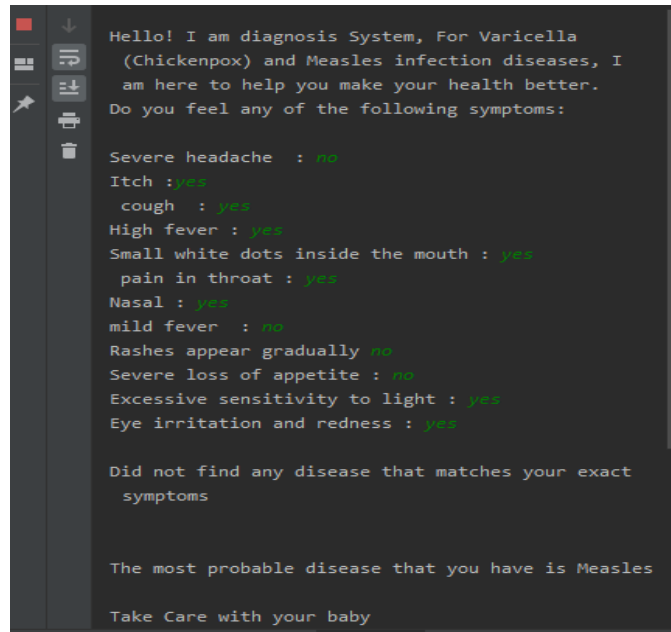


Fig4: example of measles infection.

The system is developed based IOT technique using twilio application, figure 5 shows the message that sends to parents when the system exams the child to inform them about infection.

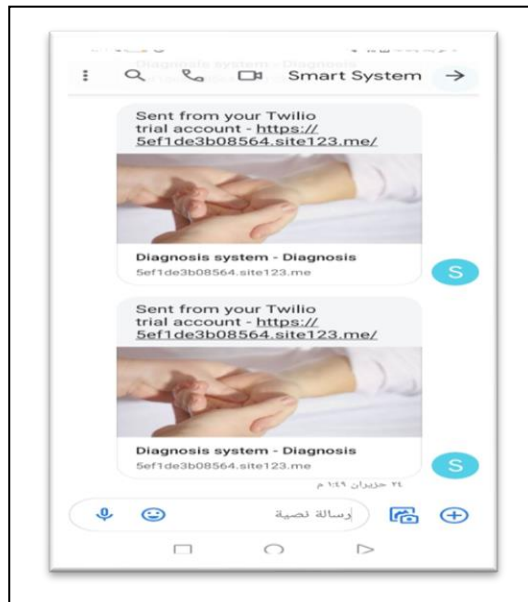


Fig5: alarm message sent to parents.

Figures 6, 7 show some of details for web site which sent to parents in case of measles infection.

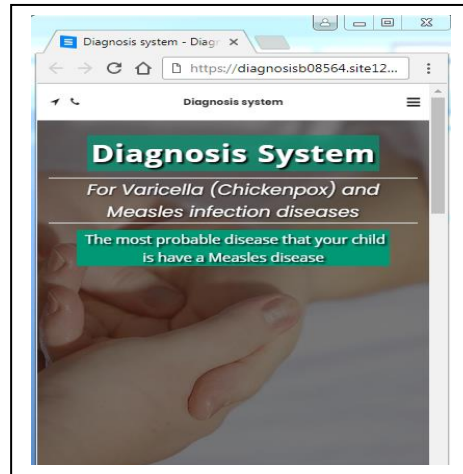
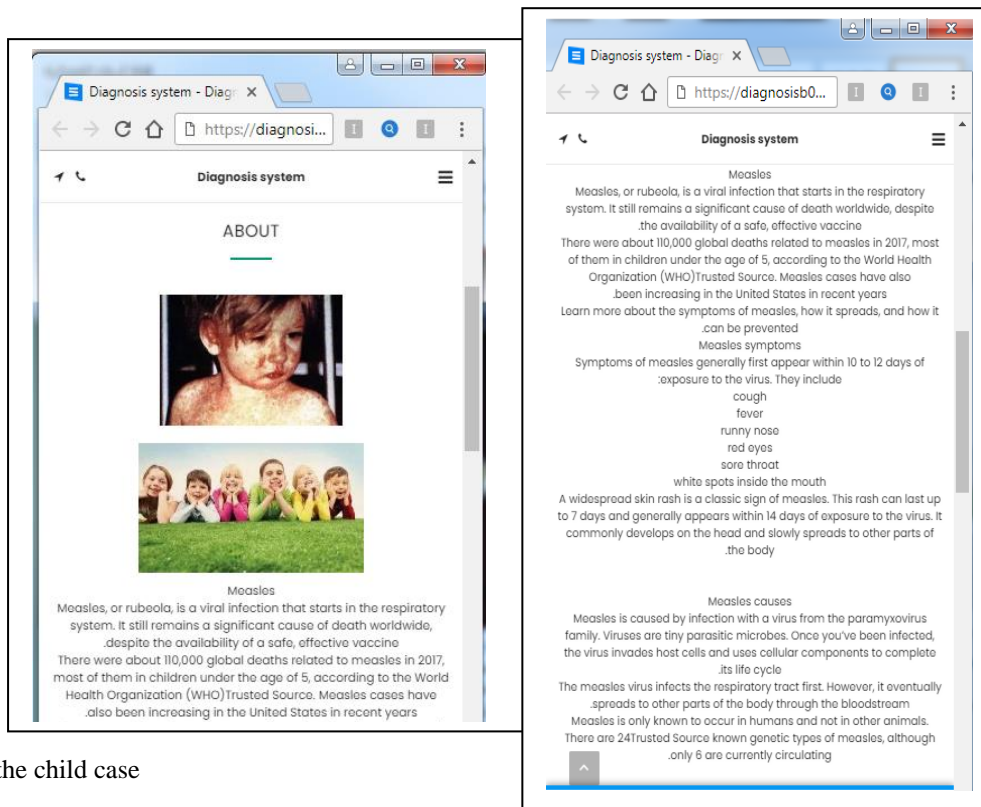


Fig 6: web site which sent to parents in case of measles infection.



the child case

5. Conclusion

This research is developed an early detections system to diagnose whether a child is infected with a Varicella (Chickenpox) or Measles diseases. The IoT knowledge-based system depended in the present work. It is very useful for children at kindergarten age which is help to reduce spread the infection between other children with the same stage. The system is able to inform the parents of the children about the injury in real time.

The system able to send alarm message includes a link contains a multi web pages. The system involves an information about the type of infection and description on the disease, system has a user-friendly interface using Python 3.8 programming language and Twilio which is an IoT technique application.

Acknowledgment

We would like to thank Department of Computer Science, College of Science, Mustansiriyah University, Baghdad, Iraq). For supporting this study.

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