Visualization of the Health Care System with NLP And GIS As Modern Tools of Technological Development

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Abstract

This paper combines accessibility analysis of NLP and GIS using traditional visual interfaces on health care systems. Natural Language Processing (NLP) approach provides support for the interaction between users and the information system. GIS is optimizing urban mobility data by providing location-based services through NLP tools. In this scenario, NLP provides users with precise expressions, consultation, and queries of synonyms and qualitative expressions of users (patients). NLP and GIS data exchange proposes a self-powerful interface method that help users wherever. NLP helps medical personnel to communicate with patients and collect data from patients while GIS help identify, locate and optimize urban mobility data for remote specialists and emergency worker.
To ascertain the massification of NLP and GIS with users for a perfect human-human and machine interaction, a GIS survey was conducted and imported to the paper. The combined system is defined and considered by the authors to evaluate the feasibility and relevance of (1) accessibility of technical skills required to perform remote activities, (2) Time required to identify the desired results, (3) Quality and quantity of human perception of remote and the standardization of the format to perform queries, (4) expectations and results from an experiment to performed task using a traditional GIS interface (ArcGIS) and an NLP based interface.
Machine learning models provide little or no explanations to the predictions. The study use NLP and GIS that enable an explainable machine learning system example that focus on interpreting the input data and outputs dat. or the connections between inputs and outputs data for health care systems.

Keywords: Natural language processing, Geographical information system, H-healthcare, Development technology and communication development

Introduction

Remote sensing activities are effectively and increasingly being used nowadays as modern tools for decision-making in many dimensions like medical and healthcare. GIS has been applied in assessing the healthcare facilities to incorporate datasets for spatial monitoring and sensing remotely with the case study of Egypt by “Luqman and Khan, (2021)”. According to “Reeves et al., (2021” said an important determinant of healthcare is to make it an important factor for the population to facilitate a better outcome and prompt care delivery. NLP which is helping greatly in the field of research in this direction is seemingly embracing GIS data to help us make better queries. With GIS model, in particular, is well suited in this context because it helps analyze and display capabilities by tracing by “Parvin et al., (2021)”.

Healthcare systems are knowledge centers that deal with large information in a written form obtained various patience, documented in different forms such as reports, physicians case notes, pathologists and radiologists reports. According to "Choperena-Aguilar et al., (2021)" said vast information in healthcare requires a new system owing to difficulties to retrieve the information when needed. They said natural language processing is a good system to help secure and store information. Advancement of Healthcare system thanks to the technology development. It is now possible to engage text classification and analytics of Data Language (NLP) through AI in health sectors. Nowadays, highly scalable language agnostics are feasible based on pure machine learning, Knowledge Graph awareness, and modern software. According to “Shahri and Taban, (2021)” it is a collection of computational methods used for analyzing and representing concise data of human language to derive human-like dada called language processing. Modern technology is advancing and it is indicating to us that natural language is not just about text to computer systems. Today modern technology has introduced other means of inputting text into the system. We can see modern means of smart recording to text characters as means of inputting data into the systems that interact with humans. According to "Mador-Haim et al., (2006)" explain how language text can be used to effectively solve some of the semantic problems. The paper explains how to use language to localize different areas for

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different activities and with different climatic conditions. In the paper they explain the steps that can be taken to locate an area

Importance of Natural langue processing on Healthcare:

- Help Summarize text for clinical use.
- Help to map data elements found in unstructured text to structured fields in an E-health record to advance clinical data integrity.
- Help transform the text into machine-readable formats for reporting and analytical purposes.
- Help provide results to queries that require the synthesis of multiple data sources.
- Help in speech recognition that allows users to decide and determine clinical notes and other relevant information that can then be turned into text

Importance of GIS on Healthcare.

Determine the Spread of Infectious Disease. GIS can use geography information and other inputs to identify areas where diseases are most likely to spread next. This has been highly utilized during the peak of Covid-19. With the help of GIS, many countries were able to implement restrictions and barriers for spread.
GIS improving Services. With modern GIS technology, it is very possible to cooperate with community leaders and developers to achieve a better healthy environment. Through tracking of personal information, it is possible to determine how likely others can be affected when close to others and the frequency of likelihood. According to "Garlasco et al.,(2021)" GIS represents an exciting and rapidly growing technology through data that is captured, stored, return, displayed, manipulated, and analyzed to help its users in a hospital in Italy. The authors further said GIS gives a detailed information of onset and a better understanding of the phenomenon that enable effective results

Research Question

This section represent the paper section that helps the author to determine the perfect combination of human-human and machine interactions. According to "Zhang et al., (2021)" said social engagement with robot chatbots have improve quality of life. A sample survey was carried out to ascertain the agreement or disagreement of human-human and machine interaction. From the findings, the following questions were used with the help of ArcGIS online survey.

1. Can E-Health services independently assessed remotely and efficiently retrieved user's data records?
2. Are remote healthcare delivery services timely, convenient and comfortable for you?
3. Can E-Health technologies facilitate clinical decision support and team care?
4. Have you used, heard or experience any E-Health platform services?
5. Can GIS information help health practitioners to locate users and patients?
6. Can NLP and GIS help facilitate the input and retrieving process of data into and out of remote platforms for effective healthcare delivery?
7. Are there good technical tools, datasets, systems, processes and software to advance smooth remote healthcare with the help of NLP and GIS?
8. Do you belief that Tech-industries can provide advance services for E-Healthcare deliveries?
9. Can you trust a well-developed self-service platform to provide you with health services?

Method and Material application

The paper recruit the criteria of inclusion and exclusion criteria for both primary and secondary data. Also an ArcGIS Online Survey conducted with help of sample questionnaires. Responses collect and analyzed. Data was analysis statistically with techniques from ArcGIS Survey Software, published and answers imported into the paper without any adjustments or editing. Evaluation and subsequent interpreted reflect the view of general public.

Accessibility of technical skills required to perform remote activities

This section explains the elements and approach to facilitate and ease activities between health personnel and patience. In every system that relates to human activities, there's always a need for approval. Automatic sites are evolutionarily accessible are essential to prove a starting point towards obtaining accessible websites by "Abascal, et al. (2019)". To say the possibility of E-health will be possible if all tools needed to perform remote activities are accessible via electronic space.

Legislations that Support Deployment of Telemedicine. In a free and open society, for every activity to benefit the general public, it must be legally accepted by the law. Today, the world has observed an advancement in digitalization. Many people are excited about such a good situation. Many people who used to find it difficult to afford a hospital bed for their health

issues are most happy. Still, no law gives it a legal right to perform remote health services. Telemedicine needs specific policies to enhance and support the deployment of activities by "Ohannessian and Ponson., (2015).

Remote Tools. As we opt for remote healthcare, there are also obligatory items to make this happen. It takes a lot of effort and time to make things happen home away from home. Whether it is the health sector, financial institutions, all this requires some basic and vital tools.

E-Health sectors required good personal health records, modern mobile apps, good and reliable patient portals, fair information repositories, good internet-based programs, and well-developed software to be used for monitoring patients and managing their health

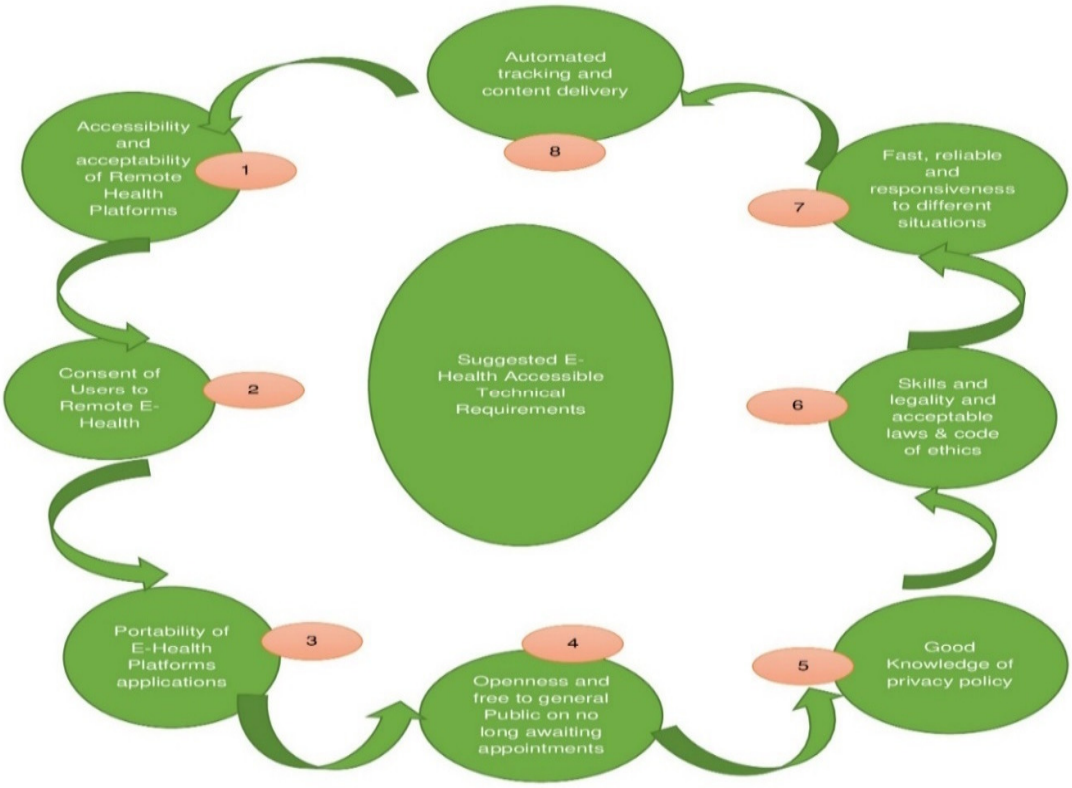


Figure 1 E-Health accessible requirements. Source; owner

From (figure 1) above the E-Health accessible requirements like consent of users should be a platform that is able to take into consideration the desires of users. It should be a platform that listens to what users want. The E-Health requirement such as openness to the public and free and cheap. Every subscriber should be able to access it anywhere. It should be a platform that can operate on mobile devices, laptops, and tablets. It should be a platform that is legally accepted and preserve and protect the privacy of users. He-Health platform should be open to the public and there is the accountability of every activity and be without barriers and limitations.

Access to the internet. The future of E-Health lies in providing modern tools that will help track healthy habits and advance remote interaction between patients and practitioners. Internet of things provides a narrative review on current state-of-the-art at the level of access to remote activities by "Coulby et al.. (2020)". With the developments, it's possible now to access almost everything and anywhere. Thanks to the internet of things that it's possible to monitor and review devices, the health of patients and to give results via the internet.

The flexibility of platforms for practical activities. Remote access to healthcare services can increase participation for many users if it is flexible in platforms that sustain them. A good platform should be used for video, text, local coals, and

text messages consultation respectively. Any emote system that is not flexible to receive emails and other forms of telecommunication is limited in nature and capacity.

Security of process and activities involve. For every system or institution to function very well without back large. It is a must to handle privacy policy with a lot of care, recently, there's been a lot said about privacy policy. Many technological providers are tasked with maximum load to protect the information of users. It will be very dangerous if this is not taken seriously as E-health is very promising nowadays.

Time required to identify the desired results

In every system time require is very important in every activity. The process of transmitting biological or physiological information from a remote location for implementation is by enabling an important reduction in computing time particularly in the time required for the transition by "Rahman et al., (2011)" Time management and identification of various aspects in every institution is very important. Without a specific and durable schedule, it is really hard to secure a good relationship with the audience. The diagram below explains a suggested software that can help mitigate time spent by patients to get access to health facilities.

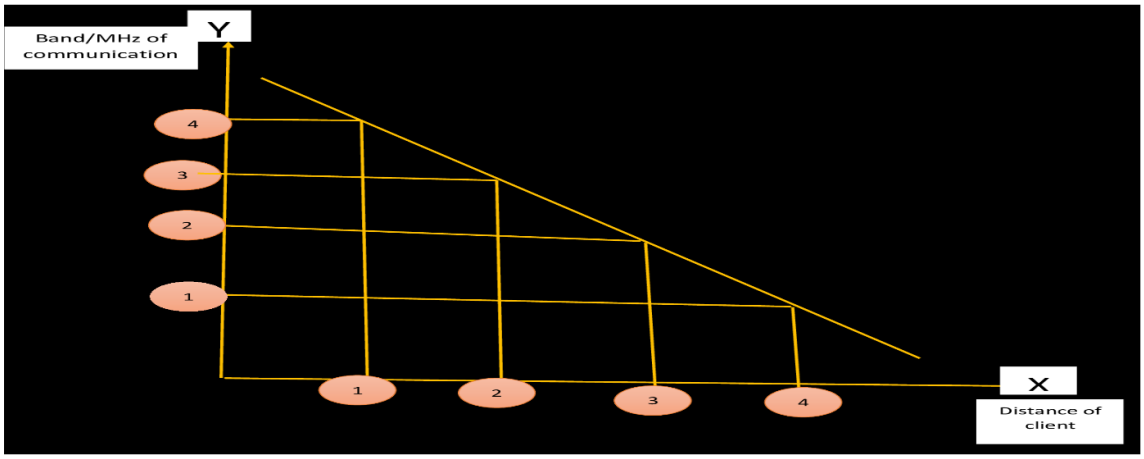


Figure 2 : determinant of time and distance of client, source; Owner

To determine the time taken and possibly determine client or patients distance. The segmentation algorithm is put in place to detect significant transitions of energy the frequency band. Boundaries of communication devices are detected based on local changes in energy distribution. The longer the distance the lower the band. This is enough to handle any time calculations. It is verified from various experiments that having more frequency bands increased the number of segmented distance is closer.
From the 9figure 2) above, the comparison with manual segmentation. When band of MHz increase from HMz1-HMz2 the distance is drop from 4km-3km. And when frequency is at HMz4 the distance is at 1 km. The higher the frequency of data available the lower the distance.

Track Changes in Sentiment over Time with NLP and GIS. Analyses of sentiments in an environment are possible when the relationship between time, space, and sentiment is critically examined. When one turns to observe people have more positive attitudes in public and commercial spaces in a particular time of the day, week or month more social contact, leisure, and shopping appear. Some people react to create the most positive sentiment for people, even when comparing urban and rural regions. With the possibility to use data within social media such as in Facebook, Instagram, Twitter, and apply conventional sentiment analysis, which quantifies terms used that are negative and positive in feeling from a user. For example, using nouns that portray actions or events happening with other persons. It is possible to obtain regression and autocorrelation that can be used to investigate relationships on how given locations, places, or spaces may affect mental health. Here it's possible to combine the attributes of NLP to investigate sentiment by linking up with the location, place, or space with the help of

Quality and quantity of human perception of remote and the standardization of the format to perform queries

This section explains and describes a possible remote healthcare system with the support of GIS and NLP. The section try to paint a picture of how health personals can communicate with patients with the help of GIS and NLP.

With natural language processing (NLP) applied, analysis on sentiment can be formed to assess how people feel about things like perception measuring of ideas and images and how they feel about advertisement. With technology development, analysis that uncovers how living things react to events happening and objects around them is more important. Even though NLP and GIS analyses have rarely been used to analyze, there's hope it can do better for the health sector.

Things are now changing. Many activities are moving remotely. It is very essential to place trackers on office items and other equipment to promote and ease accessibility. The medical world is a discipline with more concentration. It is better to connect things with the help of GIS data for a simplified workplace.

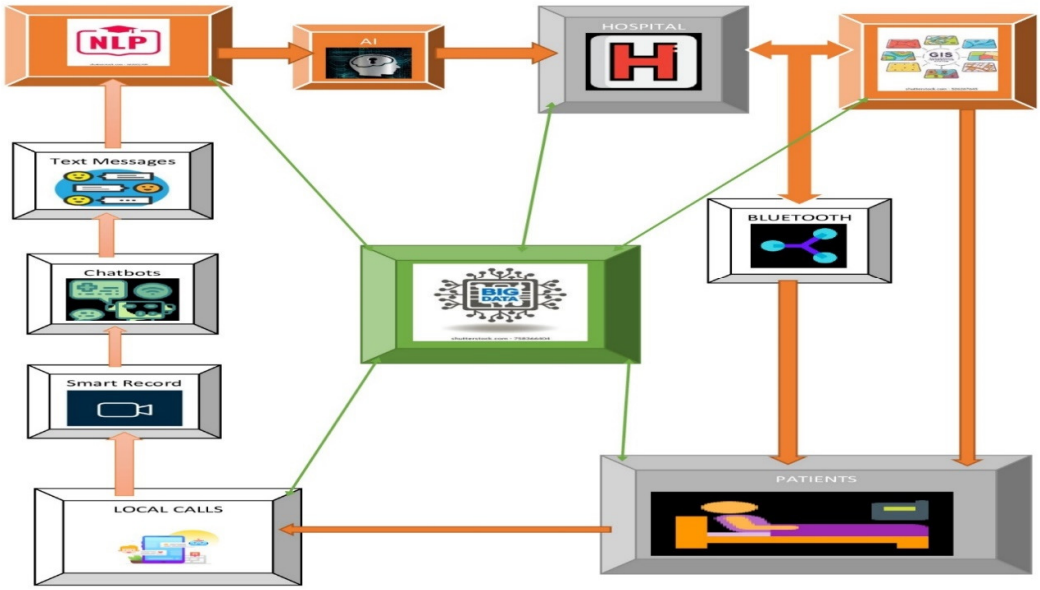


Figure 3: Remote healthcare for GIS and NLP, Source; Owner

In the diagram, it is possible to input information with the use of text messages, calls, smart records, and chatbots. With technology advancement, NLP can access the patient's collect data and process with the help of Artificial intelligence systems to hospitals. Hospitals can use GIS information to trace patience and collect meaningful information for healthcare needs. In the above diagram, there is the use of big data to help users access versus platforms without any disturbance or network limitations. We can also observe the function of Bluetooth. This function helps to keep patients in buildings or locations under the ground as GIS doesn't function well in these areas.

Expectations and results from an experiment to perform task using a traditional GIS interface (ArcGIS) and an NLP-based interface

This section explains how NLP and GIS are actively changing people's minds and how it can be used to determine health and wellbeing. With the old barriers of cultural differences and location challenges, it has been observed that many were unable to achieve their health needs. The health system moving remotely is a big gift to many. There is no barrier, no cultural challenges, anuouod no cost of transportation.

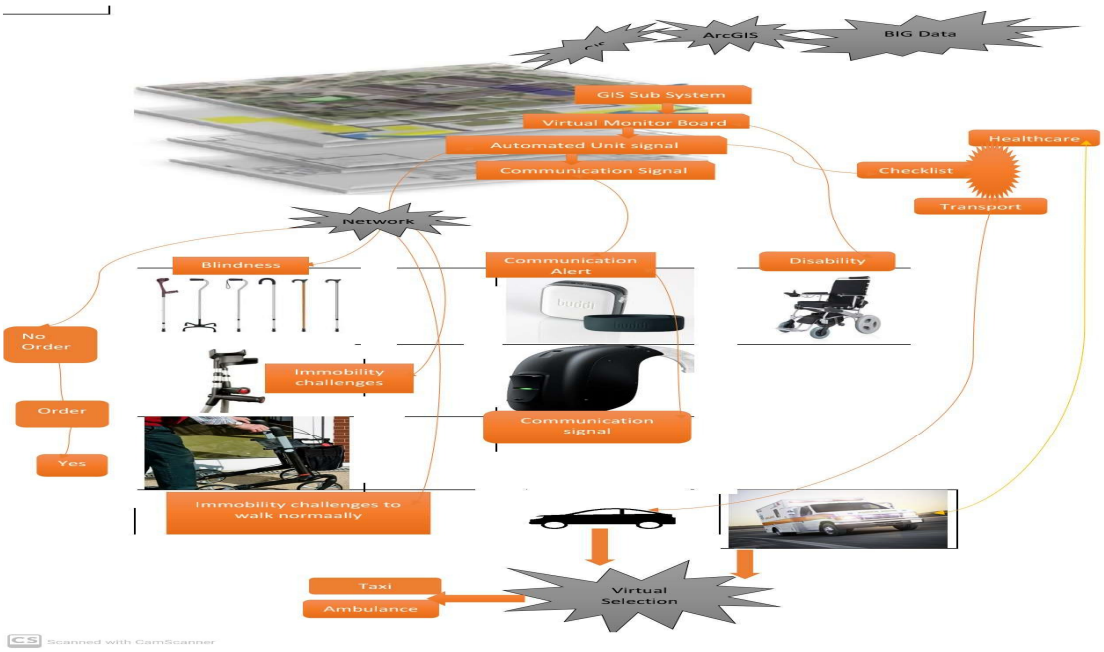


Figure 4: GIS and time communication devices; source; Owner

From the above (fig 4), the system is a suggestion that uses GIS to communicate with different technological devices. It is a combined subsystem that connects telecommunication elements with GIS to support remote activities of patients. From the diagram, four boards exist. The first board is the GIS function with the help of big data. This section collects information from a second board called virtual monitor board and this board communicates information directly to the main server and people living on wheelchairs. The third board is called an automated unit signal. This section collects all signals and monitors the network connecting the various sections and devices. The last board called communication signal deals with all alerts and input of information into various terminals.

According to "Ali et al., (2020)" said to mitigate privacy and scalability concerns of decentralizing remote health monitoring transfer mechanisms form the basis of a secure and accountable health monitoring system through its size and block-interval. Here, block-interval is the average time required to publish results from patients.

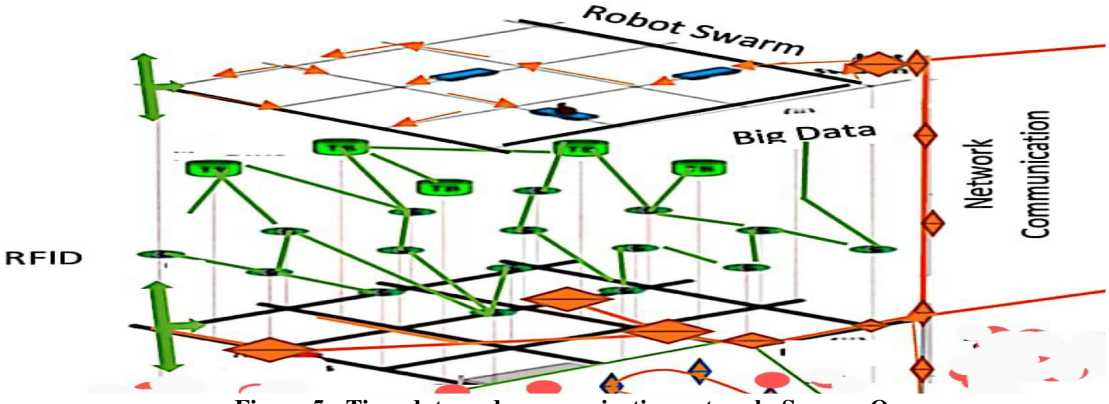


Figure 5 : Time data and communication network. Source; Owner

From the figure above, we can see a robot swarm that communicates with a GIS system with the help of a big data network system. This network help collect information from the GIS through various communication tools also there is a Radio Frequency Identification system. This system help enables communication with natural language processing and GIS. This helps keep the system connected especially where the network is not available. As technology keeps up advancing, more tools will communicate systems together to help human-run their day-day activities.

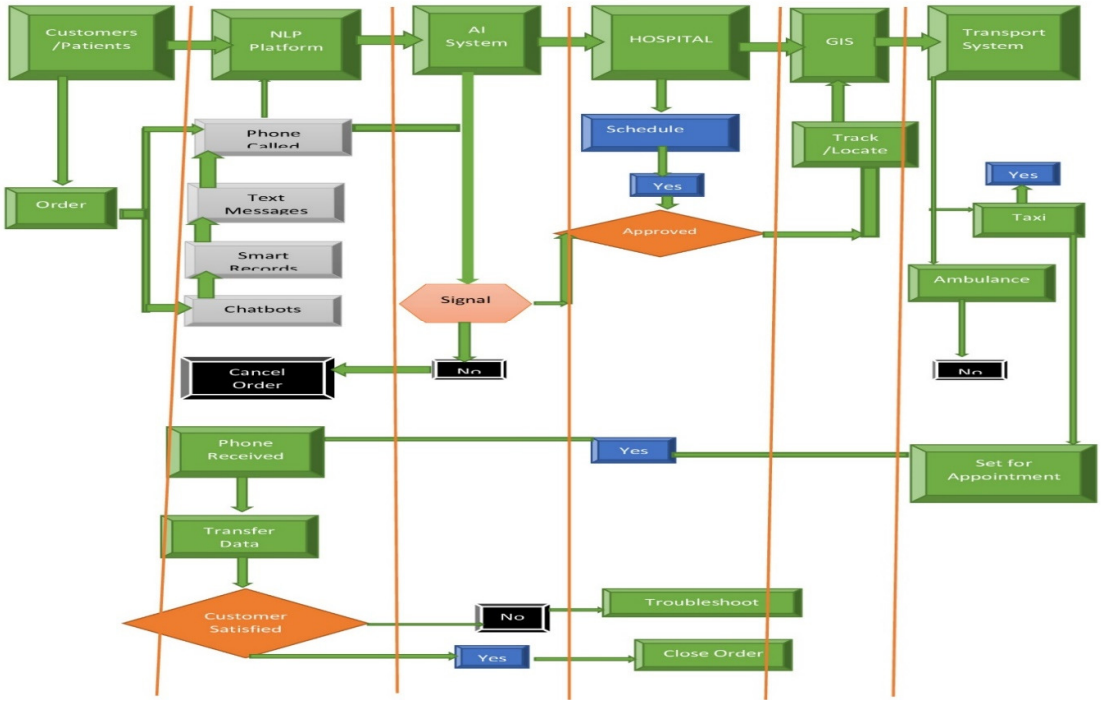


Figure 6: GIS and NLP flow chart Function. Source: Owner

The above diagram explains a suggested combined function of the GIS and NLP system. The above diagram gives a possible detailed communication in a remote healthcare system. From the diagram, some sections link the patients and NLP and information transfer to hospitals and then moved to a GIS system and end up with the transport sector. This system is similar to a suggested system already suggested by many scholars.

From the above diagrams, there are section blocks. The customer, NLP, AI, Hospital, GIS, and transport system block respectfully. When information leaves one block to another it follows a defined process. All these processes put together will greatly help customers to achieve a desirable remote healthcare system.

How People Experience Environmental Space with GIS and NLP.

With analysis and sentiments, it is potentially very important for policy and surveying how people interact with space. Using online to determine how parks affected the feelings of people can be gotten through comments and reactions through their language express. If critically examine one can observe the reaction of people living close to the events and location to those living far away. From every indication. People living close to facilitate are always confident and open free minded than those living kilometers away. With the coming of E-Health, no distance is perceived how well the health and wellness of people look like? For this reason, I strongly believe NLP and GIS should be more focused on future technologies than ever before. According to"Tim., (1995)" GIS analysis display on environmental health information helps in explaining how disease spread and the patterns of its reaction in terms of its relationships with social, institutional, technological, and natural environments

Functional Type relationship between NLP and GIS for E-Healthcare

Base on the mathematical theory of function, there is a combined relationship between NLP and GIS for a smooth E-Health service. Location of persons for remote monitoring is possible through search or programmable location queries. A well-defined system will use GIS to help caretakers to locate and determine the location of patients or users easily. As the patient's ward gives a gap between healthcare practitioners and patients themselves, it is very normal that GIS information will be of great importance for tracings. Be it the business sector or health. It is been recently observed that most follow-ups are done through tracing of clients' locations with the use of follow-up, advertisements, and automated emails.

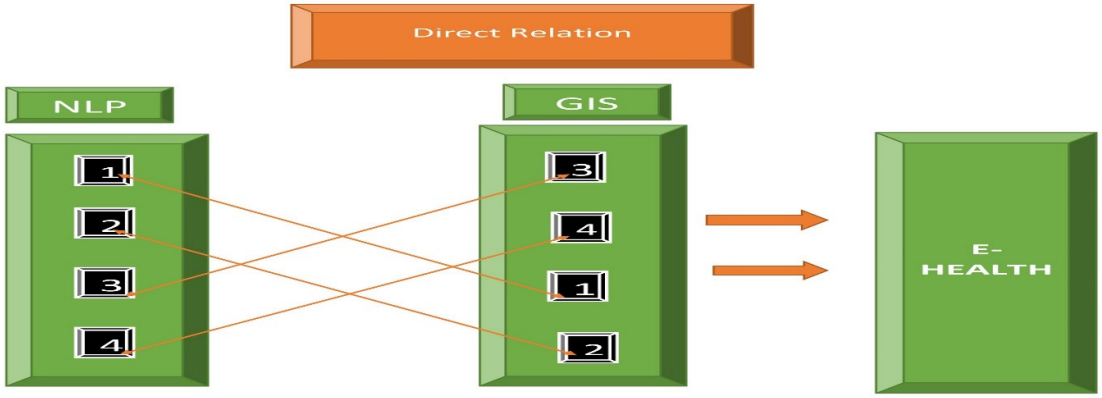


Figure 7: Function relation of NLP and GIS for E-Healthcare

From (figure 70 above, the function relation of NLP and GIS is an example of the perfect combination. With (NLP1) matching (GIS1), NLP2=GIS2, NLP3=GIS3, and NLP4=GIS5 which indicate equal relationship and role of unbiased that should be practiced within the remote healthcare system. The caregiver should practice gravity of the situation as need and quick attention should be forwarded to persons of very severe care than minor. Every situation should be scaled in a function-type scenario where minor cases take option GIS1=NLP1 and change as cases and severity grow. People placed under NLP4GIS4 should be treated first.

Analyzes of text, called text mining can process and obtain quality information in text data. At this point, text mining carries a set of machine learning, statistical techniques, and analysis that can be used in extracting relevant data from text mining. Analysis of sentiments, text classification, summarized text, cluster text, institutional extraction, wards recognition, resemblance analysis, and relation models are the center focus here that bring together NLP and GIS

Comprehensive modern information on the planned land use of a local point found in multiple documents can be traced with queries of NLP and located with knowledge of GIS on location. It is very essential to use NLP that help in providing keywords. From the virtual perspective, the concept of a combination of textual arrangements and extractions within secure data that allows the unification of land use classification and the integrated multiple documents stored in the development plans memo is essential.

Mathematically, to calculate and ascertain the relationship between the NLP and GIS for E-Health, the following function prevail in an inverse relationship. To effectively examine a user or patient, we sum the weight of words based on the number of its occurrences divided by the total number of occurrences found in the algorithm of the calculated statistical weight. Informs on the frequency of occurrence taken into account the proper balance between the occurrence term and its total occurrence meaning in the context of the complete text collection.

Inverse Relationship = NLP+GIS for E-Health

========== **Inverse Relationship =** $\frac{Sample\ No\ of\ Occurences}{Total\ No\ sample\ of\ Occurences}$

With growing remote activities, communication is key for the flow of action. Therefore it is very important to take into consideration word count to easily determine reality and goal in every conversation. Most meanings in spoken words are usually understood through the number of words used. With the growth of remote activities, most things that were done in the office by action are now run through spoken and written words. In other to effectively determine the success of remote or E-Healthcare, we need to sum the number of words occurrence divided by the total number of occurrences.
As previously explained with the use of diagrams and flow chart mapping and different mathematical functions. NLP determines the situation with the applicable algorithm while GIS help to determine the location of users for effective virtual doctrine.

Result and Conclusion

From the figure above a flow chart of text classification by NLP is seen. The suggested system indicated that input of information is through text, phone call, chatbots, and smart recordings. As the health sector move remotely, it's important consultations amongst client moved to a secure and convenient systems.

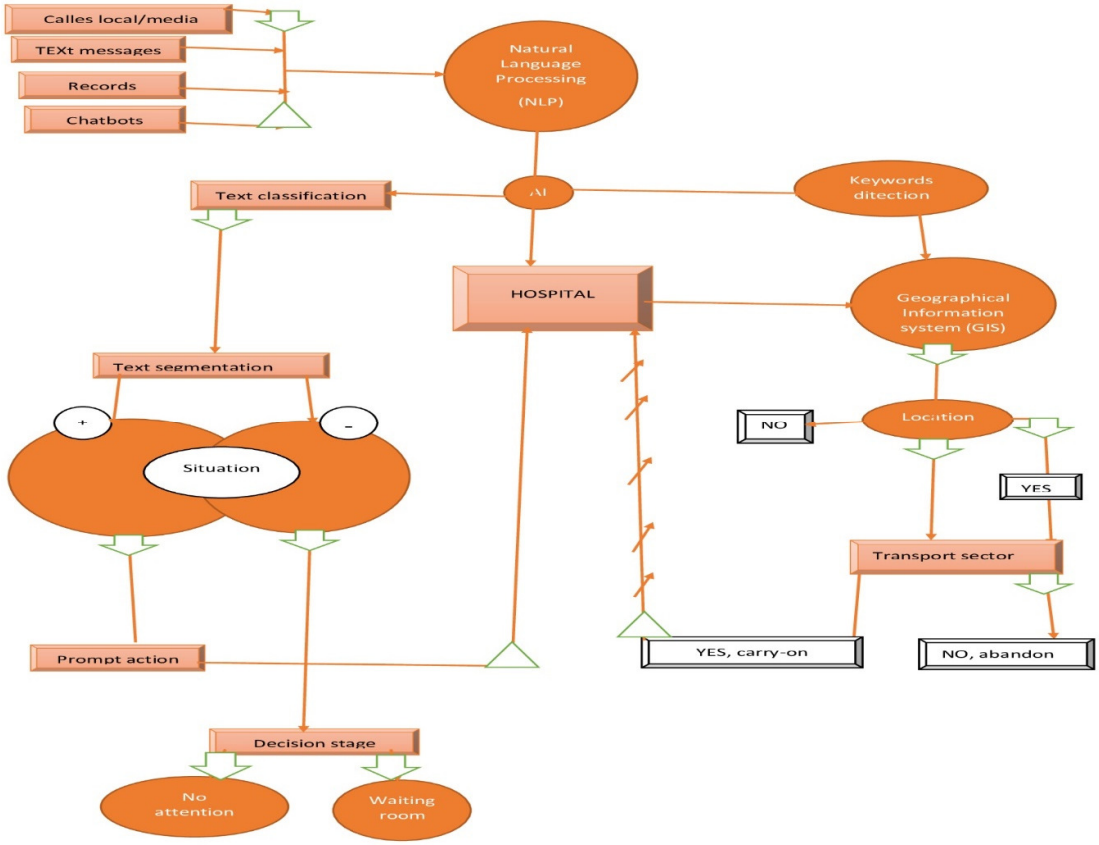


Figure 8: mapping of text classification. Source by owner

From (figure 8), mapping of text classification. Detailed information between patients and health practitioners should use four approaches which are via calls, text messages, recording of audio messages, and via healthcare platforms chatbots. From (figure 8), when text enters the system platform from the right-hand side, NLP converts it with the help of AI through text classification and sends it to text segmentation. Text segmentation is where text is classified. Two categories of text are available, positive situation (+) and negative situation (-). Once information leaves text segmentation it goes to prompt action which is filtered and ready for use. Another information goes to the decision stage which is information not much severe. Before text goes to text classification detailed information is sent to a keyword detection unit that communicates with GIS and the transport sector. Once the information from prompt action reaches the hospital, wave information also goes to GIS section that controls the transport sector for immediate pickup. At this point, there are taxis at most close range or ambulances at most close range. Any of the transport that first reaches information start moving. Since they both use GIS information goes only to the closed transport medium.

From the self-text classification by NLP and Location by GIS, it is suggested that a system can be developed to assist remote healthcare practitioners to perform their activities.

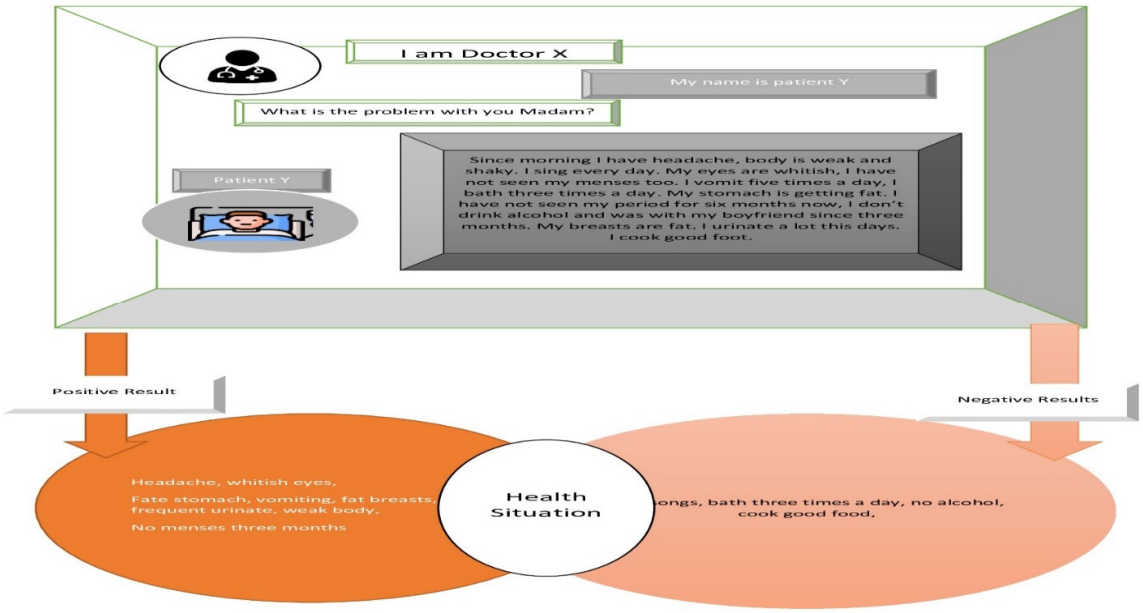


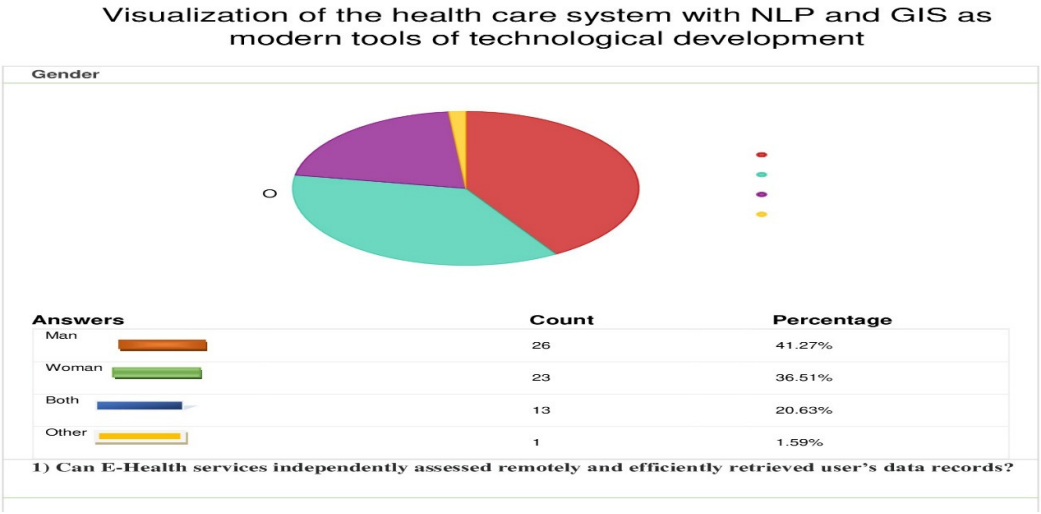
Figure 9: Example of text classification for healthcare practitioners by NLP by owner

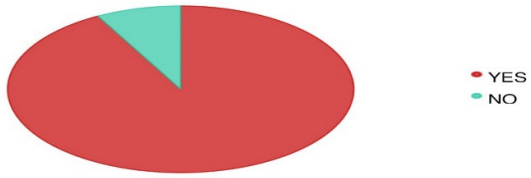
From the suggested system, text can be classified into the model that is ready for use. From the conversation above. With the help of NLP, a medical practitioner can say that the patient is suffering from pregnancy symptoms.

Developing an explanatory system is a very important and critical problem in the field of Natural Language Processing (NLP), They said most machine learning models provide little or no explanations for the predictions in many activities by Liu and Wang (2018)". For this reason, I suggest the approaches of NLP and NLP for explainable machine learning systems example that tend to focus on interpreting the input and outputs or the connections between inputs and outputs for health care systems. Also, according to "Lai et al., (2015, February)" said text classification often relies on many human-designed features like dictionaries and knowledge. This is to say that we can use conversation from users to determine their difficulties and what they want.

Survey Analysis for a Perfect human-human and Machine interaction

This section gives detailed results from the survey to ascertain the interaction between humans and machines for smooth remote healthcare delivery. It is very important to determine if the general public has a unique and unanimous mindset in favor of remote healthcare delivery services or not. The data below give a general view of the few who were able to lay hands on the online survey.





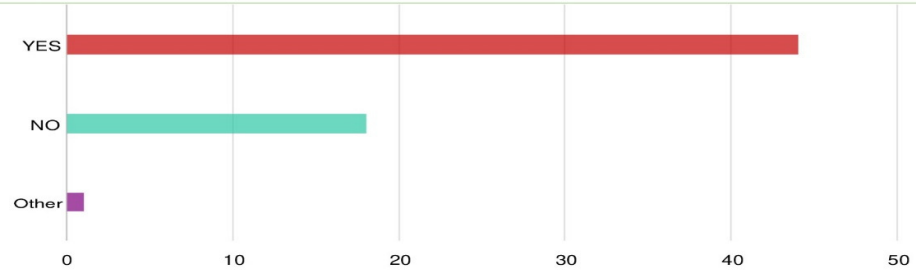
Answers	Count	Percentage
YES	58	92.06%
NO	5	7.94%

2) Are remote healthcare delivery services timely, convenient and comfortable for you?

Answers	Count	Percentage
YES	41	65.08%
NO	20	31.75%
Other	1	1.59%

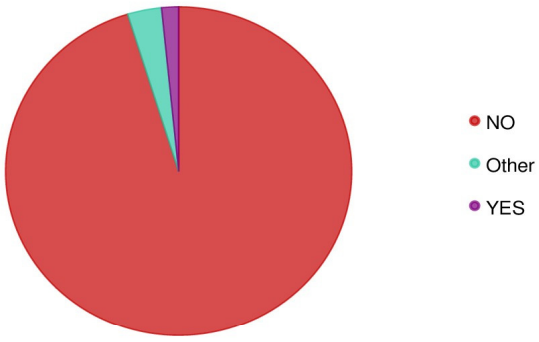
Answered: 62 Skipped: 1

3) Can E-Health technologies facilitate clinical decision support and team care?



Answers	Count	Percentage
YES	44	69.84%
NO	18	28.57%
Other	1	1.59%

4) Have you used, heard or experience any E-Health platform services?



Answers	Count	Percentage
NO	60	95.24%
Other	2	3.17%
YES	1	1.59%

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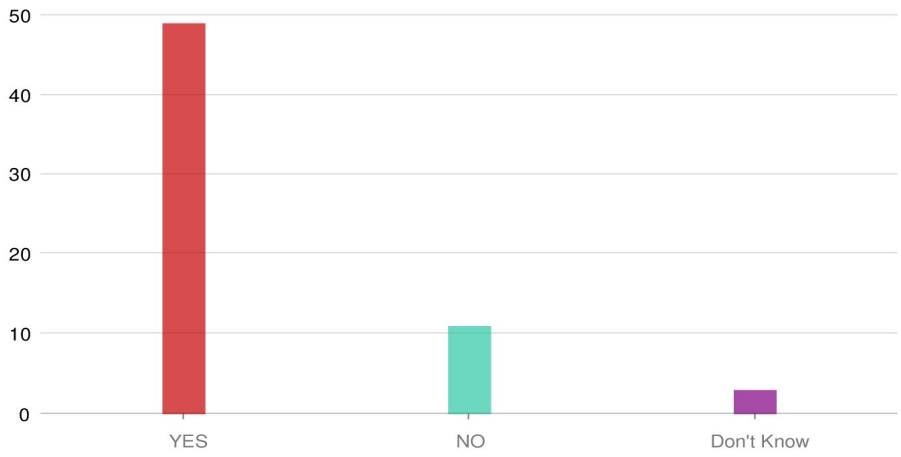
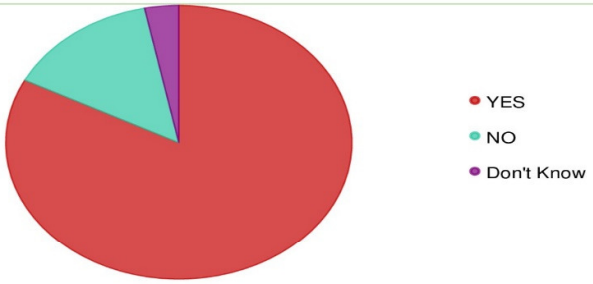
5) Can GIS information help health practitioners to locate users and patients?



YES	49	77.78%
NO	11	17.46%
Don't Know	3	4.76%

6) Can NLP and GIS help facilitate the input and retrieving process of data into and out of remote platforms for effective healthcare delivery?

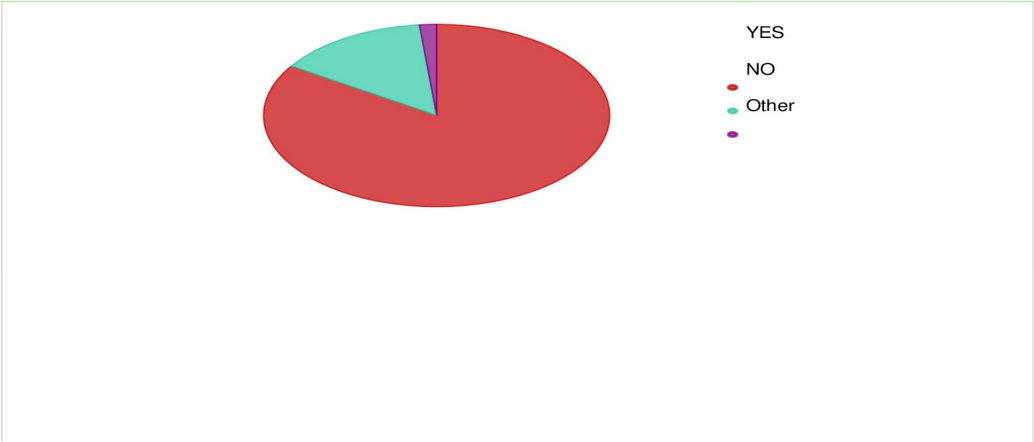


Answers	Count	Percentage
YES	52	82.54%
NO	9	14.29%
Don't Know	2	3.17%

7) Are there good technical tools, datasets, systems, processes and software to advance smooth remote healthcare with the help of NLP and GIS?

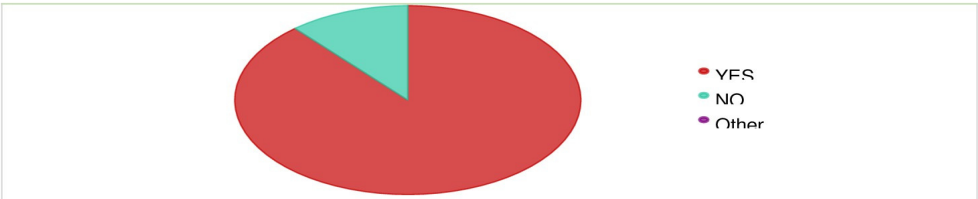
Answers	Count	Percentage
YES	56	88.89%
NO	6	9.52%
Don't Know	1	1.59%

8) Do you belief that Tech-industries can provide advance services for E-Healthcare deliveries?



YES	53	84.13%
NO	9	14.29%
Other	1	1.59%

9) Can you trust a well-developed self-service platform to provide you with health services?



Answers	Count	Percentage
YES	55	87.3%
NO	7	11.11%
Other	0	0%

Figure 10: analysis of sample questionnaires, Source by owner

From (fig 10) above, nine questionnaires were sampled. The gender obtain from the survey was mixture sex which give the survey a total of 63 respondents. Nine questionnaires were posted online for public response. Out of the nine questionnaires which were to determine that human-human and machine interaction is feasible in the real world. The questionnaires were well developed to capture the public view on Human interactive desires for telehealth. Most of the questions were multiple choice to either accept or reject the motion that the human-machine relationship is not acceptable or not comfortable with modern trends in today's technological world.

Out of the total nine sample questionnaires, a high percentage of positive responses of "YES" was observed. The majority of the respondent confirms that there's a possibility of human-human and machine interactions. The only negative impact obtain from the survey was that majority of the public has not utilized E-Health services.

To conclude. Machine learning has been used successfully and extensively to classify text documents into sets of concepts. However, typically, linguistic information through machine learning has not performed pre-classification of information for

prediction before the output of the classification. According to “Gonçalves and Quaresma. (2004” saif text or resulting document text has not been used in the classification process or its use has not been fully evaluated.

Following a positive response from the sample survey. The study, therefore, concluded that there is a machine-machine and human acceptable relationship. Out of the sample questionnaire, the study recommends acceleration in the implementation of E-Health to fulfill users' desires. We know technology has come to make life comfortable. There is often a difficulty in the implementation of new changes. The survey is evidence that the technological industry is behind general public needs. The general public is eager for a new revolution in the health sector. Therefore there's a need to fasten developments of remote healthcare services.

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