International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 11 Issue 01, January-2022

Decision Support System for the Diagnosis of Covid-19 in the Democratic Republic of Congo

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***Abstract*:- The corona virus disease epidemic is making news in the health world, researchers are currently carrying out studies in order to seek ways and means of trying to stop the spread of this virus, several countries are affected, the Democratic Republic of Congo n Not to be outdone, most of the Congolese population is affected by this disease, being a poor and underdeveloped country, the control strategies established by the government to fight the epidemic fail for several reasons, in particular: living conditions are very difficult, failure to respect barrier gestures, especially in common places (transport, market, etc.), Congolese live at the daily rate, so the governor of the city of Kinshasa has set a series of fines to be paid in cases of non-compliance with barrier gestures if they are not respected, [1] therefore the real reason for non-compliance with control strategies, given all that preceded, the numbers of cases continue to vary [2]. Despite the tests that are available as well as with the vaccines, the virus continues to make Degas. The very slow screening process with the mass of the Congolese population of more than 89,560,000 inhabitants [3] is hard.**

In this article, we propose a simple computerized decision support system, which will facilitate to make the diagnosis in an automatic way, based on a set of facts and rules with an inference engine, this work will be based on an automatic diagnostic tool; intelligent referring to an algo but rather system of turn of the rules in the form of a loop by a knowledge base which will trigger the result and this result is examined based on) a notion of probability proposed by the logician, that from the few symptoms out of the totality of the symptoms of coronavirus as well as the external effects associated with the symptoms on the patient's health status, it is likely that the patient will be covid -19 positive as a result of the status software of the sick person on the basis of the symptoms he presents, in order to facilitate his therapist for the care of the patient and his treatment, the system will be in the various sites or health zones on the extent of the national territory in order to to help healthcare personnel make a quick and simple diagnosis by a computer system within a few seconds.

Key word: Decision support system, diagnosis, holiday base, rule base, inference engine, covid-19 disease, knowledge base.

1. INTRODUCTION:

The rapid diagnosis of diseases or symptoms becomes a significant aspect of the profitability and emergence of the health sector and above all it is a very crucial step in the treatment of diseases, in addition to poverty reduction.

Epidemiological diseases are becoming more and more numerous and are invading our society without there being a very fast way of diagnosing them in a fully automated way by knowledge-based systems. It is then a question here of considering the diagnosis as a permanent and dynamic process taking place in parallel with the life of a health organization. This falls within the domain of knowledge management [4], oriented towards reuse, and whose objective is to put the know-how of an individual and his knowledge at the service of a whole community of individuals.

Knowledge is found in the intelligence, know-how, memory, experience of people and also in documents, databases, etc. It must therefore be extracted in order to preserve it and be able to transmit it so that it can be reused, in other words: this knowledge should be managed and a knowledge base created.

Knowledge acquisition is one of the major difficulties in the design of knowledge-based systems.

This is what we will seek to do throughout the realization of this work by showing how the acquisition of knowledge, then allows by their reuse to solve diagnostic problems for the case of covid-19.

2. ISSUE

This theme was chosen with a view to computerizing the diagnosis of epidemic diseases carried out manually and taking too much time to give the results with high risks of contamination to the nursing staff and also requiring too many and sometimes insufficient means, especially inside the country (in the provinces) in some corners (villages) the diagnosis was made orally, that is to say by questions and answers between the caregiver and the patient, then at the end the caregiver draws a conclusion on the state of the patient. It is serious to see these realities in Africa in the middle of the 21st century, for lack of adequate equipment.

There is a saying that says: health has no price, given the insufficiency of materials (tests, drugs...) it has become a business for those who lack them, drugs, tests even impregnated mosquito nets (in the case of malaria) are sold [5], especially the population of the village buys since health has no price while its materials are free in Africa and precisely in the Democratic Republic of Congo, there are too many realities and problems in the health field.

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3. ASSUMPTION

For this, we propose to computerize the diagnosis of epidemic diseases
In particular With covid-19, by putting an automatic diagnostic system which will launch the result after a few seconds, the system will have to trigger its result on the state of a person, based on the data it has to detect if the person is affected or not, by questions of the system and the reactions of the patient
Given the growth of the corona virus disease, which always changes in its different waves [6], we being researchers, we also change the forms of diagnosis.
A diagnostic system that will be quick to help the Congolese population.

4. OBJECTIVES

The system aims to mimic the workings of the human brain, or at least its logic when it comes to making decisions. ... If the subject is not able to tell the difference, then the machine has passed the test and according to the logician, can truly be considered "intelligent". So, the software will imitate humans by making decisions to serve the users (health personnel).

4.1. Specific objective

The system must allow the user:

- To detect and diagnose the disease quickly without doubt,
- Accelerate the process of improving results,
- To move towards adequate solutions for healing and eradicating the disease;
- To give the directives or orientations of treatment,
- To give a general idea of the state of the person in relation to the virus.

5. INTERESTS OF THE SUBJECT

To make available to the health community of Congo, in the different health zones, a decision support software which will make it possible to carry out the diagnosis of covid-19 in an automatic and rapid way in order to reduce the risks associated with counting and reduce the execution time or processing of the results per case as well as reducing the expenses or means (logistics, financial, etc.) for those in the interior of the country where there are more people.
Each time there is a new wave of covid-19, researchers will continue to carry out studies to obtain information on the evolution of the disease... there is no question of ordering the tests, the software is permanent in each health zone, it is enough to reinforce the system on the news of the virus (in case of new symptoms…).

6. COMPUTATIONAL APPROACHES

It is necessary to use information-based approaches that allow to give a clear and precise result to the patient without trial and error, including the symptoms, with a list of more than 15 symptoms [7] which will be grouped together in a base of the facts submitted to the different rules of the automation game which will be continuous in the form of a loop in which each symptom or fact is associated with a rule then produces a partial result within the internal processing system at the end of the processing process the final result will be triggered on the basis of the partial results of each fact, this whole mechanism is carried out by the CLIPS tool. After the result, the patient will be referred for treatment.

7. METHODOLOGY: METHODS, TECHNIQUES AND TOOLS

The first task was to identify the covid data, in particular these different symptoms, its mode of transmission, the epidemiological chain as well as its means of control The objective of this work was to develop and set up a help system to the decision by an intelligent diagnosis which can, later, be considered
As a tool that will facilitate the diagnosis of other epidemic diseases outside covid-19.

7.1. Methods

- *KADS:* method for setting up the computer system structured in terms of knowledge-based system using the clip language.

This model is intended as a methodology for the study, construction, use and maintenance of knowledge systems.
The principle of rapid implementation of a prototype is rejected (“superficial” knowledge, lack of structure, lack of maintenance), seeking on the contrary to conceptualize and model the domain completely before undertaking an implementation. The approach must make it possible to store the knowledge of the expert independently of the expert system built.

- *Descriptive:* a method that allowed us to describe the epidemic disease in terms of covid-19 as well as its different symptoms.

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7.2. Techniques

Several techniques have been developed to collect the information necessary for the development of a work. It is also an instrument that the researcher uses to implement their methods. For the case of covid-19 we used:

- *Interview:* this technique helped us with the interview during which an interview with the medical personnel, to know their opinion, their work, their projects. In addition, this technique allows an investigator to have direct contact with any person. It allowed us to obtain from the medical corp, information concerning epidemiological diseases, therefore covid-19, their symptoms and even to see the regions where they appear the most.
- *Observation*: this technique allowed us to observe or draw attention to the facts. As for this technique, it allowed us to complete the study of the existing situation by actually observing what is happening on the ground, by observing the behavior of patients with covid-19.
- *Documentary:* this technique allowed us to consult the various documentaries (archives) concerning epidemiological diseases as well as covid-19 and their symptoms. Their evolution since their appearance or their history over time and thus the related treatments.

7.3. Tools

A type of programming tool, an integrated development environment designed to implement knowledge-based systems. it is a program specially designed to model human expertise or knowledge. [8] CLIPS is called a knowledge-based system tool because it is a complete environment for developing expert systems. The word Shell is reserved for that portion of CLIPS that performs inference or reasoning. The CLIPS Shell provides the basic elements of a knowledge-based system, namely:

- The list of facts, and the list of instances: global memory for data;
- The knowledge base: contains all the rules, it is the rule base;
- The inference engine: controls the execution of the rules.

A program written in CLIPS can consist of rules, facts, and objects [9].

8. RESULTS

This work documents the process of automatic processing of information

Decision-making by an intelligent system for diagnosis in terms of a decision support system for the diagnosis of epidemic diseases including the breakage of the coronavirus, at a reduced time the system will be able to display the patient's result on the basis of the different symptoms that he foresees by a logical reasoning of the system based on the knowledge (data) instructed in coding mode in the form of rules and these different rules associated with the facts which produce a final result, of which this result is produced by a system of turns of the rules from software to patient data.

- Tasked: Computer program designed to reason. If the result is achieved, the system must then be able to draw its own conclusions from its analysis and even be able to deal with uncertain knowledge…

It will be used as a decision-making tool that will replace screening tests for the case of covid-19 and will facilitate rapid and precise work for health personnel with Reduction of the risk of contamination because its coronavirus tests are failing too much.

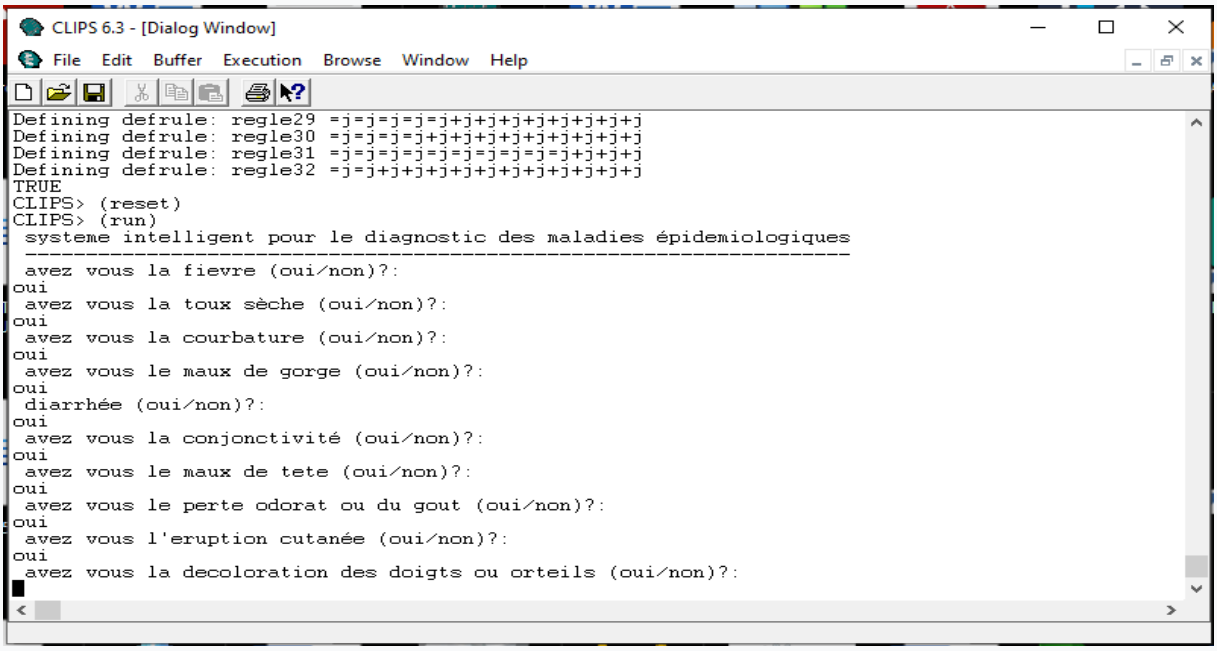

Figure 1

International Journal of Engineering Research & Technology (IJERT)
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Screenshot of the intelligent decision support system, showing the statements of the system on the different requests made in order to have results to continue the treatment process for a final result, thanks to the CLIPS tool with the version 6.3.

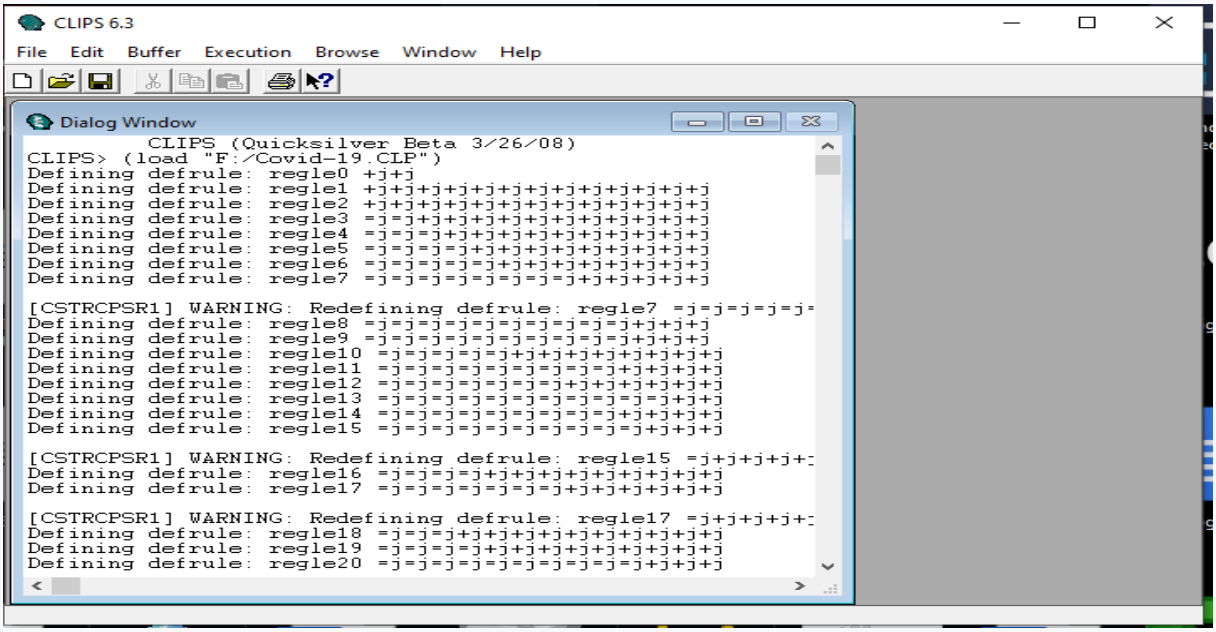

Figure 2

Screenshot of the system, presenting the basis of the rules which we have several regels and each rule corresponds to an effect of the patient and with a continuity until triggering the terminal result on the analysis of the patient.

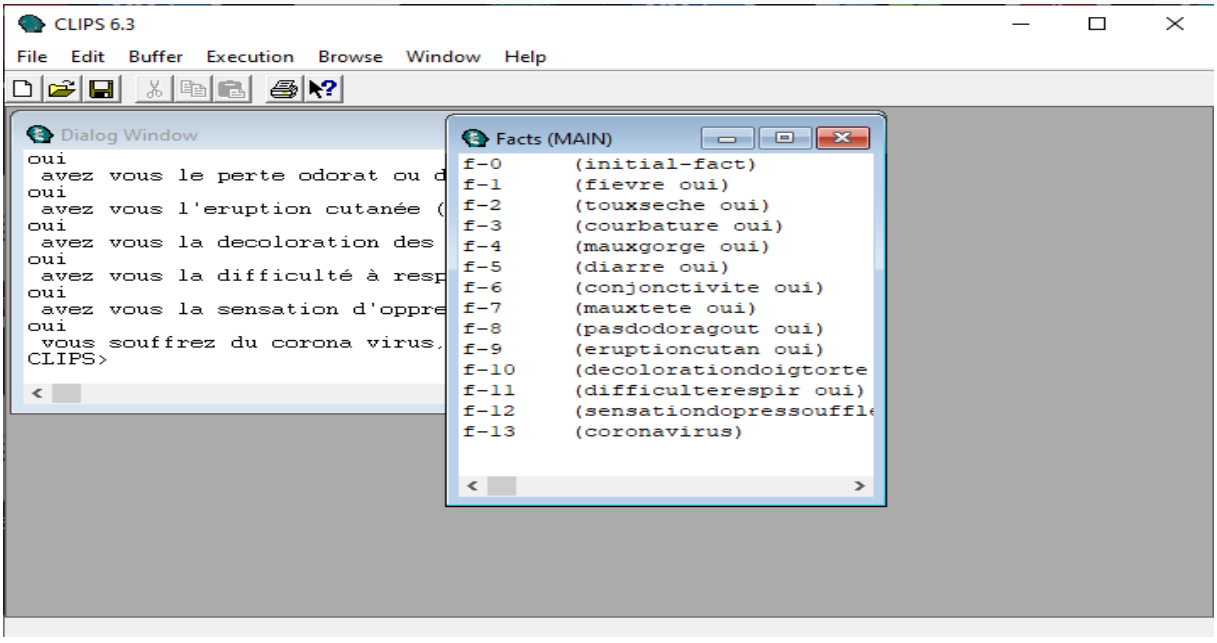

Figure 3

Screenshot of the system showing the basis of facts that justifies a set of the different symptoms that the system has, which will be one by one, incremented in order to constitute a partial result of the system before the final result.

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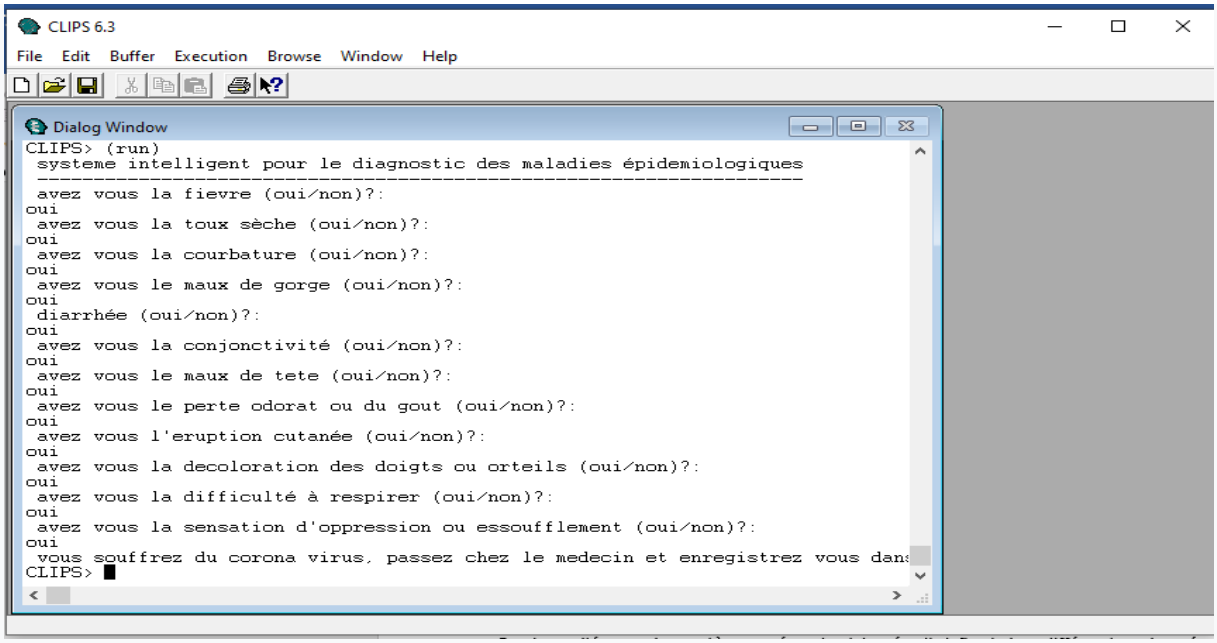

Figure 4

Screenshot of the system showing the final result of the various patient data then orientation for a positive case of covid-19.

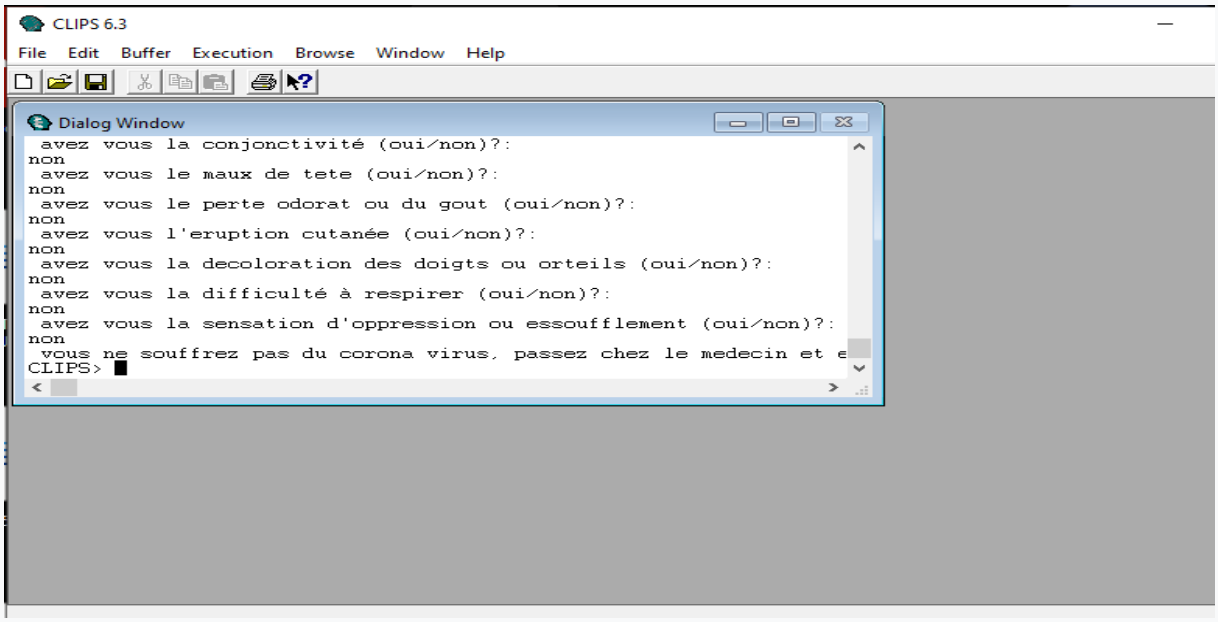

Figure5

Screenshot of the system, showing the negative covid-19 result

9. DEBATES

The corona virus ag respi-strip diagnostic assay was designed to help diagnose the disease even before the release of the various vaccines, but we find that these tests are very slow despite its results, so the time to take the samples tested, go to analyze and give the results, it can take more than 24 hours, in the Democratic Republics of the Congo, it takes more or less a week to have the

As a result of covid-19, [12] and the biomedical research institutions dealing with epidemic diseases are only found in Kinshasa (INRB) [13] , while the country has 26 provinces...

The question we ask ourselves, if the person is positive for coviv-19, he can infect others, the time to wait for his result and if the person is very sick or serious, he can die just to wait for his result. While with our system we can facilitate everything in a few seconds, the result is triggered and the person is oriented despite everything, it is an electronic system by a machine which requires maintenance, Energy for its operation, 'autonomy...but it's not very helpful, different from the manual tests of covid-19 which require time for the results and which also make failures also manual work does not lack errors...this section presents discussions in turns different points, in particular: the duration of the result after the test, the result with precision, the risk of contamination due to the expectation of the result, several cases of samples can cause errors, etc.

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10. CHALLENGES

The current challenges linked to the covid-19 epidemic which has of course become a
Pandemic, the potential roadmap towards an optimal solution based on the coronavirus disease, particularly in the Democratic Republic of Congo and even in Central Africa, we have learned lessons and techniques to try to control human-to-human transmission and this towards a strong raising awareness of the signs and symptoms of the disease as well as vaccination, relying on our intelligent computer diagnostic decision support system to carry out the diagnosis to the population, to remind the population of respect for barrier gestures each time then to the research and monitoring of contacts, however by not ignoring its various proposals, we will never be confined to the house and especially with the current political situation and the humanitarian crisis which prevails, characterized by violence and armed conflicts associated with attacks on health areas and workers, patients, local distrust and displaced internal population ments. This epidemic is only a complex public health concern in addition to a risk factor in public health emergencies, which is an area of violent conflict whose there are more obstacles that require Strategies, . Research on the knowledge, attitudes and practices of populations affected by the coronavirus disease, not to forget the displaced populations are more susceptible to contamination.
Also suggest that human health organizations update existing guidelines and protocols to inform ethical and culturally respectful engagement with communities by health care workers assigned to outbreak areas.
Also, since the vaccines are accepted and their effectiveness, it is necessary to raise awareness among the entire population to be vaccinated. We also suggest specific drugs for covid-19 which will be considered as potential drugs for its treatment after diagnosis as for the In the case of malaria, quinine is highly rated for its treatment despite these effects...

11. OUTLOOK

This covid-19 disease which has become a pandemic seems to be between a continuous battle given the change in these forms or waves that affect the different countries of the world, the DRC is not left out for this, we propose to tow the health systems and research to new technologies and multidisciplinary collaboration, we also propose to set up a diagnostic computer system which will be standard for diagnosing the various epidemic diseases wider than our decision support system which concerns only covid -19 then apart from covid-19 which is a problem, there is also Ebola, measles, cholera, tuberculosis... in addition to setting up a data management system for all epidemic information which will be distributed to the different health zone on the extent of the territory in order to give an idea of the evolution of the different cases of epidemics in addition, translational research by supporting the design of e new IT tools or pipelines. More importantly, knowledge and lessons learned from different epidemics could inform policy. And why not also establish a coordination of research together with researchers in the field of health on the development of rapid computer tools appropriate in their field...

12. CONTRIBUTIONS

The contribution of this work is more pragmatic than theoretical, this so-called intelligent decision support system for the diagnosis of covid-19 is helpful and will facilitate health personnel. A simple system to use for users who are not in the computer or technical field, easy to handle, not requiring conditions, in particular: the password or the opening of an account or the internet connection... it should be noted that the termoflach is not a diagnostic tool nor an instrument which detects covid-19 but it's just a thermometer that allows you to know a person's temperature, the Current thermo-flash alone has shortcomings compared to the test, because apart from fever as a symptom (or temperature high), the person may not have it even though they are really suffering.

Figure 6: termoflach

For the patient to be positive for covid-19, it is envided that he has the different effects, more or less 15 symptoms [10] so the probability is from the 7 or more of the different symptoms related to the disease already the person is suffering from coronavirus. Hence our software contains all the different symptoms related to covid 19 to facilitate an accurate and safe result, so the system is open for other additions in the event of new forms of the disease or waves because each time there is has a new wave, symptoms can move too [11]

13. CLOSING

A scientific or purely technical work is never easy, mastering a system that will facilitate giving an automatic result on a logical analysis based on knowledge in any field, is a difficult task that requires the contribution of multidisciplinary stakeholders and especially the information that integrates in the form of knowledge acquired in order to operate the system to meet the needs of users in any field. This work is in support of the fight against epidemic diseases, in particular covid-19 disease, from which we

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 11 Issue 01, January-2022

have integrated the various data for an idea of facilitating the diagnosis of this covid disease by proposing intelligent diagnostic software in terms of of a decision support system for the diagnosis of cases of the current coronavirus. This system should be a guide tool for a better orientation for the treatment of this disease and which enlightens the optimal strategies of research at the global or national panel level.

And to open a direction for research on new options for treatment tools for epidemic diseases as well as to give political decision-makers a reinforcement plan for future epidemics, given the health realities with which the Democratic Republic of the Congo is confronted.

14. FUTURE WORK

This decision-making system for the diagnosis of covid-19 should not be considered as a replacement but rather as an aid tool that supports the treatment of the disease by facilitating certain tasks for caregivers by offering them a rapid diagnostic device. given the overpopulation of the Congo, a diagnostic system, not to be confused with therapy, of which we propose to strengthen this diagnostic system by combining it with a therapeutic system which will be a guide tool for the treatment of covi-19 disease. The Democratic Republic of Congo knows other diseases except the coronavirus, from where we propose to set up other computer systems which will contribute to facilitate the diagnosis, the therapist, the management, the sharing of epidemic data and others…on the national as well as African and why not global level.

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