



A fuzzy Logic-based model for gastroenteritis diagnosis in pediatrics

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Abstract

Preceding interference in the prevention of gastroenteritis disease in pediatrics is necessary as this has the possibilities of preventing prolonged treatment with unbearable financial implication and in some cases which leads to death of patients, especially when the patients sensitivity to treatment is low. Choosing the appropriate preventive method is key in the analysis of gastroenteritis. The problems faced by the system are inaccurate analysis due to errors like redundancies in the data, imprecision. The study is therefore concern with the using of fuzzy logic-based formulation mathematical model to predict the presence of gastroenteritis in pediatrics and it degrees, using fuzzy logic with the objectives of providing a scalable symptoms database to determine the degree of the presence of gastroenteritis symptoms with respect to various stages and then generate an analysis report which then determine the dosage of drugs to be administered to the pediatrics for full recovery. The study is beneficial to the health sector, the research communities with it's scope to determine the degree of gastroenteritis and produce accurate analytical report. The study helps to improve medical analysis. The study is guided by rapid application methodology. The study is limited to the use of symptoms. The expert system was designed using Hypertext Programming Language a framework of Laravel with My structure query language relational database on Apache Sever under Windows operating system platform, and using Java Script, bootstrap and cascading style sheet to archive the system design, at the end an analytical report was predicted to determine the presence of the degree of gastroenteritis being at a mild, moderate, severe and very severe degrees

Keywords: Gastroenteritis, Fuzzy Logic-Based, Model, Diagnosis, Pediatric

Introduction

Early intervention in the prevention of gastroenteritis disease in pediatric is essential as this has the potential of preventing prolonged treatment with unbearable financial implication and in some cases which leads to death of patients, especially when the patients sensitivity to treatment is low (Bailey *et al.*, 2010) [2]. Choosing the appropriate preventive method is key in the analysis of gastroenteritis signs and symptoms. Conventional methods for detecting gastroenteritis signs and symptoms may not have been effective in the sense that they lack the ability to detect the précised degree of the presence of gastroenteritis signs and symptoms which can lead to inappropriate treatment. Medical reports have it that gastroenteritis disease occur or manifest as mild, acute or severe. The degree of manifestation determines the type o treatment to be administered. To avoid prescribing the wrong treatment in an uncertain situation, an intelligent gastroenteritis signs and symptoms detective mechanism is required. This forms the motivation behind this research. It is evident that several attempts have been made to integrate computer technology into medical diagnosis including gastroenteritis investigation process. One known computer technology for the investigation of the cases of uncertainty is a branch of artificial intelligence which is fuzzy logic.

Clarity in many fields of endeavours has been proven by the effective use of Fuzzy Logic. Fuzzy Logic has been mostly used in system control, household devices, in making decisions, prediction techniques and car manufacturing. Inflammation of the lining of the small intestine that results in diarrhea, vomiting, nausea, abdominal cramps, fever and appetite loss is known as Gastroenteritis. Gastroenteritis is mostly caused by virus, bacteria, or parasites. The symptoms and signs relating to the presence of these

organisms helps the doctor in the diagnosis of the disease. Gastroenteritis can be acute or chronic (Chan *et al.*, 2015) [4]. It is said to be acute when it occurs for about a few days to a week, it is chronic when it persists for a long period of time. Chronic gastroenteritis leads to dehydration and imbalance of food chemicals because of the loss of fluids in the body through the stooling and vomiting of the child. Gastroenteritis is best prevented by proper sanitation, proper storage of food and drinking uncontaminated water, proper enlightenment on the need for proper hygiene. About 3 to 5billion cases occur each year worldwide, it is most common in countries that are developing, it is mostly seen among pediatric under the age of 5 years, where access to proper health care is low, millions of pediatrics die every year from dehydration and diarrhea caused by inflammation of the lining of the small intestine. Developed counties where pediatrics are well taken care of and have entrance to distinguished medications, the effect are not severe. However in Nigeria gastroenteritis is still a persistent complication. Every year, about 1.5 million doctor appointments is gastroenteritis, about 200,000 hospital appointment and 100 to 500 deaths. Although there are several models that are machine learning that have been developed for the analysis as regards to gastroenteritis, there are still lapses which have to be addressed to improve on the analysis accuracy. Specifically, this trait has led to undesirable problems described in the next section.

Statement of the Problem

1. Inaccurate Analysis: Inaccurate analysis due to errors like redundancies in the data (data collected multiple times), incomplete data, outdated data. For this problem to be solved data should be properly collected, data

collection should be consistent and correct to avoid wrong analysis. False data should be avoided.

- 2. Imprecision:** imprecision has to do with irregularity of the solution of measurements from one investigation to the other. Depending on the imperfection of the measures. For imprecision to be avoided, data should be outlined by real numbers or vectors with real-valued elements.

Aim and Objectives of the Study

The aim of the study is to predict the presence of gastroenteritis in pediatrics using fuzzy logic. The objectives of the study are to:

1. provide a scalable symptoms database of gastroenteritis in pediatrics
2. design a gastroenteritis predictive model
3. Evaluate the developed gastroenteritis model.

Gastroenteritis Concept

Inflammation of the lining of the intestines or the inflammation of digestive tract caused by virus, bacteria or parasite that results in diarrhea, vomiting, fever, abdominal cramps, and substandard appetite is known as Gastroenteritis, inflammation has been known to be responsible for dehydration. The pediatrics manifestation and account of revelation help the doctor verify the diagnosis. Gastroenteritis can be Acute or Chronic, when acute it is said not to last for long, its usually about a few days to a week, some parents/guidance don't usually say a pediatric have acute gastroenteritis but rather they incorrectly say the pediatric have stomach flu/Bug/Virus and when Chronic it is said to persistence for a period time. The best preventive measure of gastroenteritis in pediatric is to educate them to avoid contaminated water and incorrectly kept food, as well as to wash their hands often. Liquid and remoisturize mixture are provided, but pediatric patients may need to see a doctor and perhaps check into a hospital. The most prevalent digestive illness in children is gastroenteritis. Desiccation and variation of blood chemicals (electrolytes) are brought on by severe gastroenteritis due to the loss of bodily liquid in the stool and vomit. Every year, there are between 2 and 4 billion episodes globally, with the majority occurring in underdeveloped nations among children under the age of 5. Every year, between 1.3 and 2.9 million children under the age of 18 pass away through diarrhea and remoisturize brought on by gastroenteritis in underdeveloped nations in which pediatrics are especially susceptible and treatment is sometimes difficult to get (Churgay *et al.*, 2012) [5]. The effects are less severe in industrialized nations because pediatrics are replete and gained entrance to top-notch medical treatment, most particularly intravenous hydration when necessary. However, acute and chronic gastroenteritis continue to be widespread issues in the US. About 1.8 million doctor's appointments, 400,000 hospital appointment, and 300 to 500 fatalities are brought on by gastroenteritis each year.

Inflammation occurs when the body's white blood cells declare chemicals into the blood or tissues to defend the infant against outside intruders. As a solution, the area of injury or infection takes increased blood flow. Warmth and redness may report from it. A few of the substances result in fluid leakage into the tissues of children, which causes

swelling. This defense mechanism could irritate the nerves and hurt. (Woolley *et al.*, 2009).

2. Gastroenteritis Causes

Common gastroenteritis causes are:

Viruses (common cause), Bacteria and Parasites

1. Viruses: The common source of gastroenteritis in Nigeria are viruses. The viruses that commonly cause gastroenteritis are: norovirus (common in the United States), rotavirus (common worldwide), astrovirus and adenovirus

The utmost common measures for the propagation of viral gastroenteritis is feces-to-oral transfer. Fecal-oral applies to the conduction of viruses from a contaminated individual diarrheal stool (feces) into another individual's mouth. Of course, stools are not directly consumed by human being. Rather it is contacted through pediatrics that have diarrhea or their parents, caregivers and /or guardians when they handle few adulterated feces in their hands and do not wash their hands thoroughly and they use same hands to touch surfaces and objects. Any one who touches these objects and surfaces stands the risk of contracting the virus. Additionally, sneezing and spitting might transmit a viral gastroenteritis infection (Catriona *et al.*, 2008) [3].

Since rotavirus vaccinations were introduced, norovirus has surpassed rotavirus as the enormously frequent source of gastroenteritis in pediatrics in the United States. Infections happen all year round. The majority of children get ill after ingesting polluted food or drink. Norovirus is very infectious, making it simple for children to get the disease from other kids.

- a. Astrovirus may infect individuals of any age, but typically targets young children and newborns. Fecal-oral transference of the disease is further prevailing during the winter.
- b. Pediatrics at the age of 2 is enormously often impaired with adenovirus. Diseases occur every year long and are hardly ever habitual in the summer (Halligen, 2014).

The disease is mostly transmitted by feces and the mouth bacterial gastroenteritis. Fig.1 shows the bacteria gastroenteritis.

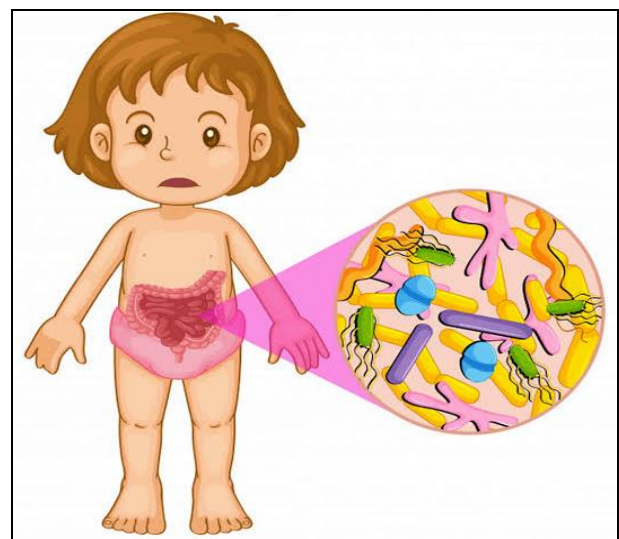


Fig 1: Bacteria Gastroenteritis (Source: Van and Pontual 2013).

Bacteria

The bacteria that are greatly the regular effect of gastroenteritis involves:

Escherichia coli (E. coli), Salmonella, Campylobacter, Shigella, Yersinia, Clostridium difficile, Enterocolitica and Aeromonas.

Pediatrics can proximity bacterial gastroenteritis through:

1. Holding or eating adulterated foods, especially raw or ineffectually cooked eggs or meats.
2. Eating rotten shellfish.
3. Drinking unprocessed juice or milk.
4. Holding animals that have definite bacteria.
5. Swallowing polluted water, such as through wells, swimming pools and streams.

Many different forms of uncooked, unrefrigerated meals may develop bacteria (potential problem situations include buffets and picnics). Food infected with Staphylococcus germs can discharge a toxin that creates rapid diarrhea and vomiting. Food contamination is the word used to characterize gastroenteritis which is seen as engrossing food that accommodates microbial toxins or bacteria.

By consuming or swimming in unhealthful water, equivalent as that seen in streams, wells, water parks, and swimming pools, pediatrics may have gastroenteritis called recreational water illness (Fazal *et al*, 2019) ^[10].

Parasites

The most common ways to get parasitic gastroenteritis, notably as Cryptosporidium parvum and Giardia intestinalis, are regular taking in polluted water or by fecal-oral dissemination (which is seen to happen in day care centers). (Hascelik *et al*, 2019) ^[14]. In impoverished nations, the parasite Entamoebahistolytica is seen as a persistent source of bloody diarrhea, although it is uncommon in the United States.

3. Gastroenteritis Symptoms

Gastroenteritis Symptoms are normally a consolidation on:

1. Fever
2. Nausea
3. Diarrhea
4. Abdominal cramps
5. Vomiting
6. Appetite loss

The exceedingly regular symptoms of gastroenteritis, disregarding of the source, are diarrhea and vomiting (Naser *et al*, 2016) ^[22]. Gastroenteritis associated from a disease can as well object abdominal cramps and fever.

Diagnosis of Gastroenteritis

1. Review of vital signs
2. Symptoms, the pediatric chronology, and a physical diagnosis.
3. Analysis of stool
4. Full blood count
5. Retroviral Screening (RVS) HIV.
6. Duration of illness.

5. Prevention of Gastroenteritis

These are some preventive measures for Gastroenteritis

1. Wash your hands after using the toilet before eating.

2. Retain heated meals heated and freezing foods freezing as common instructions
3. Food that are have been kept out for consumption has to be consumed within an hour.
4. Due to the presence of immunoglobulin transfer from mother to child during breastfeeding, mothers are advised to make use of spoon and cups to avoid contamination through bottles.
5. Constantly sanitization of nappies-interchange positions with a freshly produced bleach solution is preferred.
6. Constantly sanitization of nappies-interchange positions with a freshly produced bleach solution is preferred.
7. Pediatrics with diarrhea can wait until their symptoms have subsided before returning to pediatric care facilities. (Gupta *et al*, 2008) ^[12].

7. The Fuzzy logic (FL)

Fuzzy Logic (FL) is a procedure of thinking that looks like that of an individual. The process is in resemblance of how humans execute decision taking Fuzzy logic instructions assists to resolve an issue taking into consideration every accessible data then it collects the most preferred feasible determination for the provided input (Pelletier and Daniel, 2000) ^[23]. Fuzzy Logic is an application to flexible clarifying that permits for manifold principles to be refined via the matching adaptable. Fuzzy logic strives to deal with difficulty with an open, indefinite scope of data that makes it feasible to acquire an arrangement of precise terminations. Fuzzy logic is premeditated to answer complications by taking into consideration every obtainable details and manufacturing an excellent conceivable resolution specified by the input.

1. Fuzzy logic authorizes for several modern conclusion-tree clarifying and superior amalgamation with regulation-based schedule.
2. Hypothetically, this permits the avenue for many opportunities to mimic real-life conditions.
3. Fuzzy logic can be accustomed by quantifiable analysts to optimize execution of their instructions.

Fuzzy logic emanate from the mathematical analysis of fuzzy conception which also include fuzzy groups of data. Mathematicians can possibly utilize a diversification of appellation when mentioning to fuzzy conceptualization and fuzzy analysis. Predominantly and extensively these location are categorized as fuzzy connotations.

Realistically, this builds all and gives room for several values of the "true" circumstances. Rather than True being numerically parallel to 1 and False being parallel to 0 (or contrariwise), the True situation can be of any number of values not more than one and considerable more than zero (Bai *et al*, 2006) ^[1]. This invents opportunity for instructions to make resolutions install on scale of price data in opposition to one prudent data point.

1. A fuzzifier that transliterate frangible input (long-established numbers) into fuzzy advantages
2. An inference engine that avail oneself of a fuzzy hypothesis function to have a fuzzy output contingent upon Mamdani inference.
3. A knowledge base that involves a set of fuzzy principles and a set of membership purposes for showcasing the fuzzy sets of linguistic malleable.
4. A defuzzifier that translates fuzzy output into frangible advantages.

Methodology

The rapid application development methodology was adopted for the design of fuzzy-logic based analysis model for gastroenteritis in pediatrics system. RAD is an procedure to information systems development with a lifecycle designed to render much speedy development and increased-quality reports. It is designed to have the maximum advantage of strong development software that has excellent quality, risk control and projects delivery on time with the given frame of time budget. This is achieved by accustoming sets of trusted application development tools, around a well-defined method. It is a process from which the development cycle of an application is expedited. This method was developed by (James, 1980). The rapid application methodology has four main phases:

1. Requirements planning phase: individual’s interaction and agreement concerning project wants, project spectrum, barriers and system specification.
2. User architecture phase: individuals interactions over every system procedures inputs and outputs, techniques and CASE tools.
3. Construction phase: duties are programming and application growth, coding, unit-integration and system testing.
4. Cutover phase: implementation phase, involving data conversion, testing, changeover to the new system, and user training.

5. A Fuzzy Logic-Based Model for Gastroenteritis Diagnosis in Pediatrics

The fuzzy logic- based diagnostic model is a system that uses fuzzy mathematical formulation for its result analysis. The fuzzy system brought to mark two different ways in actualizing it desired output prediction. The first is putting into consideration five symptoms, second using the fuzzy logic knowledge based approach. The fuzzy logic-based system predicts gastroenteritis in pediatric using fuzzy logic mathematical formulation. The system assists the doctor to diagnosis the presence of gastroenteritis disease in a pediatric in a fuzzy way. Based on the symptoms enter into the system, according to the symptoms, the fuzzy logic system diagnosis based on its knowledge, add catalyst factor (if any) and do ranking and gives result in fuzzy form. This stores the permanent knowledge of the domain of the application and allows the system to act as an expert in the domain under consideration. It is this module which depends on the domain of application. it holds a set of rules of inference (production rules) that are used in reasoning. These rules are of the form; if <condition>, then <action>. The knowledge base contains knowledge belonging to the domain of the system; it stimulates the activity of an expert in his/her deductive and explanatory capacity. Gastroenteritis pediatric diseases whose symptoms are Fever (F_s) Nasal congestion (N_s) Diarrhea (D_s) Abdominal (A_c) Vomiting (V_s). So it will be stored in knowledge base in the form of a rule which is as follow: - Disease (Patient, gastroenteritis): - Fever Symptom (F_s), Nasal Congestion Symptom (N_s), Diarrhea Symptom (D_s), Abdominal cramp Symptom (A_c) and Vomiting symptoms (V_s) are store in the knowledge based before the inference engine will make it prediction based on the degree like mild, moderate, severe or very severe. The productivity was gotten at 75%, responsiveness gotten at 85% and the availability and usability gotten at 60%. Diagram of the A Fuzzy Logic-Based Model for Gastroenteritis Diagnosis in Pediatrics design is shown in Fig 2.

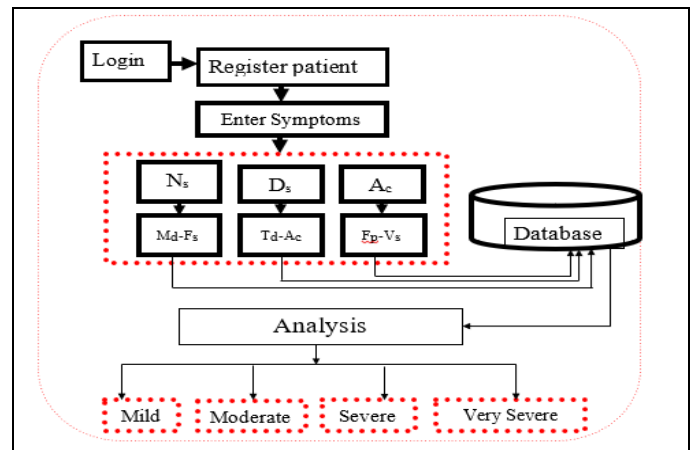


Fig 2: Architecture of A Fuzzy Logic-based Model for Gastroenteritis Diagnosis in Pediatrics

2. Explanation of A Fuzzy Logic-Based Model for Gastroenteritis Diagnosis in Pediatrics Components.

The new system contains the following components:

1. **Login:** the login is used to authenticate the user of the system, granting the users of the system the access to login and carried out their given assignments.
2. **Patent details:** In the existing acute gastroenteritis system, an account is created for the child by the front desk officer, bio data gotten from the child includes name, sex, age, address of parents and phone number, the name of the child is used as login user name and the phone number of the guidance is used as password.
3. **Symptoms:** the input symptoms are diarrhea or vomiting the doctor will enter with the aid of the keyboard.
4. **Prediction:** the child is diagnosed with gastroenteritis through reviewing the symptoms. The system automatically output if the child is positive of gastroenteritis or negative of gastroenteritis.

3. Algorithm of A Fuzzy Logic-Based Model for Gastroenteritis Diagnosis in Pediatrics.

Listed below are the steps to follow when carrying out a fuzzy logic-based for gastroenteritis diagnosis in pediatrics.

- Step 1: Start
- Step 2: Enter symptom
- Step 3: Si = is ith symptom selected or not else return to step 2
- Step 4: Wi = weight of symptom
- Step 5: (Smajor)j = jth major symptom which is not selected by the user
- Step 6: (Wmajor)j = weight of jth major symptom
- Step 7: Maxth = maximum threshold
- Step 8: Minth = minimum threshold
- Step 9: ΣSiWi = total weight of a disease based on the selected symptom
- Step 10: Σ (Smajor)j(Wmajor)j = total weight of unselected major symptoms of a disease
- Step 11: display result mild, moderate, severe or very severe.
- Step 12: End.

Advantage of A Fuzzy Logic–Based Model for Gastroenteritis Diagnosis in Pediatrics.

1. The fuzzy based analysis model is accustomed to determine the presence of gastroenteritis with the fuzzy mathematical formulation model.
2. Fuzzy rule is used for the determination of the degrees of gastroenteritis.
3. The fuzzy logic- based analysis model gives an accurate test analysis of the disease.
4. It is has a scalable database

5. A Fuzzy Logic–Based Model for Gastroenteritis Diagnosis in Pediatrics Conceptual Model

The Fuzzy Logic–Based Model for Gastroenteritis Diagnosis in Pediatrics conceptual model describes the structure, behaviour and in-depth view of the system, It defines the input, processes and the output of the fuzzy analysis model.

6. Database Design of A Fuzzy Logic–Based Model for Gastroenteritis Diagnosis in Pediatrics

Database architecture is the procedure of manufacturing a distinguished data model of a database. This logical data model have all the necessary logical and physical architecture choices and physical store parameters needed to produce an architecture in a data definition language, which can then be used to create a database. A fully attributed data model contains detailed attributes for each entity. In the database design there are various users in the system and parameters used in determining the degrees. The steps of doing database design publically includes the various duties carried out by the various users in the database design.

Table 1: Allocation Database Table

S/N	Field	Type	Length
1.	Id	Int	11
2.	patientID	Int	11
3bg.	Status	Enum	20

Table 2: Database

S/N	Field	Type	Length
1.	Id	Int	10
3.	Username	Varchar	100
5.	user_type	Enum	Admin/front desk/doc
6.	Password	Varchar	255
9.	Age	Int	100
7.	Sex	Enum	male/female
10.	Address	Varchar	200
11.	Phone	Varchar	18
12.	date_of_visit	Varchar	20
13.	Token	Varchar	255
1	Status	Enum	active/block

Table 3: Doctors Database

S/N	Field	Type	Length
1.	Id	Int	11
2.	Doctored	Int	11
3.	PatientID	Int	11
	Symptoms	Varchar	255
7.	Result	Varchar	200
8.	Status	Enum	processing/done

7. Fuzzy Rule for Gastroenteritis

When $CM_d < 2$, $CT_d < 3$, $CF_p < 3$ then $G_D = \text{Mild}$

When coefficient of malaria disease is less than two, coefficient of typhoid disease is less than three, coefficient of food poison is less than three, then gastroenteritis disease is equal to mild.

When $CM_d < 3$, $CT_d < 4$, $CF_p < 4$ then $G_D = \text{Moderate}$

When coefficient of malaria disease is less than three, coefficient of typhoid disease is less than four, coefficient of food poison is less than four, then gastroenteritis disease is equal to moderate.

When $CM_d = 3$, $CT_d = 4$, $CF_p = 4$ then $G_D = \text{Severe}$

When coefficient of malaria disease is equal to three, coefficient of typhoid disease is equal to four, coefficient of food poison is equal to four, then gastroenteritis disease is equal to severe.

When $CM_d > 3$, $CT_d > 4$, $CF_p > 4$ then $G_D = \text{Very severe}$

When coefficient of malaria disease is greater than three, coefficient of typhoid disease is greater than four, coefficient of food poison is less greater than four, then gastroenteritis disease is equal to very severe.

8. Use Case Diagram of A Fuzzy Logic–Based Model for Gastroenteritis Diagnosis in Pediatrics.

A use case drawing describes a unit of effectiveness given by the system. The use cases drawing is used to assist in growing teams visualize the functional specifications of a system including the relationship of “actor” individuals who will discuss with the system to essentially have relationship among changeable types use case.

Findings and Results

A real representation of mathematical values were used in designing the prediction of gastroenteritis in pediatrics, values were merged to linguistic data so as to produce reliable results for feedback and a successful comparison of data for effective evaluation and statistical documentation was carried out. The system consists of five input variables: Fever symptom (F_s) Nasal congestion (N_s) Diarrhea symptom (D_s) Abdominal cramp (A_c) Vomiting symptom (V_s) which are seen as the major causes of the disease. Malaria disease (M_d), Food poison (F_p), Typhoid disease (T_d), Tooth growth (T_d) and Pneumonia (P_d) are the resultant outcome associated with the symptoms of the disease. Some probabilities were put into considerations where it is possible that Fever symptom plus Nasal symptom is equal to Malaria disease, Diarrhea symptom plus Abdominal cramp plus Vomiting symptoms is equal to Food poison, Fever symptom plus Nasal symptom plus Diarrhea symptom equal to Typhoid, Diarrhea plus Abdominal cramp plus Vomiting symptom is possible the pediatric been allergic and Nasal symptom plus Diarrhea symptom plus Abdominal cramp equal to Pneumonia. The rule base of this system is used to determine the four output parameter value: Very Severe, Severe, Moderate and Mild according to the five input values where we have it that when coefficient of malaria disease is less than two, coefficient of typhoid disease is less than three, coefficient of food poison is less than three, then gastroenteritis disease is equal to mild, When coefficient of malaria disease is less than three, coefficient of typhoid disease is less than four, coefficient of food poison is less than four, then gastroenteritis disease is equal to moderate, when coefficient of malaria disease is equal to three, coefficient of typhoid disease is equal to four, coefficient of

food poison is equal to four, then gastroenteritis disease is equal to severe and when coefficient of malaria disease is greater than three, coefficient of typhoid disease is greater than four, coefficient of food poison is less greater than four, then gastroenteritis disease is equal to very severe.

The architecture for the diagnosis of gastroenteritis disease shows two main phases. The phase one is used for the diagnosis of the disease and the phase two is used for the expert learning system where expert doctors can update their machine with knowledge for the improvement of the system. In phase one of the system, there are three main stages. The input from the patient helps in identifying the probability in terms of percentage of diseases the patient may have. The process with repeat until the last stage of the diagnosing system; than the inference mechanism and the Defuzzification process uses a centroid method to aggregate the inference of fuzzy expert system. After user has check the symptom the inference engine helps to diagnose it based on what the user selected. Each symptom is mark to a particular weight. The result was recorded after series of test carried out by different patient. Each of the pediatrics symptoms was selected for the system to diagnosis and the output result would determine the type of illness. The result table helps to diagnose the disease of the pediatric. The patient inputs help in determining the result of the system. When each symptom is selected the inference engine loads it into the knowledge based for decision making.

The gastroenteritis was implemented using height level programming language like hyper preprocessing language, JavaScript, Notejs, and hypertext make-up language etc. Hyper preprocessing language, JavaScript and Notejs is used has the backend code in the system while hyper text make-up language is the front end. Before the system was hosted software testing was carried out to check if there are any bugs. After the above following reports were taken the following results were generated by the system. Fig: 1 sows the login result page which enables the various users of the system to login, Fig: 2 shows the doctor diagnosing result, Fig 3 shows the symptoms diagnosed successful result, Fig 4 shows the result of a pediatric at a mild level of the presence of gastroenteritis, Fig 5 shows the result of a pediatric at a moderate level of the presence of gastroenteritis, Fig 6 shows the result of a pediatric at a severe level of the presence of gastroenteritis and lastly, Fig 7 shows the result of a pediatric at a very severe level of the presence of gastroenteritis.

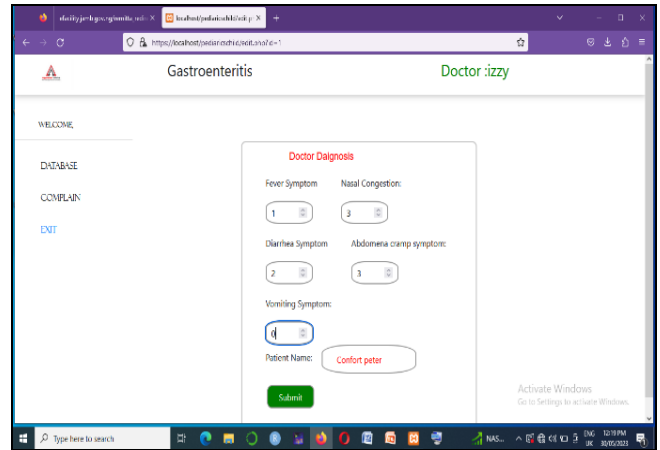


Fig 2: Doctor Diagnosing Result

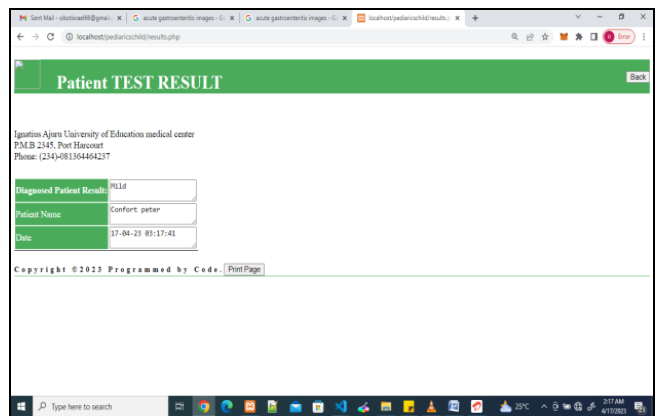


Fig 3: Symptoms Diagnosed Successful Result Fig. Mild Analysis Result

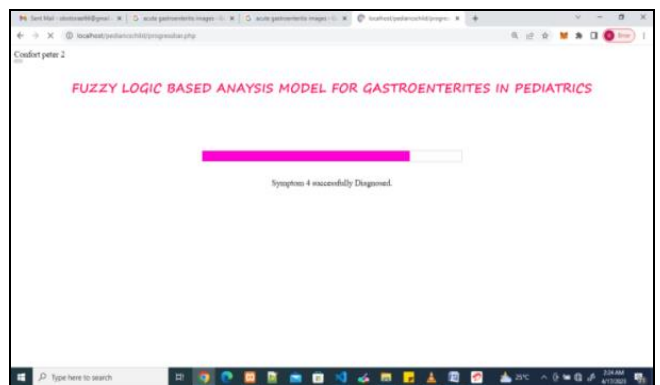


Fig 3: Symptoms Diagnosed Successful Result

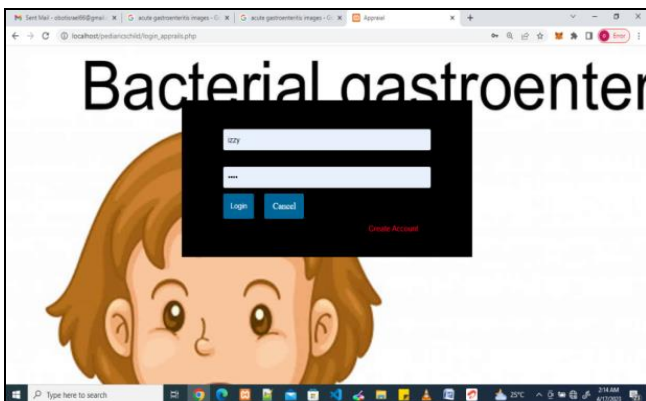


Fig 1. Login Result

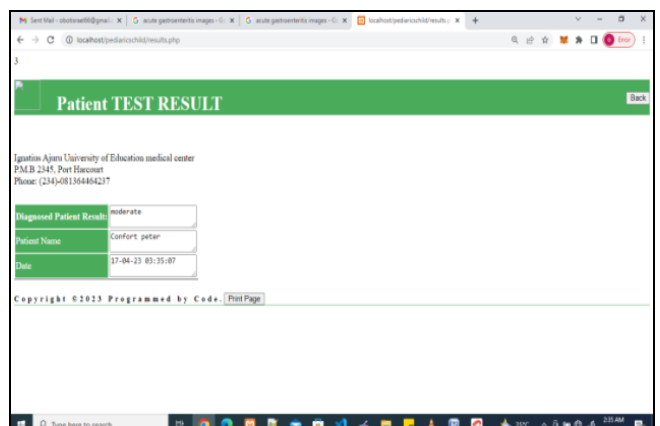


Fig 4: Mild Analysis Result

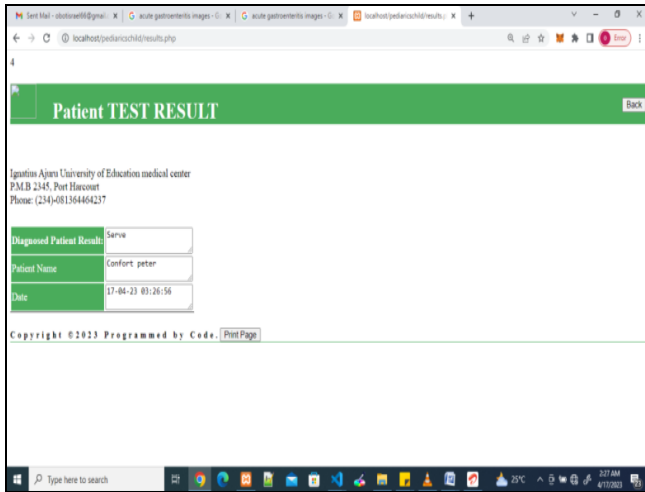


Fig 5: Moderate Analysis Result

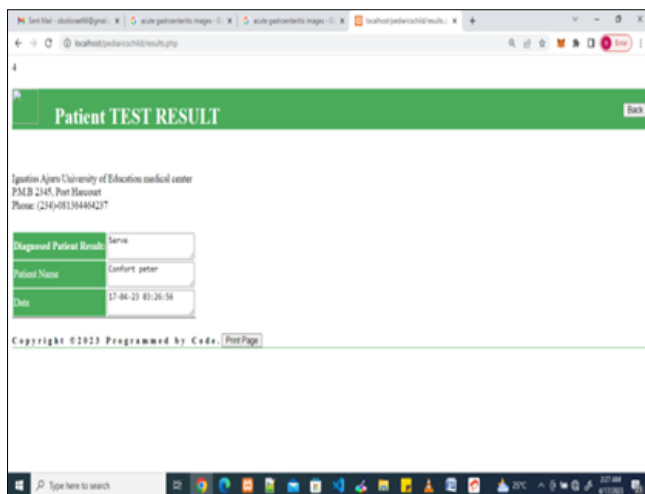


Fig 6: Severe Analysis Result

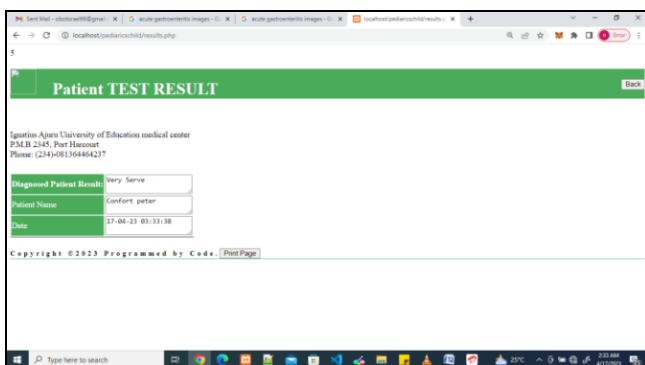


Fig 7: Very Severe Analysis Result

Conclusion

The Fuzzy Logic–Based Model for Gastroenteritis Diagnosis in Pediatrics system handles inaccurate analysis and imprecision of the acute gastroenteritis system using the fuzzy logic mathematical model formulation, the system provides a scalable symptoms database and also determines the degree of the presence of gastroenteritis symptoms with respect to very severe stage which then generate the analysis report of the disease.

The doctor can analyze the pediatric without being a pediatrician who is a specialist in pediatrics or a gastroenterologist; the users of the system can perform analysis in the hospital without any prior knowledge of

programming or having to visit a programmer with the help of this system. A Fuzzy logic–based model for gastroenteritis diagnosis in pediatrics system outperforms the acute gastroenteritis system with using fuzzy logic mathematical model formulation to get an accurate prediction and it degrees. This makes it the best analytical system in determining the degree of the presence of gastroenteritis.

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