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A Review on Handover for 5g Networks using Fuzzy Logic

[1]Sandeep Kaur,[2] Er Lovepreet Kaur

[1]M. Tech Scholar, Guru Kashi University, Talwandi Sabo
[2]Assistant Professor, Guru Kashi University, Talwandi Sabo

ABSTRACT:

The future fifth generation (5G) remote correspondences support the super ultra dense network where arrangements of a huge quantity of little cells coincide with current 4G net-works. Notwithstanding, the dense small cell organization is confronting a specialized test in flexibility the supervisory because of the expanded number of handovers (HOs), particularly in heterogeneous organizations. The expanding likelihood of HOs may cause HO failure (HOF) or HO ping-pong (HOPP) which debases the framework execution. Fuzzy Logic (FL) is a strategy for thinking that looks like human thinking. The methodology of FL mimics the method of dynamic in people that includes all middle prospects between computerized values YES and NO. In this article various analysts' research work is inspected and various issues are looked in 4G/5G organization. The serious issue looked in this exploration territory is the fuzzy framework, speed and direction metric and ping pong aversion isn't thought of, which is a primary Fuzzy handover dependent on Signal strength, Cell burden and Distance. Every one of these issues is settled in future.

Keywords —HetNets, self-optimization, handover, fuzzy logic, WSN, 4G and 5G.

INTRODUCTION

The fifth generation (5G) of versatile innovations has been created to fulfill expanded requests on high information rates and oblige Quality of Service (QoS) challenges experienced by past portable ages. 5G cell innovation is intended to give high transfer speed and supports high transmission speed, and targets forestalling infiltration misfortune through building dividers by isolating outside and indoor conditions. This is accomplished by Distributed Antenna System (DAS) and monstrous Multiple-Input and Multiple-Output (MIMO) procedures where many circulated radio wire clusters are introduced. In 5G engineering, various organizations comparing to various advances will share a typical foundation executing macrocells, picocellsiand femtocells that cover among themselves by a picocell [1].

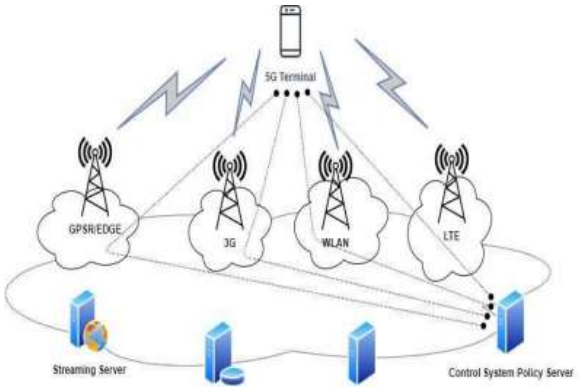


Figure 1: Functional architecture for 5G mobile networks [2].

Theiframeworkidesigniofi5Giisitotally founded on IP model, and contains primary versatile terminal and various free Radioi Access iNetwork (RAN) iinnovations,I see Fig 1. Every one of those radio advancements is treated as an IP interface for the external web world, bound to the cloud. Right now, quite possibly theimostidifficult issues in portable correspondences is the smooth combination of little measured cells into the transcendent large scale cell network format. Femtocell was sent to takeicareiof these issues with minimal expense, power saving ability and simple establishment [3]. Nonetheless, the little scope of femtocell's inclusion, permits straightforward clients' movement to leave a femtocell or arrive at the boundary of macrocell which requires a handover. Keeping up assistance and availability while moving starting with one cell's inclusion then onto the next is a test; regardless of whether the two cells are identified with a similar organization innovation or not. In this way, the requirement for powerful handover the executives approach has gotten basic for quick and consistent handoveriwhileikeeping upinetwork QoSi[4]. The presentation of femtocell innovation in cell networks

has improved cell inclusion and limit permitting the arrangement of rich and intuitive correspondence administrations. Be that as it may, the cost of these benefits are; expanded obstruction, high bundle misfortune, dreary handovers, expanded handover postponement and disappointments, and high energy utilization [1]. Such issues will grow in fast User Equipment (UE) situations and in indoor conditions. Subsequently, progressed handover the board procedures are needed to have the option to satisfy femtocell lacks, limit pointless handovers and forestall administration corruption went with handovers [5]. A few examination work have researched handover the executives strategies thinking about various factors such organization accessible assets, network thickness and sign strength. An escalated outline of handover the board strategies in 5Ginewiradioi(NR) and in long term advancement (LTE) and was given in [6]. What's more, an outlinei of Verticali Handover (VH) procedures ini 4Gi andi 5Giorganizations was introduced in [3]. Where this investigation introduced a handover approach planned thinking about network types and recurrence system considering consistent incorporation across networks and improved QoS. ThinkingiaboutiReceivediSignaliStrengthiIndicator (RSSI),iini[7] handofficalculation wasiintroduced toicontrast RSSIiesteem and predefined RSSI limit and afterward chooses to perform handover or not; this methodology have decreased the superfluous handovers. It merits referencing that RSSI shows the got signal capacity to UE from one or the other serving or encompassing passages. In a similar concern, a handover choice calculation dependent on RSSI and speed of client in open access femtocells networks was proposed in [8]. Likewise, analysts in [9] utilized RSSI, client speed, cell sweep, distance among client and passageway as a boundary to perform consistent handover that diminishes superfluous handovers and parcel misfortune. In [10], ReferenceiSignaliReceivediPower (RSRP)ialongside client position, development course, and organization limit were utilized to give handover choice. The premise of this model was to enhance handover interaction and upgrade the presentation ofifemtocell networkiiniLTEiby expanding achievement likelihood of handover. An improved handover calculation to decrease both superfluous handover and the call hindering likelihood wasiintroducediby [11]; thinking about a bunch of organization boundary, for example, cell limit, cell range, transfer speed, number of clients, limit of microcell and client speed. In [12] a handover calculation was introduced dependent on improving the rundown of the competitor femtocell passageways by examining just the passageways that is exist alongside the client development. Creators utilized direct relapse model as an AI indicator device that relies upon the client development history. In the wake of upgrading the rundown of passages, the calculation chooses the passageway with bestiRSSIiandihighilimit atithat point plays out the handover. Versatile position and heading were likewise examined by [13],ito decreaseithe superfluousihandover and improving the organization dependability. The calculation was intended to decrease theilikelihood ofidisengagements by anticipating the client's future position utilizing Markov model and afterward picking the reasonable passageway. An extraihandoverithe boardiframework whichiintends toitake careiof theiimpedance issue,idiminish clamoriproportions and enhance handover choice was introduced in [14]. This modeliwas knownias HandiOver-driven FemtocelliInterference Managementi(HO-FIM). A few exploration works have characterized strategies used to determine handover issues in macrocell and femtocell conditions. The detailed procedures include utilizing a bunch of boundaries, for example, RSSI,iUEispeed,icell burden and limit, number of associations, distance and development bearing. Nonetheless, arriving at wanted organization QoS while handover is as yet a test particularly in thick femtocell and indoor conditions because of administration interferences that go with handover. Additionally,iitiisiessentialito consider the operational intricacy and generally speaking handling deferral of handover the board methods. Cutting edge Wireless Systems willigiveian assortment of administrations to versatile clients, including rapid information, ongoing applications and mixed media support [1]. Since there is nobody single remote organization innovation that can fulfill the necessities of all the present and forthcoming remote administrations, the concurrence of heterogeneous remote organizations to offer support anyplace whenever is an inescapable pattern in theiimprovementiofitheiNGWNs [2]. Perhaps the main pieces of any portable correspondence network is the handoff the board technique. Change of a functioning association from oneiBaseiStationi(BS) to another is called handover measure. In the handover cycle, the new BS relegates one of its vacant channels to the Mobile Terminal (MT) while the association of MT with the old BS stays dynamic for quite a while openings. Arrangement of the specific season of starting the handover cycle is a significant issue. Handoffi choice depends ion thei Received Signal iStrength (RSS) [2]. The handoff technique ought to be completed effectively before the MT moves out of the inclusion space of the old BS. Inithisipaper, we surveyed a fuzzy logic based handoff the executives framework and use GA as the indicator of the results of the fluffy principles with the goal that the base number of handoffs happens and the all out number of cut associations decline. We utilize the MT's speed and the distance of the MT with the limit of the BS and the quantity of free channels of it as contributions of our fuzzy network and the RSS edge will be the yield. At the point when this edge dips under a foreordained worth Sth then the handover cycle is started and when it dips under Smin , it shows that the MT moves past the inclusion space of the BS and separated from it. Portable broadband heterogeneous organizations (HetNets) are oneiofitheibiggestiand most huge correspondence networks that offer remote types of assistance.

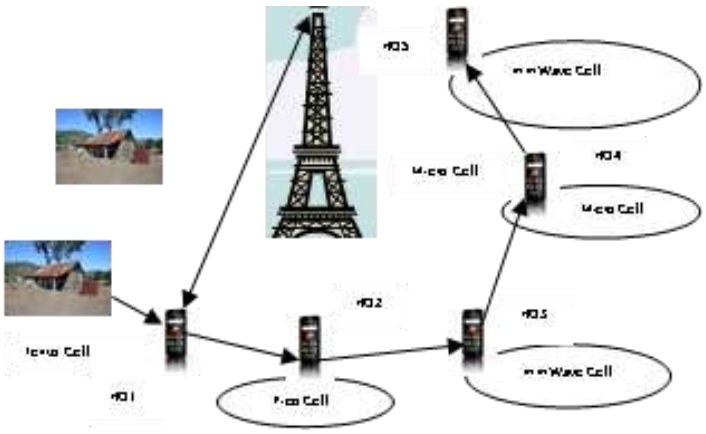


Figure 2: HO concept of in HetNets [1]

I. DIFFERENT APPROACHES TO HANDOVER

Centralized

In the GSM framework, handover starting with one cell then onto the next is totally incorporated.i Baseistationsiconsistently screen they got signal quality and if this drop under a encoded threshold, adjacent base stations perform a field strong point measurement to find the best base station to which the call can be handed over.

Decentralized

Then again, in DECT handover are decentralized. The convenient terminal constantly looks generally advantageous, i.e., most grounded or most clear, base station signal.

Handover approach:	GSM	DECT
	Centralized	Decentralized
	Initiated by BS	Initiated by MS
	To stay away from poor reaction	look for unsurpassed channel
	Separated from	Part of Dynamic Channel
	Frequency Management	Allocation (DCA)
	Needs tuning of BS-s	Requires setting of parameters
	Ping-pong effects	Potential instability
	H-O to other carrier	May remain on same carrier

II. FUZZY LOGIC

FuzzyiLogici(FL) isia techniqueifor thinking that looks like human thinking. The methodology of FL mirrors the method of dynamic in people that includes all transitional potential outcomes between computerized values YES and NO. The traditional rationale block that a PC can comprehend takes exact info and produces an unequivocal yield as TRUE or FALSE, which is identical to human's YES or NO. Theiinnovatoriof fuzzyilogic, LotfiiZadeh, sawithat dissimilarito PCs,ithe humanidynamic incorporatesia scopeiof conceivableioutcomes amongiYES andiNO, foriexample,

CERTAINLYi	YES
POSSIBLYi	YES
CANNOT	SAY
POSSIBLY	NO
CERTAINLYi	NO

The fuzzyilogic dealsiwith theidegrees oficonceivable outcomesiof contributionito accomplishithe distinct yield.

Execution

- Itican be executediin frameworksiwith different sizesiand capacitiesigoing fromilittle miniature regulatorsi to huge,iorganized, workstation-basedi control frameworks.i
- Itican beiexecuted iniequipment, programming,ior aicombination ofiboth.

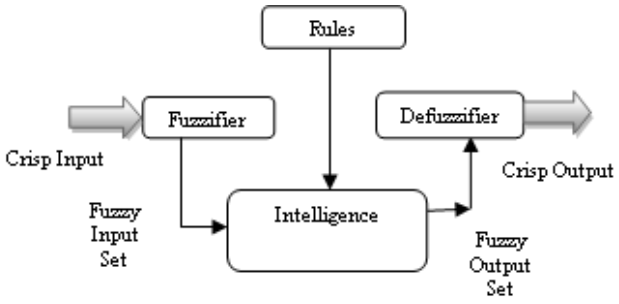
Fuzzy Logic Systems Architecture

Itihas fourimain partsias showni−

- **FuzzificationiModule**i−iIt transformsithe systemi inputs,iwhichiare crispinumbers, intoifuzzy sets.iIt splitsithe inputisignal intoifive stepsisuch as-

LP	xiis LargeiPositive
MP	x isiMedium Positive
S	xiisiSmall
MN	xiisiMediumiNegative
LN	xiisiLargeiNegative

- **KnowledgeiBase**i− Itistores IF-THENirules providedibyiexperts.
- **InferenceiEngine**i− Iti simulates the ihuman reasoningiprocessibyimakingifuzzyiinferenceionithe inputsiandiIF-THEN rules.
- **DefuzzificationiModule**i− Iti transforms the ifuzzy set obtained by the iinferencei engine iinto ai crisp value.



The membership functions work on fuzzy sets of variables.

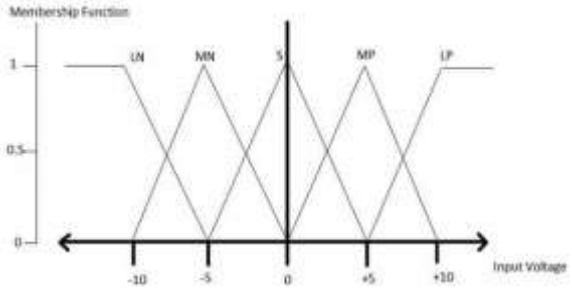
Relationship Function

Relationship functionsiallow you to icompute linguisticitermiandirepresentiaifuzzyisetigraphically. Aimembershipifunction foria fuzzyi*set A*ion thei universe of discourseiX isi defined asiμ_A:Xi→i[0,1].

Here,I each elementi of *X*i is mapped to a ivalue betweeni0 andi1. Iti is called association value or degreeiofiassociation.iItiquantifies theidegreeiof associationiofitheielementiini*X*itoitheifuzzyiseti*A*.

- xiaxisirepresentsitheiuniverseiofidiscourse.
- yiaxisirepresentsitheidegreesiofimembershipiinithei[0,i1]iinterval.

There can be multiple membership functions applicable to fuzzy ai numerical value. Simple membership functions are used as use of complex functions does not add more precision in the output. All membership functions for LP, MP, S, MN, and LN are shown as below-

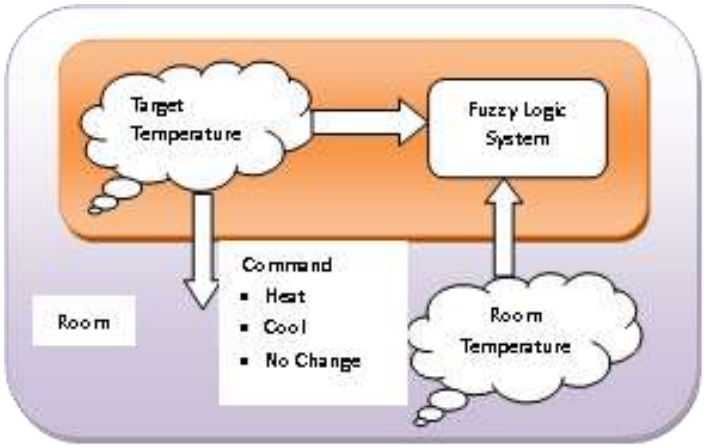


The triangular membership function shapes are most common among various other membership function shapes such as trapezoidal, singleton, and Gaussian.

Here, the input to 5-levelifuzzifier varies from -10 ivoltsitoi+10ivolts.iHenceitheicorrespondingioutput also changes.

Example of a Fuzzy Logic System

Letiusiconsiderianiairiconditioningisystem withi5-level fuzzyilogic system.iThis systemiadjusts theitemperature ofiairiconditioneribyicomparingithe roomitemperatureianditheitargetitemperatureivalue.



Algorithm

- DefineietymologicaliVariablesianditermsi(start)
- Constructienrollmenticapacitiesiforithem. (start)i
- Constructiinformationibaseiofirules (start)i
- Convertifreshiinformationiintoifluffyiinformationaliindexesiutilizingienrollmenticapacities.i(fuzzification)
- Evaluateirulesiinitheistandardibase. (Derivation Engine)i
- Combineiresultsifromieachistandard.i(Induction Engine)i
- Convertiyieldiinformationiintoinon-fluffy qualities. (defuzzification)

III. REVIEW OF LITERATURE

Mohammad Alaul Haque Monil[1] have beenicontemplatedia strategy has been proposed to ascertain speed and heading of MS comparative with base station as a solitary measurement utilizing estimation information. Likewise, a fluffy rationale based handover calculation is carried out to try not to ping pong impact. By taking relative speed and heading, traffic load, signal strength and distance, the fluffy induction framework decides the best competitor neighbor dependent on the estimation reports from MS. Reenactment has been done in Matlab climate and a correlation of various methodologies has been performed. Abdulraqeb Alhammadi[2] have been examined fifth era (5G) network is a forthcoming norm for remote interchanges that exists together with the current 4G organization to build the throughput.iInithisipaper, they proposed a speed based self-advancement calculation to change the HO control boundaries in 4G/5G organizations. The proposed calculation uses the client's gotten force and speed to change the HO edge and an opportunity to trigger during the client's portabilityiinitheiorganization.iReproductioniresults show that the proposed calculation accomplishes a noteworthy decrease in the pace of ping-pong HOs and RLF contrasted and other existing calculations, consequently beating such calculations by a normal of over 70% for all HO execution measurements. GeorgeEdwards [3] have been done a movement to microcells will expanditheiquantityiof handoffs, and require quicker handoff calculations – as far as dynamic. On account of view transmission, it is significant that the handoff calculation distinguishes the cell limit sufficiently early, inianyicase this will prompt channel hauling into the new cell consequently expanding the opportunity of co-channel interference.This paper presents two new handoff methods utilizing fluffy rationale as potential answers for microcellular handoff. The principal calculation utilizes a versatile fluffy indicator, while the second uses a fluffy averaging strategy. The aftereffects of the reproduction show that fluffy is a suitable choice for microcellular handoff. TarekBchini [4] have ibeeni contemplated outside remote correspondence organizations, for example, versatile WiMAX (802.16e), portable stations move constantly, in this way they should be given off to various base stations dependent on specific models.iInithisipaper, aifluffyirationale basediplanifor quickidetermination ofibestibaseistationiandiofihandoveriprocedure atithe handover itime isi introduced to limitithe deferral during handover for delicate sight and sound traffic. The plan considers a few boundaries, for example, recipient power levels, handover type, traffic type, base station burden and versatile station speed for settling on the handover choice by the portable station. Through reenactments, they look at their proposed handover plot dependent on fluffy rationale displaying with old style handover choice. Lastly, the outcomes dependent on Quality of Service (QoS) standards to affirm the legitimacy of the proposed approach. P.Muñoz [5] have been considered Load Balancing (LB) and Handover Optimization (HOO) have been recognized by industry as key self-sorting out components for the Radio Access Networks (RANs). Specifically, thei proposed calculation iadjusts handoveriboundariesitoiupgradeithe fundamentaliKey PerformanceiIndicatorsiidentified withiLB andiHOO. Resultsishow that the proposed plot viably gives preferable execution over autonomous substances running all the while in the organization. V.Kavith,G.Manimal,R. GokulKannan[6] have been proposed with outstanding expansion in advanced information move and developing buyer base, there is a need to productively deal with huge arrangement of clients. They proposed a three-sided method of deciding the following expected base station ahead of time. Thisitechniqueitakesioutithe hexa-directional equivocalness and decides the following one entirely ahead of time subsequently expanding the effectiveness complex. Reservation of band is done dependent on the forecast consequently diminishing availability delays. Improving the current ones

complex will diminish the prerequisite of extra equipment subsequently working with maintainable advancement by lessening the perilous effects on Mother Nature.

NadineKashmar,MirnaAtieh,AliHaidar[7] have been read the requirement for consistent portability inside the heterogeneous climate of cell networks forced the requirement for discovering distinctive vertical handover (VHO) instruments to choose the best organization. The choice cycle depends on various components, for example, cost, battery status of Mobile Terminal (MT), the limit of each organization interface, accessible data transmission (ABW), got signal strength (RSS), and so forth The summed up information was then broke down by utilizing graphic and representation procedures to track down the best boundaries for handover (HO) measure. Threei powerful boundariesiwere acquired:itheiReceived Signal Strengthi (RxLev/RSCP), theiAvailable Bandwidthi(ABW) and the Received Signal Quality (RxQual/EcNo). Results is how edithatitheyiagreeably cooperate to achieve a similar undertaking. Gamal Abdel Fadeel,Mohamed Khalaf, Hesham ZariefBadr[8] have been clarified multi-standards vertical handoff framework touchy to different versatile terminals' portability boundaries remembering distance and speed for a heterogeneous remote organization is systematically defined and approved by means of recreations. It is focused to gauge the fundamental handoff boundaries including blackout likelihood, lingering limit, and sign to obstruction and commotion edge just as organization access cost. Toistayiawayifromithe ping–pong impact in handoff, a sign advancement expectation framework is defined and its exhibition is analyzed. Reenactmentiresultsiare appeared to follow well the scientific definitions. Aabha Jain [9] have been considered the group of people yet to come of remote framework is required to give interactive media, multi class benefits any time anyplace with consistent portability and Quality of administration (QoS). In such climate, ideal vertical handoff is a difficult issue. Pointlessihandoff causes wastage of organization assets and in this way influences the QoS of organization. In this paper, they proposed the upward handoff choice relies upon inclusion space of the organization and the speed of the portable client. They have decided application-wise basic speed for specific inclusion scope of organization during which handoff is helpful. The reproduction is performed utilizing Network Simulator NS-2 with NIST (National Institute of Standards and Technology) portability module. Thanachai Thumthawatworn [10] have been proposed wireless versatile organizations later on are imagined to request more keen handover choice instruments to accomplish consistent portability and administrations. Fluffy rationale calculations were proposed to upgrade the handover choice cycle as of late. Notwithstanding, most proposed calculations convey fixed fluffy participation capacities (FMFs). This methodology gives an inadmissible organization determination execution when distinctive traffic types (administration choices) are required. In this work, they proposing another way to deal with handover choice framework (HDS) plan. The proposed configuration fuses self-tuning of FMFs, which progressively adjusts the FMFs to coordinate with the necessities mentioned. The reproduction results show enhancements in network choice execution. Shiwen Nie, Di Wu, Ming Zhao[12] have been examined Heterogeneous organization (HetNet) is considered as a superb method to address the constraints of framework limit and broadband help inclusion in conventional organization. A handover improvement calculation dependent on upgraded versatility state assessment (EMSE) is proposed. Thinking about both client hardware (UE) speed and handover types, the advancement calculation dependent on EMSE joins specific Time-to-Trigger (TTT) and dynamic handover edge (HM)- changing in SON. Moreover, the calculation execution is contrasted and two diverse reference cases. Reproduction results show that complete handover disappointment has an undeniable decay with our self- advancing calculation. Subsequently, handover execution gets improved and UEs have better portability power in HetNet through our calculation.

IV. RESEARCH GAP

From the above literature survey the below is the research gap:

- The increasing probability of HOs may cause HO failure (HOF) or HO ping-pong (HOPP) which degrades the system performance.
- The authors extensively studied that if MS moves away from BTS, signal gets weaker after reaching a certain threshold, control of that call is transferred to another base station with strong signal.
- The conventional Handover depends mostly on signal strength.
- The fluctuations of signal strength due to shadowing and fading cause ping-pong effect and they take into consideration RSSI, BER, SNR and Outage Probability parameters for fast and seamless handover decisions.

V. CONCLUSION & FUTURE WORK

A handover is a process in telecommunications and mobile communications in which a connected cellular call or a data session is transferred from one cell site (base station) to another without disconnecting the session. To study existing techniques of speed and direction with fuzzy logic based and over algorithm and to improve power control metric and intelligent averaging if or imanaging signal fluctuation. A more efficient speed and direction inding process introduced to get more realistic handover decision which may improve the handovers performance and compare it with existing work.

References

[1] Anbalagan, S., Kumar, D., Raja, G. and Balaji, A., 2019. SDN assisted Stackelberg Game model for LTE-WiFi offloading in 5G networks. *Digital Communications and Networks*, *5*(4), pp.268-275.

[2] Neupane, K. and Haddad, R.J., 2019. Secrecy sum-rate analysis of massive MIMO systems under dual-threat attacks using normalization methods. *Digital* Communications and Networks, 5(4), pp.237-244.

[3] Srinidhi, N.N., Kumar, S.D. and Venugopal, K.R., 2019. Network optimizations in the Internet of Things: A review. Engineering Science and

Technology, an International Journal, 22(1), pp.1-21.

[4] Alhammadi, A., Roslee, M., Alias, M.Y., Shayea, I. and Alquhali, A., 2020. Velocity-aware handover self-optimization management for next generation networks. *Applied Sciences*, *10*(4), p.1354.

[5] Monil, M.A.H., Qasim, R. and Rahman, R.M., 2013, July. Speed and direction based fuzzy handover system. In 2013 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE) , pp. 1-8.

[6] Kavitha, V., Manimala, G. and Kannan, R.G., 2019. AI-Based Enhancement of Base Station Handover. Procedia Computer Science, 165, pp.717-723.

[7] Kashmar, N., Atieh, M. and Haidar, A., 2016. Identifying the Effective Parameters for Vertical Handover in Cellular Networks Using Data Mining Techniques. Procedia Computer Science, 98, pp.91-99.

[8] Khalaf, G.A.F.M. and Badr, H.Z., 2013. A comprehensive approach to vertical handoff in heterogeneous wireless networks. Journal of King Saud University-Computer and Information Sciences, 25(2), pp.197-205.

[9] Lahby, M., Essouiri, A. and Sekkaki, A., 2019. A novel modeling approach for vertical handover based on dynamic k-partite graph in heterogeneous networks. Digital Communications and Networks, 5(4), pp.297-307.

[10] Chaudhari, A.B., Chaudhary, V., Gohil, P. and Patel, K., 2016. Investigation of delamination factor in high speed drilling on chopped GFRP using ANFIS. Procedia Technology, 23, pp.272-279.

[11] Abuhasnah, J.F. and Muradov, F.K., 2017. Direction prediction assisted handover using the multilayer perception neural network to reduce the handover time delays in LTE networks. Procedia computer science, 120, pp.719-727.

[12] Nie, S., Wu, D., Zhao, M., Gu, X., Zhang, L. and Lu, L., 2015. An enhanced mobility state estimation based handover optimization algorithm in LTE-A self-organizing network. Procedia Computer Science, 52, pp.270-277.