

"Savvy Medical Services" a Clinical Record Framework for Powerful Wellbeing Administrations

Dr. R. Suneetha Rani¹, Dr.M.Suresh², N. Aravind³, K. Sirisha⁴, K. Venkata Ratnam⁵

^{1,2,3,4,5}Department of Computer Science and Engineering

^{1,2,3,4}QIS College of Engineering and Technology, Ongole, Andhra Pradesh, India

⁵ Engineering and Technology program, GVPCDPGC(A)

¹suneetharani.r@qiscet.edu.in, ²csehod@qiscet.edu.in, ³aravind.n@qiscet.edu.in

⁴sirisha.k@qiscet.edu.in, ⁵kvenkataratnam@gvpdcpgc.edu.in

Corresponding Author Mail: qispublications@qiscet.edu.in

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Abstract

Unusual — the goal of this study was to determine the criteria engineers used to develop the framework for clinical records in medical clinics. The degree of administration to patients will be influenced by the usage of clinical records that are of excellent quality. The effective management of health services becomes powerful and productive with the use of a good clinical record-keeping system. The exploration's suggested frameworks are electronic and portable in nature. The scope of the plan under review includes the compositional plan, the stream graph plan, the information base plan, the information stream outline plan, and the framework interface plan. 72 treated patients from the streets of Jakarta and 5 experts and medical assistants who work in clinics were included in the initial stages of this investigation using an exploratory methodology. ThisFocus on the The Clinic License Commission's sophisticated IT experts were a great resource because they were aware of the issue with synchronizing the clinical record framework at the clinic. Data was collected via surveys that were correctly customised from January through April of 2020. The objective of this study is to create a clinical record data architecture that can solve issues with patient enrollment, administration effectiveness, management of information from the clinical record, and simplicity of the clinical record data.

INTRODUCTION

The enhancement of people's well-being is both a national aspiration and a government goal in Indonesia. Regulation Number Long Term 2009 controls the improvement of wellbeing in and of itself. As a theory for the improvement of HR that are socially and financially beneficial, "wellbeing improvement" implies to increase mindfulness, ability, as well as the capacity to continue living a healthy life for everyone to comprehend the most significant level of overall wellbeing [1].

Socioeconomics With a population of 265,015,313 people in 2018, Indonesia was the fourth-largest country by population on Earth. Of this total, 133,136,131 people were male and 131,879,182 were female [2]. The population of Indonesia is predicted to grow at a rate of 0.6% by 2035, bringing the

total population to 305 million [3]. Indonesia has to improve its system for gathering accurate well-being statistics due to its massive population and population growth.

Despite Indonesia's completion of health improvement to support the demands and changes of customers who are more educated and aware of a healthy life in the public eye, the use of health services in Indonesia actually has some problems with the execution of health services, such as

The difficulty of the administrative procedures arises initially when patients must travel to a medical facility and receive treatment. The intricacy of this regulatory loop deters patients because it makes it impossible for them to be admitted and receive great care when they visit a doctor's office. Patients should never come at the clinic less than 30 minutes before their scheduled appointment time. During this time, the patient is registered, a line number is obtained, and everything up to medicine administration is taken care of [4].

Secondly, the procedure used to gauge the patient's status following therapy. Even when the patient's condition isn't excellent and they are completely relieved, patients commonly feel the need to see health offices again following treatment because there was no follow-up care. Most individuals visit a wellness centre only once to receive treatment for their annoyance. When they finish treatment, they are frequently still not fixed. Since it takes so long to pay for a single treatment, they are unable to visit medical facilities again.

Third is the expansion of patients, which results in long lineups at medical offices. Numerous patients gather at health care facilities as a result of inefficient and effective health administrations. As a result, there are often long lineups for healthcare services when people need them. Despite the Service of Wellbeing's recommendation of 10 minutes, this treatment cycle typically takes more than 30 minutes simply to enrol [5].

The public's demands for the best healthcare services from clinics will almost always increase and alter throughout time. This uniqueness serves as a challenge for the emergency clinic to improve its management style and develop new strategies for attracting and retaining customers. A company should be able to create new services and products using the most recent technology, creative in addition to being innovative, in order to address the challenges of competitive competition in the future. Associations should also have the choice to be flexible and adaptable.

The ability to deliver tasks and services on time, having a variety of services available in the clinic, willingly assisting patients as needed, paying attention to patient protests and developing solutions for client needs, providing computerised processes by using a framework, and providing responsive cycles are all necessary for further developing responsive cycles, according to research using the SERQUAL model. Although maintaining a good public image and advancing the development of a trustworthy cycle necessitate having precise and reliable data accommodated model [6]. The quality of administration can be raised in order to increase patient satisfaction. Patients are encouraged to use their strengths outside of medical facilities with high-quality assistance. Given that the author thought it was important to develop a framework for an emergency clinic and some of the aforementioned centers' patients.

Regular to the internet. The rise of web usage in Indonesia serves as evidence of this. According to Indonesia's online entry, out of a total population of 264.160.000, 69.8%, or 171.170.000 people, use the internet [7].

In order to help raise the standard of healthcare services in Indonesia, there is a growing need for advancement and technological change in the healthcare sector. Making products for providers of portable and medical services is one method (m-wellness) and electronic administration for patients.

The goal of this investigation is to develop a clinical record data framework that can address information and outcome problems with patient enrollment, administration speed, handling of clinical record information, and clinical record data simplicity.

II. LITERATURE SURVEY

The mobility of recording information and clinical history are terms used in the clinical field to refer to data from the patient's clinical record. The patient's medical record contains information that can be used as a kind of reference point for additional assessments of the patient's health as well as actual documentation of the patient's disease' diagnosis and therapeutic successes.

This focus also examines the three ways that the healthcare sector has divided up digitalization: the centre, clinical devices, and patients [12].

A. Framework for Smart Medical Care

The guiding notion of an ideal fantastic wellness data structure is examined in this investigation. Based on this evaluation, the government may provide a framework for health administration that can be used by anyone, at any time, and everywhere [13]. And in order to do that, health care must develop a decentralized, understanding-focused framework with an intelligent health data framework model. Methods can produce timely, enjoyable, and productive patient experiences when they are persistent [14].

B. Using mobile or electronic wellbeing.

To create a superb medical services framework, the framework must be centred on persistence. In this test, describe how m-wellbeing is an example of a technology that can be utilised to help patients. M-wellness is a healthcare practice backed by symptomatic technology that may be adjusted. This gadget is described as a means for delivering patient-centered healthcare services when it is used at the point of care. Patients can enhance the quality of their lives through m-wellness by allowing them to continue with their regular daily activities while being monitored and receiving health advice and encouragement from professionals [12].

C. Facilitating Internet of Things (IoT) innovations for savvy medical services

In particular, this paper discusses how recent developments in information and communication technology (ICT) have encouraged general medical care to use technology more frequently in order to raise the standard of current administrations and lower costs.

The design of e-Medical services allows patients the opportunity to:

- Enable them to continue with their regular daily activities while being monitored and receiving health advice and guidance from professionals, thus improving the quality of their lives.
- Given the rapid rise in chronic illnesses, particularly in agricultural countries, the use of ICTs is crucial for the early detection and prevention of these illnesses as well as for lowering spending on medical services. This will protect these developing countries' ability to afford • Monitoring general health, including the use of local networks to advance health services and remote administrations to reduce the risk of chronic illnesses [15]

III. METHOD

A. Research Techniques

The exploratory methodology used in the beginning of this study implies that it makes a serious effort to comprehend what is happening, gain new experiences, and clarify some issues. Managing pressing matters and ambiguous problems [16]. In response to the study's findings, a framework for clinical records for medical services will be suggested.

Questionnaire

Giving the respondent a number of written statements to answer as part of a survey is how information is gathered. As a flexible application, the survey will be anticipated of Savvy Medical services Framework clients. The technique used in the survey, which the creator used as a testing tool, is a closed poll. Purposive testing strategies, which depend on the security of data rather than the number of information source tests, were used as the information source inspecting methodology. Between January and April 2020, data were collected from 72 respondents who were Jakarta medical clinic patients. The poll results are shown in Table 1 below.

TABLE I QUESTIONS AS WELL AS THE RESULTS

	Question	Answer	Result
RQ1	What is your sex?	Male	76,20%
		Female	28,80%
	What information are you seeking for	Price	42,60%
		Brand	7,40%
		Examining and Rating	67,20%
		Medical Services	41,60%

RQ2	when you find information on a health agency?	Distance	71,10%
		Physician's Schedule	71,10%
RQ3	How to sign up with a health facility?	Call	34,70%
		WhatsApp	9,70%
		Message	0%
		Application in Health	22,20%
		Register at Healthcare Providers by going there.	33,30%
RQ4	What issues did you run into when attempting to register with a health organization?	It requires time to register	47,20%
		process management	41,70%
		Healthcare Providers' Directory	36,10%
		Booking online	26,40%
		Drug Waiting Takes Time	1,40%
RQ5	Have you ever waited in line at a medical facility?	Have	97,20%
		Have-not	2,80%
	Do you find it	Yes	68,10%

RQ6	difficult to check in with me or let the doctor know how I'm doing with my recovery?	No	31,90%
RQ7	Do you have trouble recalling the kind of medication prescribed as well as details about the dosage and timing of consumption?	Yes	54,20%
		No	45,80%
RQ8	Do you have trouble recalling your medical history?	Yes	54,20%
		No	45,80%

RQ2 makes it clear that individuals examine aspects including distance, schedule, survey, and rating, in addition to price, while seeking information about healthcare providers, which is consistent with RQ1's finding that the majority of respondents are female. Given that the majority of responders contact, go to, and register with medical supply firms, RQ3 makes logical. RQ4 emphasises the issue that enrolling takes time and preparation. The majority of respondents who have ever worked in the medical field think RQ5 makes sense. service companies. RQ6 is reasonable According to 68,1% of respondents, it is challenging to put professionals in charge of enhancing their well-being. RQ7 illustrates how challenging it is to keep in mind a prescription's dosage and timing. RQ8 give an explanation of why it's hard to recall their clinical documentation.

C. Interview

In order to study the data provided by respondents, researchers communicate directly with them using this technique for information collecting. The interviewees for this project were members and experts of the clinic approval advisory group. Table 2 below contains information about the meeting's assessment and investigation.

TABLE II. RESEARCH INVESTIGATION

	Description
Research Purpose	Exploratory
Research Approach	qualitative conversations with important sources
Research Questions	RQ 1: What are the issues and difficulties of value wellbeing administrations in Indonesia? RQ 1: How to work on the nature of Medical clinic administrations?
Phase Objective	To comprehend the issue and difficulties in fostering the medical clinic framework in Indonesia and the answer for work on the nature of medical clinic administrations
Outline of stage questions	RQ 1: What is the issues and difficulties in fostering the medical clinic framework in Indonesia? RQ 1: How to work on the nature of Medical clinic administrations?
Research Strategy	Interviews
Sample	Interviews with specialists, supervisor IT, and Kars (Komite Akreditasi Rumah Sakit - Indonesia Medical clinic Authorization Board) part who oversee medical clinic authorization in Indonesia
Research instrument	Unstructured interviews

This is the outcome of research conducted by KARS' clinical and IT professionals to better understand the difficulties Indonesia's emergency clinic system faces and how to raise the standard of patient care. The issue and the difficulties are:

1. The emergency clinic structure is highly complex.
2. Indonesia lacks an emergency clinic authorization framework that adheres to international standards.

3. For the actual clinic, there are as yet numerous techniques that are done physically, and the framework isn't all around incorporated.
4. There are contrasts in emergency clinic working guidelines from each other, causing challenges in carrying out an emergency clinic framework standard that can be utilized by all clinics.
5. Implementing the emergency clinic framework calls for a long investment and has a high intricacy.
6. Associated with BPJS installation delays brought on by problems with clinic organization's accuracy and completion with the BPJS Fragmented records and incorrect data provided to the BPJS are a couple of items that can cause managerial problems.

At that point, understanding the nature of administrations is equivalent to understanding the nature of patient consideration. The following three factors are necessary for successful patient care:

1. Information

Information on the patient's condition as determined by the poll. The most widely used source of social affair data regarding the patient's condition is linked to the evaluation in this instance. Data about the patient's state is divided into two categories, specifically normative (essential) and high level (advance) data. Depending on the patient's condition, standard or high level data may be required. For instance, the patient's state information requirements will differ for patients who are pregnant women with children.

2. Analysis

In light of the patient's state data, the examination is connected to a dynamic interaction at its conclusion. Presently, in light of the ICD 10 approach.

3. Plan

Layout and dynamic conversation concerning essential activities and mediations are related. Considering the ICD approach at this time The three associated processes, in particular the most usual method of learning about social affairs, the method of demonstrative inspection, and the typical method of making arrangements related to activities and mediations, must all be automated in light of the idea of the nature of care.

The findings of a conversation with five experts about the issue and challenge are as follows:

1. During the examination interaction, specific information about the patient's condition was required. The inclusion of this point-by-point data will increase the analytical results' accuracy.
2. Once the investigative interaction is complete, specialists should remember the type of medication used to treat the illness and plan activities and mediations, such as delivering the patient a prescription medication tailored to their condition, manually. additionally modified to the patient's state.

IV. DISCUSSION

Solutions



Patient applications will be created using flexible applications. With the aid of a portable application, patients can have ideal, pleasant, and beneficial patient experiences, which is smarter in light of poll and survey study writing. The element of a flexible application, for instance

1. User Enrollment

Customers that require the help capabilities of the portable application get it from a Play Store or an iOS app store. An intriguing onboarding page with a rundown of the application's advantages is presented by the framework when the client downloads and runs the portable edition of the application. After that, the client will register for a record. A portable number is used to finish the account registration procedure in order to enhance the engagement with enrolment. The consumer will enter an enrollment structure that has the flexible number in it. The client's mobile number will then receive a special SMS from the framework that contains the OTP code. On the application, the client will enter the OTP code, and the framework will then accept it based Customers that require the help capabilities of the portable application get it from a Play Store or an iOS app store. The portable version of the application is launched after the client downloads it and enters the provided OTP code. If the OTP code entered differs from the OTP code sent, the system will notify the user that an incorrect OTP code was input. If the OTP code is correct, the client will be able to access the landing page for the application.

2. Add the client's information.

The client will edit the profile to finish the client's profile after choosing "account" from the menu. The user can view their application profile, which contains information about them such as their name, email address, cellphone number, orientation, age, and secret word..

3. Search medical services' offices

By selecting "Search," users can narrow their search by health office and location. Clients can choose which health offices to attend during the inquiry encounter by searching for centers, urgent care facilities, or free practices. After the client selects the type of office he needs, the framework generates a list of healthcare offices that meet his requirements. The framework will then present comprehensive information about the healthcare facility, including photographs, reviews, locations, open and close data, licenses, clinical criticism, and a list of the specialists who work there. The client will then choose a healthcare facility. The customer then decides which expert they want to Examples of the specialist's data that are displayed include consult and the details of the tax, the name of the specialist, the type of specialist, the number of loves, and the training plan.

1. To work with the pursuit, clients can look from the area of the closest wellbeing office.
2. Make an arrangement in medical care's offices
3. For lining enrollment, subsequent to looking at the planned wellbeing office, the client will press the "line" button, after which the client will get a notice as a line number. Clients can screen line numbers live.

4. Make an installment
5. Make a web-based really take a look at in medical care's offices
6. The patient can register online before coming to the clinic using a common form of identification that the clinic's head will verify.
7. See EMR
8. Examine a Trade

Patients can review the services offered at the health office using the survey exchange arrangement after the exchange is finished. The framework will incorporate surveys of wellness office operations and specialist surveys. The survey includes an evaluation and presentation of the audit. Immediately after the patient clicks the "submit" button.

Use case Outline, Fig. Internet application

The developer suggests supporting a web-stage for medical care offices so they can manage their functional engagement through this platform. The web application's component, for instance,

1. Healthcare offices enrollment

The organization segment completes the framework of "enrollment."

2. Patients can use the survey exchange arrangement to review the services offered at the health office once the exchange is finished. The structure will also include a survey of wellness office operations and a specialist's survey. The poll includes an assessment of the audit and a representation of it. once the patient has clicked the "submit" button.

3. Enrollment of Payment Sort

The organization section of the structure for instalment types will fill in the name of the instalment type and the payer for each type of instalment.

4. Enlistment of Payer's Sort

The information assortment structure for the player's name and payment information will be filled in by the organization area.

5. Employee enrollment

The "staff enrollment structure," which includes employee information and employee planning, will be filled out by the organization section.

6. Diagnosis Registration

The Organization Segment will enter the indicative code and symptomatic name of the demonstrative enlistment structure.

7. The enlisting process The Organization Area will include the indicative enrollment structure, to be specific the Activity code, the activity name.

8. Room Recruiting

The organization section will include a list of the room code, room name, and room enlistment procedure.

9. Patient Registration

Patients are registered by the organizational division for enrollments that don't use a mobile application. The patient's personal details will be under the organization section.

10. Enrolling in a line

The organization segment will enroll by entering the patient's name and the anticipated polyclinic in the "line enrollment" structure. Line numbers will then be generated naturally by the framework and printed for patients after that.

11. Outpatient Recruiting

Finishing the structure holding short-term information will enable PPJA to sign up for short-term care.

12. Establish an electronic clinical record (EMR) a) PPJA evaluation

The underlying PPJA evaluation structure will be filled in by PPJA. The underlying appraisal framework will be filled by PPJA.

b) Evaluation of the DPJP

The DPJP will complete the DPJP appraisal structure's foundation. The DPJP will complete the necessary paperwork regarding complaints, serious complaints, momentum infection history, past, and body perception information before entering the findings of the assessment and care plan.

c) Based on the inputted finding code, the demonstrative outcomes structure will be included in the diagnoses' outcome DPJP.

d) Procedural Results

Taking into account the activity code of 13, DPJP will add the impacts of the activities.

Install a payment

The clerk segment will enter the instalment structure along with information about the installments, such as the type of instalment and the total installment.

V.CONCLUSION

The outcomes showed that the suggested application has the potential to enhance patient administration strategies. Patients receive assistance with online enrollment via a mobile application, quick access to clinical history records, and quick and measurable administrations.

Specialists and medical personnel can easily access the patient's clinical record information using an electronic application. Specialists administer ongoing assessments and collect data through a web-based framework, and all clinical groups can access the outcomes through an integrated framework. This is incredibly productive because it reduces the error rate.

The clinic is assisted by the suggested application to provide quick patient care, which affects patient satisfaction. The board of the emergency clinic has the optimal data set; pursuing it simpler for cost efficiency and choice making.

REFERENCES

- [1] Undang - Undang Republik Indonesia nomor 36 tahun 2009. Jakarta. 2009.
- [2] Kementrian Kesehatan Republik Indonesia. Information dan Informasi Profil Kesehatan Indonesia 2018. Jakarta. 2018.
- [3] Bappenas, Badan Pusat Statistik, UNFPA. Proyeksi Penduduk Indonesia Populace Projection. Jakarta: Badan Pusat Statistik. 2013.
- [4] R. Jajeli, Recovered from Detik.com: <https://news.detik.com/berita-jawa-timur/d-3529039/pelayanan-tidak-memuaskan-bpjs-di-jatim-disorot>. 2017.
- [5] Qiwii. Retrieved from <https://qiwiid.id/sistem-antrian-di-sektor-kesehatan/>. 2018.
- [6] P.W. Handayani, A.N. Hidayanto, private investigator Sandhyaduhita, Kasiyah, and D. Ayuningtyas, Key medical clinic administrations quality examination in Indonesia. Master Frameworks with Applications, 3067-3078. 2014.
- [7] APJII. Recovered from <https://apjii.or.id/survei2018s/kirimlink>. 2018.
- [8] J.A. O'Brien, and G.M. Marakas, The board Data Frameworks. McGraw-Slope/Irwin. 2011.
- [9] M.B. Romney, and P.J. Steinbart, Sistem Informasi Akuntansi (Bookkeeping Informs Frameworks) (Vol. 13). Jakarta: Salemba Empat. 2015.
- [10] J. W. Satzinger, R. B. Jackson, and S.D. Bard. Framework Examination and Plan in An Impacting World . Cengage Learning. 2012.
- [11] D. Common, J. Smith, S. Wang, and J. Mortati, Data Frameworks for Business and Then some. 2019.
- [12] S.P. Bhavnani, J. Narula, and P.P. Sengupta, Versatile innovation and the digitization of medical services. European Heart Diary, 1428-1438. 2016.
- [13] J.S. Jeong, O. Han, and Y.Y. A. You, Plan Qualities of Savvy Medical services Framework as the IoT Application. Indian Diary of Science and Innovation, 37. 2016.
- [14] B. Chen, A. Baur, M. Stepniak, and J. Wang, Finding the fate of care arrangement: the job of savvy emergency clinics. 2019.

- [15] M.M. Mahmoud, J.J. Rodrigues, S.H. Ahmed, S.C. Syah, J. Al-Muhtadi, V. Korotaev, and V.H. Albuquerque, Empowering Advances on Haze of Things for Savvy Medical services. IEEE, 2169-3536..2018.
- [16] M. Saunders, P. Lewis, and A. Thornhill, Exploration techniques for business understudies. Second release. Harlow: Pearson Training. 2000.
- [17]. Balyan, A. K., Ahuja, S., Lilhore, U. K., Sharma, S. K., Manoharan, P., Algarni, A. D., & Raahemifar, K. (2022). A Hybrid Intrusion Detection Model Using EGA-PSO and Improved Random Forest Method. *Sensors*, 22(16), 5986.
- [18]. Poongodi, M., Bourouis, S., Ahmed, A. N., Vijayaragavan, M., Venkatesan, K. G. S., Alhakami, W., & Hamdi, M. (2022). A Novel Secured MultiAccess Edge Computing based VANET with Neuro fuzzy systems based Blockchain Framework. *Computer Communications*.
- [19]. Manoharan, P., Walia, R., Iwendi, C., Ahanger, T. A., Suganthi, S. T., Kamruzzaman, M. M., & Hamdi, M. (2022). SVM-based generative adversarial networks for federated learning and edge computing attack model and outpoising. *Expert Systems*, e13072.
- [20]. Ramesh, T. R., Lilhore, U. K., Poongodi, M., Simaiya, S., Kaur, A., & Hamdi, M. (2022). PREDICTIVE ANALYSIS OF HEART DISEASES WITH MACHINE LEARNING APPROACHES. *Malaysian Journal of Computer Science*, 132-148.
- [21]. Poongodi, M., Malviya, M., Hamdi, M., Vijayakumar, V., Mohammed, M. A., Rauf, H. T., & Al-Dhlan, K. A. (2022). 5G based Blockchain network for authentic and ethical keyword search engine. *IET Common*. 16(5), 442-448.
- [22]. Poongodi, M., Malviya, M., Kumar, C., Hamdi, M., Vijayakumar, V., Nebhen, J., & Alyamani, H. (2022). New York City taxi trip duration prediction using MLP and XGBoost. *International Journal of System Assurance Engineering and Management*, 13(1), 16-27. [23]. Poongodi, M., Hamdi, M., & Wang, H. (2022). Image and audio caps: automated captioning of background sounds and images using deep learning. *Multimedia Systems*, 1-9.
- [24]. Poongodi, M., Hamdi, M., Gao, J., & Rauf, H. T. (2021, December). A Novel Security Mechanism of 6G for IMD using Authentication and Key Agreement Scheme. In *2021 IEEE Globecom Workshops (GC Wkshps)* (pp. 1-6). IEEE.
- [25]. Ramesh, T. R., Vijayaragavan, M., Poongodi, M., Hamdi, M., Wang, H., & Bourouis, S. (2022). Peer-to-peer trust management in intelligent transportation system: An Aumann's agreement theorem based approach. *ICT Express*.
- [26]. P Ramprakash, M Sakthivadivel, N Krishnaraj, J Ramprasath. "Host-based Intrusion Detection System using Sequence of System Calls" *International Journal of Engineering and Management Research*, Vandana Publications, Volume 4, Issue 2, 241-247, 2014
- [27]. N Krishnaraj, S Smys. "A multihoming ACO-MDV routing for maximum power efficiency in an IoT environment" *Wireless Personal Communications* 109 (1), 243-256, 2019.
- [28] N Krishnaraj, R Bhuvanesh Kumar, D Rajeshwar, T Sanjay Kumar, Implementation of energy aware modified distance vector routing protocol for energy efficiency in wireless sensor networks, 2020 International Conference on Inventive Computation Technologies (ICICT), 201-204

- [29] Ibrahim, S. Jafar Ali, and M. Thangamani. "Enhanced singular value decomposition for prediction of drugs and diseases with hepatocellular carcinoma based on multi-source bat algorithm based random walk." *Measurement* 141 (2019): 176-183. <https://doi.org/10.1016/j.measurement.2019.02.056>
- [30] Ibrahim, Jafar Ali S., S. Rajasekar, Varsha, M. Karunakaran, K. Kasirajan, Kalyan NS Chakravarthy, V. Kumar, and K. J. Kaur. "Recent advances in performance and effect of Zr doping with ZnO thin film sensor in ammonia vapour sensing." *GLOBAL NEST JOURNAL* 23, no. 4 (2021): 526-531. <https://doi.org/10.30955/gnj.004020> , https://journal.gnest.org/publication/gnest_04020
- [31].N.S. Kalyan Chakravarthy, B. Karthikeyan, K. Alhaf Malik, D.Bujji Babbu,. K. Nithya S.Jafar Ali Ibrahim , Survey of Cooperative Routing Algorithms in Wireless Sensor Networks, *Journal of Annals of the Romanian Society for Cell Biology* ,5316-5320, 2021
- [32]Rajmohan, G, Chinnappan, CV, John William, AD, Chandrakrishan Balakrishnan, S, Anand Muthu, B, Manogaran, G. Revamping land coverage analysis using aerial satellite image mapping. *Trans Emerging Tel Tech.* 2021; 32:e3927. <https://doi.org/10.1002/ett.3927>
- [33]. Vignesh, C.C., Sivaparthipan, C.B., Daniel, J.A. et al. Adjacent Node based Energetic Association Factor Routing Protocol in Wireless Sensor Networks. *Wireless Pers Commun* 119, 3255–3270 (2021). <https://doi.org/10.1007/s11277-021-08397-0>.
- [34]. C Chandru Vignesh, S Karthik, Predicting the position of adjacent nodes with QoS in mobile ad hoc networks, *Journal of Multimedia Tools and Applications*, Springer US, Vol 79, 8445-8457, 2020