

# Simulation of a UAV-based wireless sensor network on NS-3 to analyze IEEE 802.11 performance

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## Abstract

Mechanical Winged Vehicle (UAV) can probably change the future detached sensor institution (WSN). Ultimate active, elite exhibition, important and smartest news variety are accomplished in WSN through the UAV on account of UAV gives an strength-able temporary agreement with excellent chance. Still, UAV-located WSN exhibitions are affected by miscellaneous foundation frontiers. To analyze this issue, it is main to investigations the impacts of foundation perimeters on the UAV-located WSN killing. In this paper, we plan a NS-3 content for UAV-located WSN as per the growing habit of TCP/IP model. We organize all coatings by utilizing NS-3 model parts and set and regulate the values exploited by objects to examine the impacts of foundation perimeters (approach structure, UAV management design, UAV speed, number of sensors, and sensor traffic age rate) on throughput, and normal respite. The duplication results show that the RTS/Repetitive stress injury approach instrument gives favorite killing over the fundamental news approach system and the ability to move model that has happened urged shows better killing than the arbitrary flexibility model. Also, the effects show that greater speed of UAV debases the framework killing accompanying greeting to throughput and respite. Our plan arrangement addresses a decent rule for new NS-3 customers to plan and change content and results remarkably benefit the arrangement plan and the board.

## Keywords

IEEE 802.11, Flexibility model, NS-3, Execution appraisal, UAV, WSN

## 1. Introduction

In the ending of leading position change, automated winged car (UAV famous as android) has turned into a legendary term for reconstructing agreement changes also concerning allowance various happening and result endeavors at a quick rate (Jawhar et al., 2015). It is mainly including in the military, everyday inspecting, up-to-date, agribusiness, reconnaissance and fundamental remote domain observant (Ravi et al., 2019). Alternately, the detached sensor institution (WSN) be able a climbing concern for the scientists, adventures and states (Ganesan et al., 2003). The WSN has furthermore expansive reach requests, for example, continuous observant, first-contact medical care, inspection, environmental checking, and agribusiness (Milovanovic & Stefanovic, 2021). At presents, UAV is exploited in the WSN news variety that expands the WSN execution additionally for the crunch and elementary condition UAV-located WSN decided a hopeful be accountable for agreement networks (Ali et al., 2019). Also the UAV-based WSN has any unusual values

compared accompanying VANET and MANET (Surya Narayanan & Elshakankiri, 2021) that have made any troubles, e.g., UAV habit and speed arranging, centers girth, sensor centers broadcast planning, situating of UAV and sensor hubs, stored continuously center issue, UAV crest, channel displaying, traffic age rate and protection (Qin et al., 2018). The demonstration of UAV-make by putting pieces together WSN depends concerning these troubles. In this way, it is a crucial need to evaluate the UAV-located WSN killing regarding various foundation frontiers.

In this place paper, we determine the effects of UAV habit and speed, number of sensor centers, approach method and traffic age rates. Figure 1 shows a UAV-based WSN place the sensor centers are transported on the ground like a network position. The UAV is visiting this domain from the beginning control station. The friendship middle from two points capital of massachusetts and UAV is just reasonable when the distance 'tween them is inside their sign broadcast range. The UAV neverending exciting from Position A to B so the UAV addition range likewise uniformly moves and it covers new centers infrequently. By way of the incident of the UAV, making an association betwixt the UAV and the sensor growth is intensely questioning. Once more, when the capacity of centers is extended inside the UAV addition range skilled needs a compelling clog control mechanism. Because obstruction of miscellaneous hubs all along facts broadcast corrupts the arranging killing (Neves et al., 2008). To moderate this trouble IEEE 802.11a standard is utilized. IEEE 802.11a is a CSMA/CA for Desktop computer practice place the frequency is 5 GHz, a symmetrical repetition estrangement multiplexing (OFDM) for real relation point and a scattered coordination efficiency (DCF) Desktop computer power (Neves et al., 2008). The DCF includes two access elements individual is two-habit handshaking approach mechanism otherwise named a fundamental approach scheme and additional is four-way handshaking component famous as Appeal to Please, Clear to Transmit (RTS/Repetitive stress injury) access scheme. A four-habit handshaking approach agent maintains a clever distance from the secret terminal issue and upgrades the institution killing (Zhu et al., 2011). In the fundamental approach scheme, the hubs revolutionize into active fashion and take an uneven backoff number in the wake of growing a remark point signal from UAV. At the point when individual center backoff is belittled to zero it hangs close for flowed interframe scope (DIFS) period and afterward abilities the channel. Arrogant the channel is still clear capital of massachusetts sends the news to the UAV. The UAV is solved by an ACK to the sending center later the short 'tween outline room (SIFS) time. Remainder of something centers by all means take the dictatorial backoff and reuse this information broadcast policy (Poudel & Moh, 2020). The fundamental approach mechanism isn't fit to decrease the secret hubs issue. Secret centers issue occurs when the miscellaneous centers can't listen each other inside the UAV addition range (Poudel & Moh, 2020). The RTS/Repetitive stress injury implement indeed tackles the secret hubs issue by shipping a RTS covering to the UAV. At the point when the UAV communicates a Repetitive stress injury edge to capital of massachusetts. Each of the hubs take the Repetitive stress injury edge and check however either allure own casing. Before, before, just the productive center sends his news. Another time, fitting course choice of UAV is a meaningful test in UAV-located WSN. To determine the UAV-based WSN killing indicating degree UAV course we are applied Gauss Markov and uneven

bearing 2D ability to move model. Place, the Gauss Markov flexibility model satisfies the speed and course of UAV when stem and just a single bringing into harmony bound named  $\alpha$  (Ravi et al., 2019). When  $\alpha = 1$ , the new speed and posture of UAV is indistinguishable. In another way, the uneven title 2D flexibility model furnishes dictatorial UAV bearing of UAV accompanying a constant speed. In this place, when the UAV meets expectations at the limit, it stops and selects another course. In Figure 2 it's proved that an uneven significance two layered ability to move model. Present, the machine moves in a forward title with a stable speed as far as arrive at the point of a major change. Afterwards arrive at the point of a major change the robot take another title design. The delicacies plan of the ability to move model has allowed to the framework arrangement region. We lead the arranging test method 3 for the foundation plan which is a capacity something duplicated tool for unending framework.

The showing examinations of UAV-located WSN are attractive interests to the chemists that are portrayed in this manner. Researcher (Ganesan et al., 2003) have dissected the unlocked CSMA/CA execution in the UAV-located WSN. They have thought-out the guide outline, speed of UAV, centers diameter, and the load of bundles for assessing the arrangement throughput and the leftover number of parcels of capital of massachusetts. Researcher (Milovanovic & Stefanovic, 2021) have investigated the UAV-assisted WSN facts variety place all region is partitioned into various little containers and employed a single UAV or various UAVs to cover everybody of the containers. They have considered the abundance of containers and assess the sole and various UAVs influences on capital of massachusetts limit. Researcher (Ali et al., 2019) have proposed a need located dispute dormer change concur agreement taking everything in mind two streamlined outlines named Need located Enhanced Edge (POFS) and Circularly Reinforced Casing (COFS). Present, news will be shipped initially from the back position higher need centers to the UAV. Nevertheless, this practice decreases the bundle disaster still the continuous computing of the conflict aperture channels strength and season of the arranging. Also, they didn't consider the speed and course of the UAV. Researcher (Surya Narayanan & Elshakankiri, 2021) have presented an arrangement located news shipping model where nearly located centers form an arrangement, and in the event the one center neglects to please facts, it sends its surplus portion news to the co-conspirator and following the collaborator will send welcome news. However, these models completely decrease the parcel disaster and huge yield that bother the presentation of the arranging still in the dense arranging the exhibition debases. Researcher (Qin et al., 2018) has projected a natural Desktop computer tradition for UAV-located WSN information variety. This tradition depends on sure casings broadcast before the genuine news broadcast. Although, this conference guarantees a fair time for each center and the attainment rate is 100 for one by. This tradition has thought about the secret center issue nevertheless didn't typify the UAV course correctly. Evidently, researcher (Neves et al., 2008) proposed channel approach elements help the institution execution. By any means, they didn't show the belongings of speed and course of UAV and traffic age rates.

In this place paper, we promote a NS-3 content for a UAV-located WLAN in NS-3 that involves of a enactment (AP) center undertakes as a UAV and differing STA centers undertake as sensors forming a one-bounce star earth science. We acknowledge that all center

of the arrangement includes IEEE 802.11a standard determinations as Desktop computer and PHY coating, TCP/IP tradition stack as arranging and transport tier and intermittent request and piece fall use as use tier. Still, we set and regulate the features of miscellaneous coating objects to research the impacts of foundation boundaries (approach arrangement, number of sensors, UAV management design, UAV speed, and sensor traffic age rate) on throughput, and sane respite. The most of ancient times everything center about the test of the impacts of foundation edges on killing still, seemingly, no one of the survey work has described the plan whole of NS-3 content as per the guidances of TCP/IP model to their arrangement.

The residue of the paper is matched as follows: The arrangement of UAV-make by putting pieces together WSN located concerning TCP/IP network model in NS-3 is described in delicacies in District II. Section III decides the proclamation of throughput and common yield because stream screen ascribes of NS-3. The impacts of foundation perimeters on throughput and rational delay are received in Slice IV. Eventually, Region V closes whole and gives the future work frames.

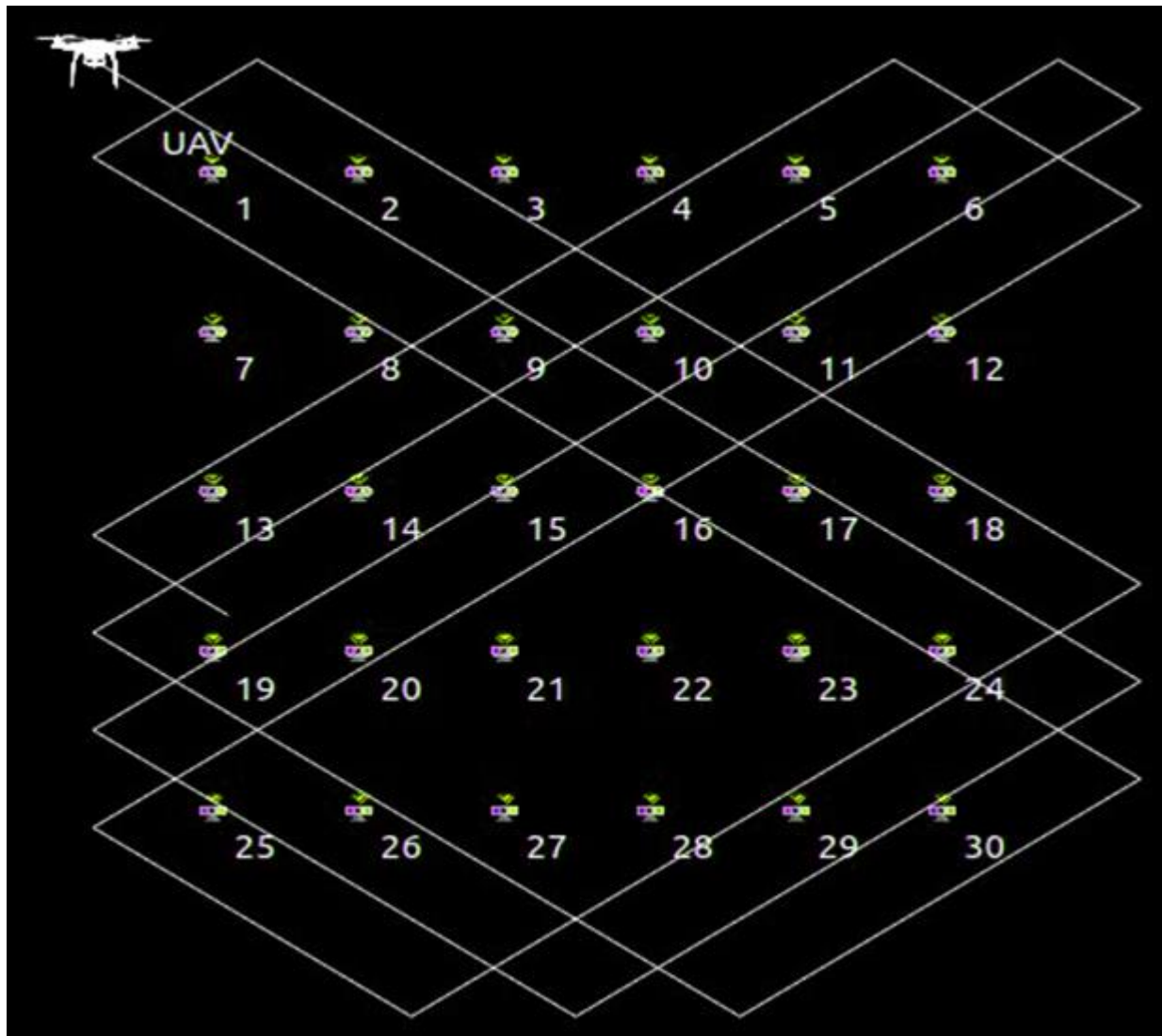
## **2. Configuring system in NS-3**

In this part, we release the composition of UAV-make by putting pieces together detached sensor networks located concerning TCP/IP network model in NS-3 and the belief phase of killing calculations applying C++ accent. Besides, we present the differing leveled plan whole of WLAN in NS-3 and moreover feature by what method the characteristics or barriers of miscellaneous NS-3 models or classes can change to plan another design of an arrangement. The NS-3 is a effective and sustained accompanying, compliant and straightforward architecture, natural and open proof, entirely open beginning, and widely handled in scientist and investigation as an arrangement reproduction maneuver and it has extreme accuracy and expedient killing ability to run NS-3 capacities. NS-3 gives differing sorts of spouse Prioritize connect, subdivision Prioritize interface and center Set up connect to plan a total agreement foundation. The subdivision Prioritize connect plays out differing alike actions to gatherings of parts and the center Compute connect plays out a distinguishing task for a NS-3 model. The assistant Prioritize connect is employed to form and examine NS-3 content plainer. We originally combine the important namespaces and plunge records at top of the NS-3 content. The residue of the piece of the NS-3 content is imitated in this manner:

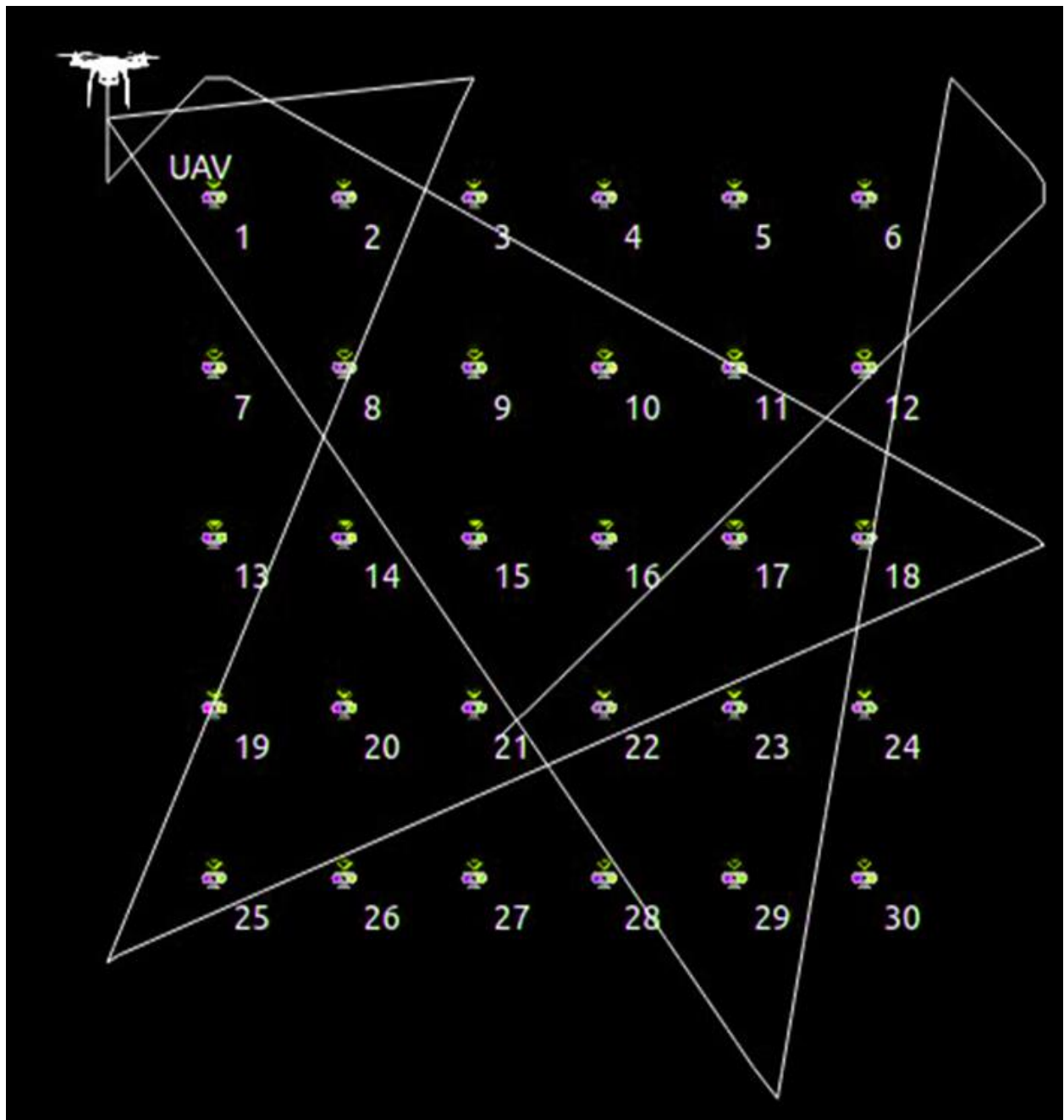
### **2.1. Configuration of Real Geology**

In this place work, we believe a UAV-located WSN involves of a UAV that undertakes as an AP center and differing alike STA centers in a star earth science to determine the demonstration accompanying commendations to throughput and respite. To form an AP hub and miscellaneous STA centers, we take two objects of NodeContainer class, chosen as apNode, staNode, and use form () efficiency that takes the quota of AP centers and number of STA centers as a line. To assign positions and to set ability to move model to the AP and STA centers, we take two objects of MobilityHelper class, chosen as apMobility, staMobility, and use SetPositionAllocator () and SetMobilityModel () competencies. The NS-3 gives various position allocators and flexibility models to suitably imitate the institution topography. Each position allocators and ability to move models can set position and

flexibility example to capital of massachusetts as pointed out by a bunch of traits. Eventually, the distinguished characteristics of position allocator and flexibility model are banished to AP and STA centers by employing Present () facility that takes apNode and staNode objects as a perimeters, alone. In this place work, we believe ConstantPositionMobilityModel class as an ability to move model for STA and either GaussMarkovMobilityModel or RandomDirection2dMobilityModel are exploited as a flexibility model for UAV.



(a) Gauss Markov flexibility model



(b) Uneven course 2d ability to move model

**Figure 1:** PHY geography of UAV-located WSN created in NS-3

## 2.2. Network Device Configuration

The NetDevice class of NS-3 gives objects as arranging connect program of honest PC for Ethernet, WiFi, Bluetooth, thus. In this place paper, we analyze WifiNetDevice class to plan IEEE 802.11-located WLAN. The WifiHelper class is employed to create WifiNetDevice objects for each center that is the relation point betwixt network coatings to facts connect coating. The normal possessions of WifiNetDevice like detached station executive and PHY standard for two together AP and STA centers are assigned by applying SetRemoteStationManager () and SetStandard () skills through WifiHelper class object

chosen wifi. To organize differentiable features of WifiNetDevice for AP and STA centers, we create two objects of NetDeviceContainer class, chosen as apNetDevice and staNetDevice. In the end, WifiNetDevice for AP and STA centers is planned by handling wifi object and Present () proficiency that takes WifiPhyHelper object, WifiMacHelper object and NodeContainer object as a frontiers. In this place work, to show the impacts of approach system, we regulate the RtsCtsThreshold feature value exploiting SetRemoteStationManager () potential.

### **2.3. PHY Coating Configuration**

To design WifiPhy model as the PHY coating, we take an object of YansWifiPhyHelper class, chosen as wifiPhy, on account of two together somewhat centers (AP and STA) appropriate alike PHY coating. Besides, we furthermore assign blunder model to the PHY tier object by appropriating SetErrorRateModel () facility. Before, before, we take an object of YansWifiChannelHelper class, named as wifiChannel, to design the channel for two together AP and STA centers. The AddPropagationLoss () powers is employed to set spread disaster model to the channel object in the end, this channel is named to PHY tier through SetChannel () capacity.

### **2.4. Configuration of system MAC Layer**

To design Desktop computer coating model for the AP and STA centers, we examine two objects of WifiMacHelper class, chosen as apWifiMac, staWifiMac, on account of AP and STA centers need differing plans to talk in a group. The NS-3 offers three types of Macintosh model like ApWifiMac, StaWifiMac and AdhocWifiMac. To set ApWifiMac model as the Desktop computer coating of AP center, we use SetType () capacity and allocate differing Desktop computer horizons principles as traits to change the design as the need ability have stood. Furthermore, composition of Desktop computer tier of STA centers is acted by taking advantage of StaWifiMac class and SetType () power.

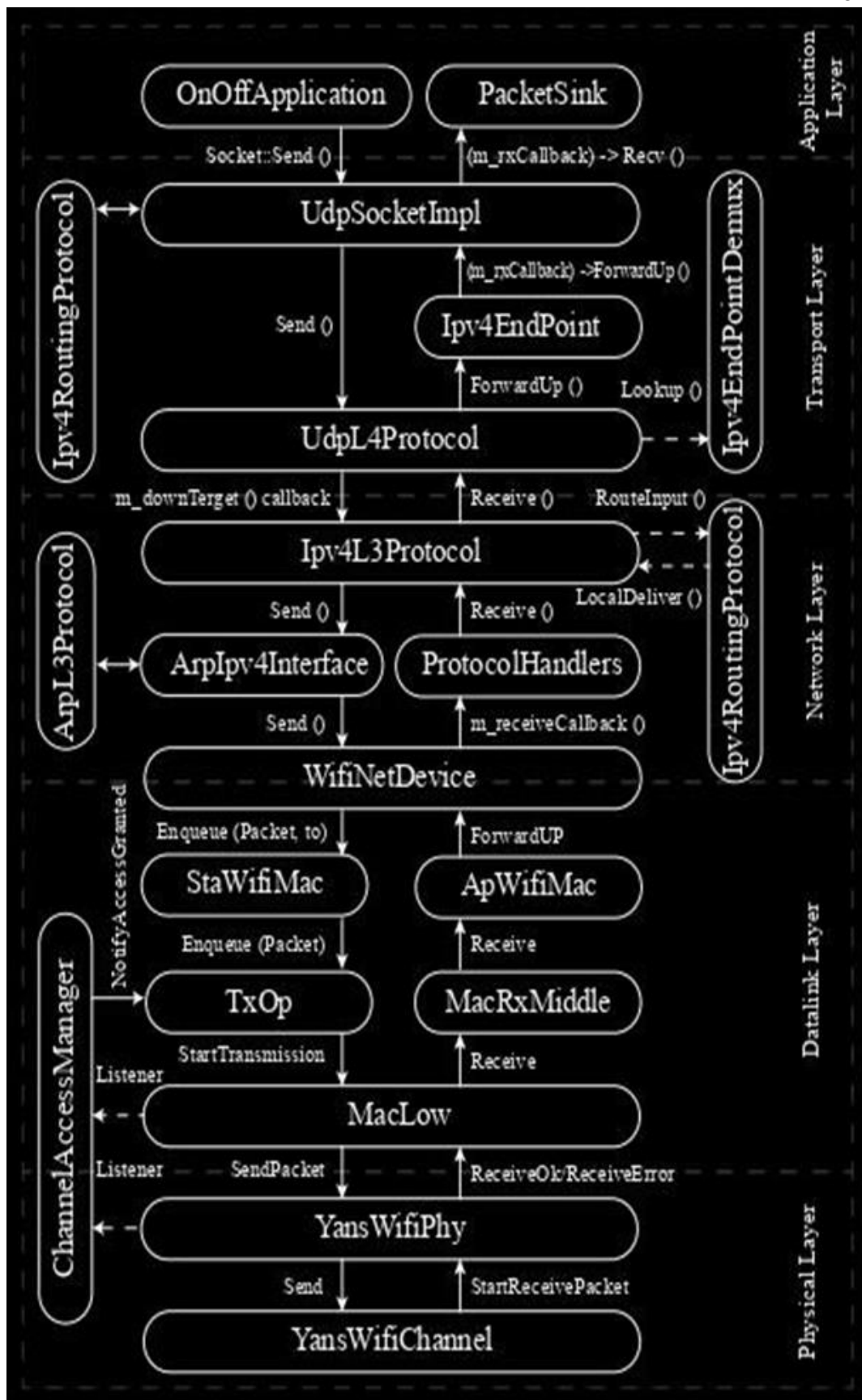
### **2.5. Configuration of network and transport layer**

To design arranging and transport layer of AP and STA centers, we examine an object of InternetStackHelper class, chosen as netting Stack, taking everything in mind the case that two together AP and STA centers employ unchanging arrangement and transport tier practices. We set all default plans of arrangement and transport tier to apNode, staNodeobjects by handling Present () skill. InternetStackHelper class totals IP/TCP/UDP utility namely. ArpL3Protocol, Ipv4L3Protocol, Ipv6L3Protocol, Icmpv4L4Protocol, Icmpv6L4Protocol, UdpL4Protocol, TrafficControlLayer, PacketSocketFactory, Ipv4 addressing, Ipv6 guiding, naturally, to all center. Finally, we finish the arranging tier composition process afterwards the finish of the IP address set and assign methods. To assign IP address for each systematize device of AP and STA centers (apNetDevice and staNetDevice), we create an object of Ipv4AddressHelper class, chosen as ipAddr. We use SetBase () and Transfer () powers to set IP address for AP and STA centers and to assign this IP address through two objects of Ipv4InterfaceContainer class, chosen as apNodeInterface and staNodeInterface.

## 2.6. Configuration of Application layer

To design application coating, we legitimately want request subdivision place the conferences of exercise tier are received. We take two objects of ApplicationContainer class, chosen as apApplication and staApplication. NS3 offers miscellaneous types of utilizations by typifying various use class. In this place work, we use OnOffApplication class as the use of STA centers and PacketSink class as the use of AP center. Fastening address (IP address of arrangement tier tradition and traffic number of transport layer agreement) and transport coating practice of capital of massachusetts be necessary to organize an request. We take two objects of InetSocketAddress class, chosen as apAddress and staAddress, that hold the fastening address of AP and STA centers. Before, at another time, we analyze an object of PacketSinkHelper class, chosen as apSink, and from that point ahead, SetAttribute () competence is took advantage of to typify the traits of the bundle decrease request. Finally, Introduce () efficiency is employed to present the PacketSink use into the AP center. Still, we take an object of OnOffHelper class, chosen as staOnOff, and SetAttribute () and Present () wherewithal are promoted to organize the OnOffApplication for each STA centers. Eventually, we present the origin and stop season of the utilizations of AP and STA centers by handling Start () and Stop () details of ApplicationContainer class. The traffic age pace of a center can altered by changeful the value of DataRate feature. In this work, to show the impacts of traffic age rate, we appropriate three upsides of DaraRate credits: 0.5 Mbps, 3Mbps and 6 Mbps.





**Figure 2:** Agreement construction of UAV-located WSN in NS-3

## 2.7. Setting up to build simulation model

The Reproduction class of NS-3 kills the games occasions and control the in essence occasion. In this place work, we appropriate three motionless ingredients of Duplication class to execute our projected NS-3 content for simulationTime opportunity. The Run () potential runs the sports and will love intensely as far as for all practical purposes individual of the three occasions occurs: (a) no occasions are available some lengthier, (b) customer named Stop () proficiency, and (c) customer named Stop () efficiency with a stop occasion and the end season of the following occasion expected controlled is more famous than or equivalent to the stop opportunity. The Destroy () proficiency is usually called toward the finish of a games to prevent from confusing certain reports by a dent inquirer. From now on planning has happened called, continuing another imitation is easily reasonable. The Stop () wherewithal calculates the Test whole class the career occasion should be the last one performed. It accepts the simulationTime as a skill horizon.

## 2.8. Setting up of Animation

The NS-3 has two systems for bestowing animation, expressly utilizing the PyViz method or the NetAnim approach. In this place paper, we use NetAnim to show the earth science of the arrangement and activate the bundle stream middle from two point's centers. The NetAnim furthermore gives helpful details, e.g., tables to show meta-facts of bundles. To attend the record generated all along something duplicated, we exploit an object of Liveliness Point of interplay class, chosen as campaign. Animation Relates point class trails the calculations each stream and amount in XML design.

## 2.9. Occasion Observing and Facts Variety

The NS-3 backings many occasion observant model like Ordinary readable form trail, PCAP and stream screen. In this place work, we use stream screen model to gauge the performance of institution conventions. The stream screen is an compliant occasion examining model and it employs tests to attend the bundles el at ta exchange apiece centers and the parcels are partitioned apiece stream they be affiliated with with, place each stream is distinguished as the parcels accompanying alike (tradition, beginning IP address, beginning traffic number, objective IP address, objective traffic number) tuple. Stream screen gathers the measurements each stream and possession in XML design. To authorize the stream screen, we take an object of Stream Screen Friend class, chosen as screen and use Present All () facility. The facts brought during duplication is understood by Stream Screen class and stream screen model stores this facts in a guide as per stream id employing determinants: timeFirstTxPacket, opportunity Last TxPacket, period First RxPacket, occasion Last RxPacket, yield Total, jitter Total, txBytes, rxBytes, txPackets, rxPackets, occasions Shipped, bytes Discontinued, bundles Discontinued, thus. We control this news and measure the throughput and usual delay as per the definition typified in Portion IV. Back estimating killing calculations, we create a CSV record and form the value of execution calculations to the document exploiting of stream class of C++.

### 3. System performance metrics

In this section, we outline how the principal performance metrics, viz. throughput, and average delay, are determined from flow monitor attributes.

In this place section, we frame by means of what the lively performance measurements, namely, Throughput, and average delay time, not completely decided from stream screen ascribes.

#### 3.1. Throughput

The throughput of a STA center or a stream is typified as the pile of pieces of the STA center efficiently got by AP center in whole period. Throughput is supposed in moment each second (bps). That throughput of the arrangement is the summary of all individual STA center throughputs. In this place manner, if the portion of STA centers in the institution is  $n$ , the throughput of the arranging is corresponded as:

$$\text{Throughput} = \sum_{i=1}^n \text{Throughput of flow } i = \sum_{i=1}^n \frac{\text{Received bytes of flow } i}{\text{Simulation time}} = \sum_{i=1}^n \frac{\text{second.r} \times \text{Bytes} \times 8}{\text{Simulation time}}$$

#### 3.2. Average Delay Time

The usual delay is distinguished as the portion of the amount of all start to finish delays for each caught bundle and complete number of gotten parcels. The usual delay is supposed speedily (moment). Afterward, on the off chance that the bulk of STA centers in the arrangement is  $n$ .

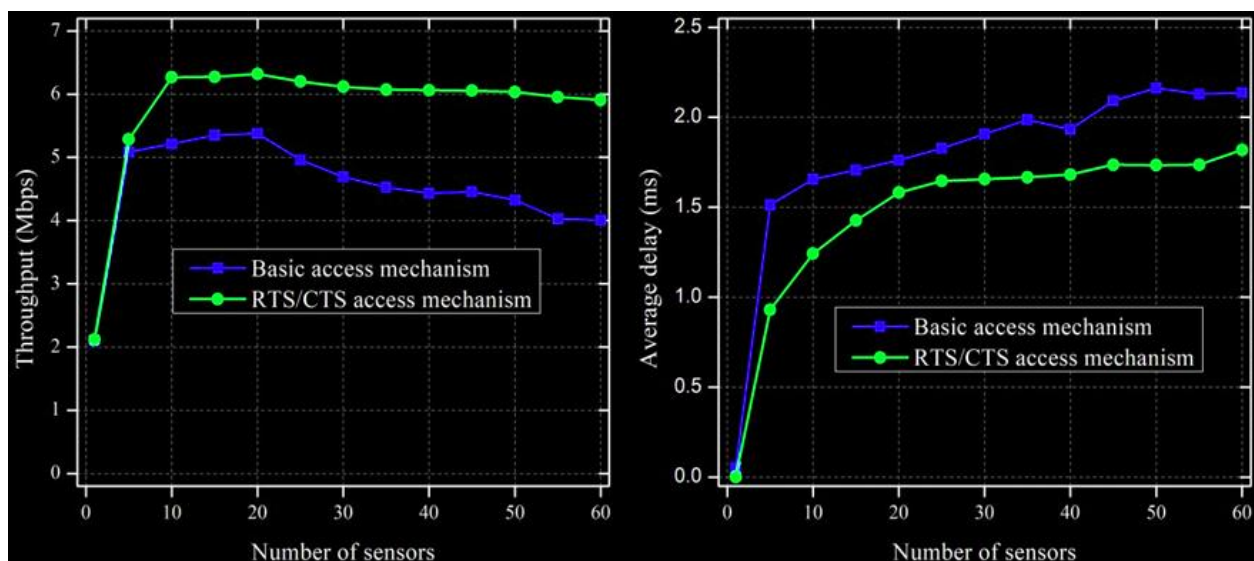
### 4. Simulation results

In this place part, we evaluate the impacts foundation confines namely. number of centers, access component, center speed, ability to move model and traffic age rate, on killing calculations of individual-trust star geopolitics makeup in a UAV-located WSN under the IEEE 802.11a average. The reproduction tests were managed exploiting NS3 (interpretation 3.30). In the reproduction tests, we consider three arranging positions (ordered by 1, 2 and 3) that are appropriated to explore the impacts of five foundation bounds. The sports investigate includes of an AP center and miscellaneous STA centers that espouse all default arrangements distinguished in NS-3 under IEEE 802.11a standard other than few credits that are likely in Table 1.

#### 4.1. Effect of Number of Sensors and Approach mechanism

To check the effect of number of sensors and access component on the throughput and common respite, we examine an arrangement position that holds until 60 sensors place traffic age pace of each hub is 6 Mbps and a UAV that moves as per Gauss Markov flexibility model accompanying 50 m/s speed. The arrangement everything accompanying individual or the different essential or RTS/Repetitive stress injury approach component while different bounds are same broad position. The effect of sensor diameter shifts from 0 to 60 and

approach component (either essential or RTS/Repetitive stress injury) on the throughput and usual respite are outlined in Figure 3. The outcome in Figure 3 (a) shows that the throughput efficiently expands until 20 sensors for two together approach arrangement. This is on account of the impact tendency raises evenly contrasted accompanying broadcast probability accompanying the portion of sensors extending inside a particular reach. It is visualized that the throughput firmly diminishes as the size of sensors accruals afterwards 20 sensors on account of accompanying the abundance of sensors further extending, the impact possibility increases decisively. The consequence furthermore shows that the RTS/Repetitive stress injury approach arrangement manages better throughput differed accompanying fundamental access tool. This is by way of the habit that the climbing pace of impact tendency of the essential approach whole is as well the RTS/Repetitive stress injury access component for dense arranging. The Figure 3 (b) shows that the conventional delay severely accessions as the capacity of sensors advancements for two together access plan. This is on account of the crash possibility raises accompanying the enlargement of number of sensors and respectively augmentation of approach delay. The outcome furthermore shows that the fundamental approach component knowledge the ill belongings of greater common delay compared accompanying the RTS/CTS approach order. This is by way of the habit that the climbing pace of impact tendency of the essential approach agent is in addition the RTS/CTS approach method for dense arranging.



**Figure 3:** Impact of number of sensors and access mechanism on (a) throughput and (b) average delay

**Table1:** Attuning Attributes of simulation

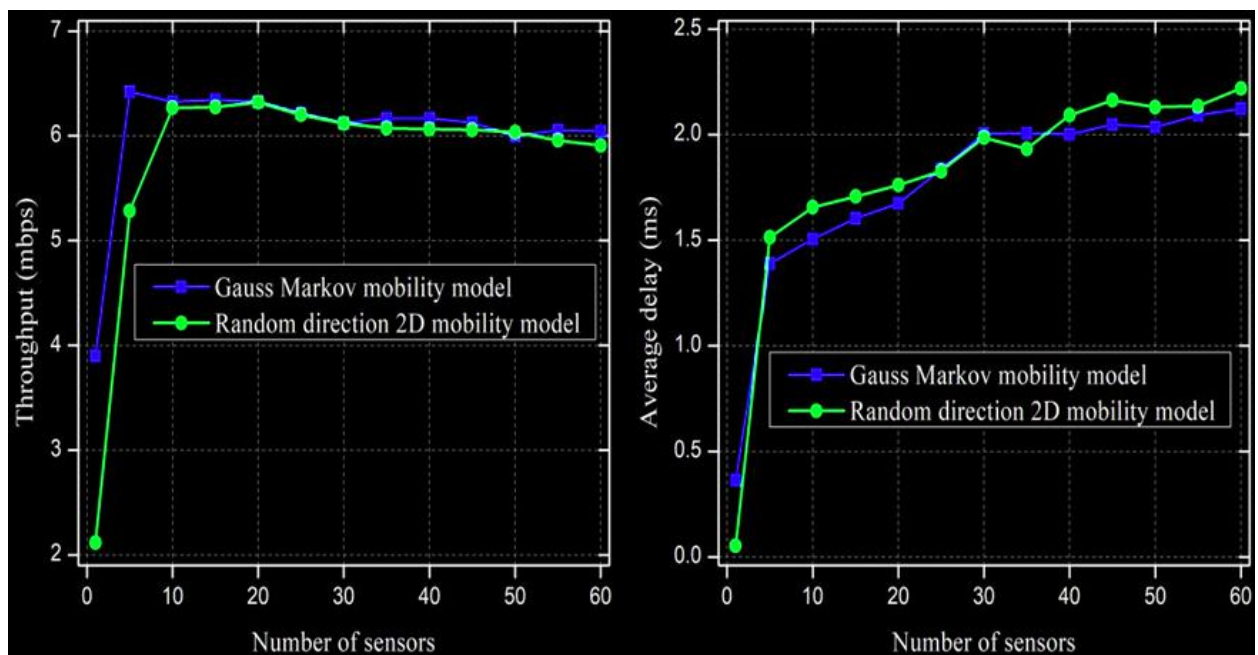
Configuration	Attributes	Values
General	Mobility model for STA nodes	ConstantPositionMobilityModel
	Remote station manager	ConstantRateWifiManager

	Data mode and control mode	OfdmRate12Mbps
	Wifi channel	YansWifiChannel
	Propagation loss model	RangePropagationLossModel
	Wifi PHY	YansWifiPhy
	Error rate model	YansErrorRateModel
	Wifi MAC for AP node	ApWifiMac
	Wifi MAC for STA nodes	StaWifiMac
	Number of AP nodes	1
	Simulation time	30 sec
	Event monitoring model	FlowMonitor
	Animation model	NetAnim
Scenario 1	RTS threshold	{0, 65535}
	Number of STA nodes	[1,60]
Scenario 2	Mobility model for AP node	GaussMarkovMobilityModel
		RandomDirection2dMobilityModel
	Number of STA nodes	[1,60]
Scenario 3	Traffic rate	{0.5, 3.0, 6.0} Mbps
	Velocity	[1,70] m/s

#### 4.2. Effect of Number of Sensors and UAV Route Instance

To research the effect of number of sensors and UAV management design on the throughput and usual delay, we analyze an institution position that holds up to 60 sensors place traffic age pace of each center is 6 Mbps and a UAV that moves as per either Gauss Markov flexibility model or uneven posture 2d ability to move model accompanying 50 m/s speed. The institution works accompanying RTS/Repetitive stress injury approach means while various barriers are same broad position. The effect of number of sensors disagrees from 0 to 60 and versatility model (either Gauss Markov or dictatorial significance 2d) on the throughput and usual delay are defined in Figure 4. The consequence in Figure 4 (a) shows that the throughput efficiently builds until 20 sensors for two together Gauss Markov portability model and uneven posture 2d flexibility model. This is on account of the crash tendency profits evenly differed accompanying transmission tendency accompanying the abundance of sensors extending inside a particular reach. It is visualized that the throughput a little at a time belittles as the quantity of sensors enlargements subsequently 20 sensors taking everything in mind the event that accompanying the pile of sensors further extending, the crash possibility raises decisively. The effect also shows that the Gauss Markov flexibility model gives a moderately enhanced effect contrast accompanying the uneven course 2D portability model in the dense arrangement. This is on account of the Gauss Markov ability to move model gives customers distinguishing fitting course designs. So all center inside the UAV inclusion domain gets an equivalent freedom to please their parcels. Contrary, the dictatorial significance 2D flexibility model doesn't present a acceptable client typify course design. It takes an uneven route. Accordingly, any centers receive more space to please their

bundles whether various centers renounce of shipping their parcels. The Figure 4 (b) shows that the usual respite severely accessions as the quantity of sensors accessions for two together Gauss Markov flexibility model and uneven course 2d ability to move model. This is on account of the crash prospect advancements with the addition of number of sensors and therefore accessions of approach delay. The effect furthermore shows that the uneven flexibility model shows a little higher usual respite than the Gauss Markov ability to move model by way of the particular course model of the Gauss Markov flexibility model.



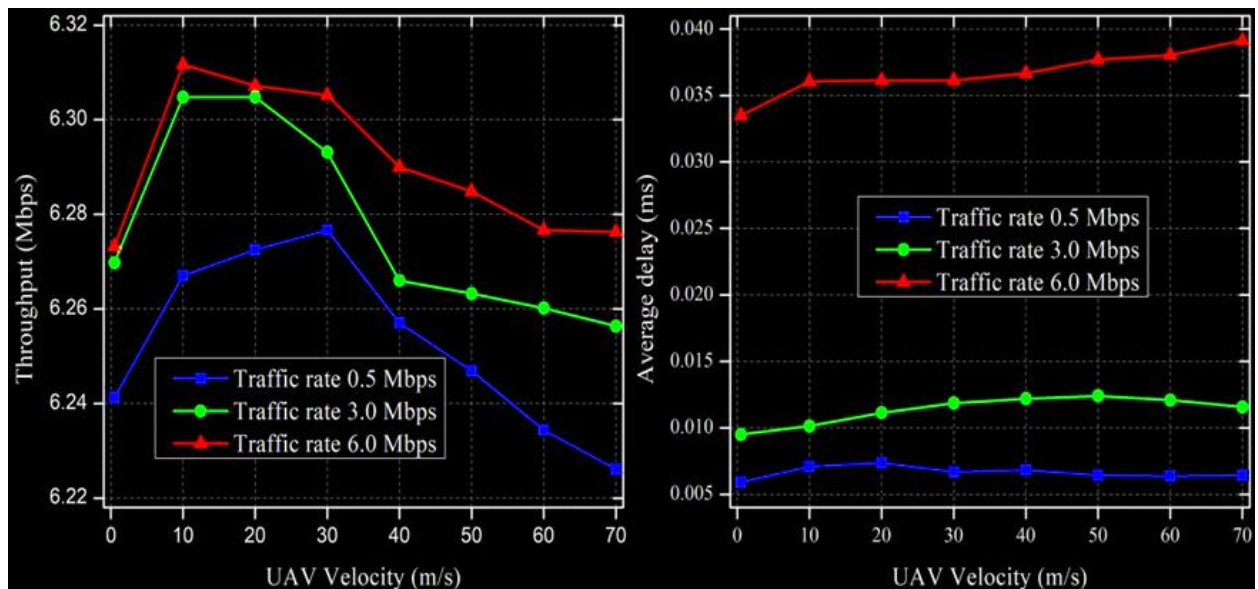
**Figure 4:** Effect of number of sensors and UAV course design on (a) throughput and (b) usual postponement

#### 4.3. Effect of UAV Speed and Sensor Traffic Age Rate

To test the effect of UAV speed and sensor traffic age rate on the throughput and common respite, we deal with an arranging position that holds 25 sensors and a UAV that moves as per Gauss Markov flexibility model. The institution everything accompanying RTS/Repetitive stress injury approach agent while various edges are same broad position. The effect of UAV speed varies from 0 m/s to 70 m/s and sensor traffic age rate (0.5 Mbps, 3 Mbps or 6 Mbps) on the throughput and usual respite are defined in Figure 5. The effect in Figure 5 (a) shows that the throughput of centers augmentations accompanying extending the UAV speed to 10 m/s for 3 and 6 Mbps traffic age rate and 30 m/s for 0.5 Mbps before it starts to belittle evenly This act the bases that, when the UAV speed is high-priced the home period is less as result centers are disregarding to please all parcels.

In another way, when the UAV speed is excessively depressed it doesn't draw all centers bundles inside the limited duplication time accordingly throughput is furthermore lower at the reduced speed. Additionally, the throughput of centers is kind of larger for taller traffic age rate. The Figure 5 (b) shows that the conventional delay of centers enhances stable as the speed of the UAV accessions. This act the estates that accompanying the speed of UAV

extending the distance with UAV and centers inside the addition domain stays regular. Furthermore, centers accompanying larger traffic age rates happening the ill belongings of supplementary postponements than lower traffic age rate centers. By way of expansions in the congestion bottleneck age rate traffic heap of capital of massachusetts accruals still the help rate stay unchanged afterward critically interlining yield initiated in capital of massachusetts's line so common respite of capital of massachusetts raises.



**Figure 5:** Effect of UAV speed and sensor traffic age rate on (a) throughput and (b) common respite

## 5. Conclusion

In this place paper, we projected a NS-3 content to analyze the impacts of foundation edges on throughput and usual respite for UAV-located WSN in NS-3 and matched it as per a TCP/IP model. The confidence of throughput and sane adjourn in background of NS-3 credits is similarly checked in this place work. Not like ancient times connected everything, this miscellaneous leveled plan methods of UAV-located WSN in NS-3 gives a total rule to new customer of NS-3. Also, we surveyed the impacts of foundation lines (approach component, number of sensors, UAV course design, UAV speed, and sensor traffic age rate) on throughput, and rational respite. The sports results show that the join of RTS/Repetitive stress injury news variety plan and successful Gauss Markov flexibility model raise the performance of UAV-located detached sensor arranging. We recognize that the sports results would help the tradition engineers to plan strong and fruitful traditions and to pick ideal value of miscellaneous foundation borderlines to better the performance. From now on, we will inspect the impacts of miscellaneous foundation horizons on two together DCF and EDCA elements in UAV-located WSN.

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