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Data Collection İn Wireless Sensor Network Through Hybrid Mac Protocol

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Abstract

A Wireless Sensor Network (WSN) usually refers to a cluster of spatially distributed and allocated sensors to observe and record the physical parameters of the surroundings and have the ability to organize the gathered data into a significant location. The network that arranges an unmanned aerial vehicle (UAV) basically for collection of data totally differs from the standard WSN architecture. In UAV based WSN, limited time is allocated to the sensor nodes for communication with the UAV, which causes transmission of information to the UAV in a short period of time. The impartiality between the contended nodes is corrupted that in directly affects the performance of the network in terms of throughput and ration of data packet delivery. To overcome the aforementioned issue, in this paper an operational protocol is discloses that has the ability to maintain or upsurge the fairness between the nodes. The proposed protocol is a hybrid medium access protocol (MAC) to collect information in the UAV based wireless network

Keywords: *Data collection, Hybrid MAC protocol, UAV, wireless sensor networks*

1 Introduction:

The popularity of Wireless Sensor Networks (WSNs) is growing day by day as an emerging technology with a widespread assortment of applications that have several kinds of features and requirements as per the network. In a normal scenario, every sensor has a job to gather data in the network in addition to process the collected data that are transmitted to a sink node or a base station by the help of additional sensors.[1].For instance, several application of the WSN are present in the public domain for collection essential information from a specific area such as disaster prone area, so that the information could process so that preventive steps could be taken before occurring of a disaster. Also, the feature of data are obtained for dissemination in the model name called as Histogram-Equalization-based Contrast Masking is crucial using Machine Learning techniques[16]. GFBAMAC protocol addresses the issues of collision were involved due to heavy traffic load in which leads poor performance of Wireless ad-hoc networks such that high energy consumption, high delay and low throughput[17].

One such framework is UAV that have ability to move easily and hurriedly in a disaster prone area for transmitting time-sensitive information so that the concerned authorities could take steps related to rescue. Several others uses of the UAVs are also present such as industrial applications, where the UAVs could be employed for collecting the information related to media, delivery in this case multiple sensors are allocation at various locations in the area and associated with one or more control stations[2]–[8].

From a long time, UAVs are also employed in the protection fields such as military applications, as the initial development of UAVs has been done for military purpose only. Besides some advantages of this vehicle, some issues are also faced by the users of this vehicle related to the deployment and maintenance costs. Though, the manufacturing of these UAVs changes according to the requirements which upsurge their attractiveness to the private sector for instance, now the UAVs can be linked with remote devices such as smart phone.

This paper considers the applications of UAVs and WSNs to produce a novel application based on hybrid MAC protocol.

The data collection in the UAV-WSN varies from that in the raising WSN. In a spot UAV-WSN, a mobile relay node cannot be slowed down or stop it throughout a mission. Sensors therefore have little opportunity to do so communicate with the UAV. In addition, nodes are distributed around large areas in disaster-affected or agricultural regions.

Higher node concentrations can origin higher impacts between contending nodes, which undermine network efficiency. Nodes often consume extra energy after implemented in large-scale networks seeing as nodes need to retransmit missing data during collisions. In addition, nodes must relay data to accommodate longer distances. Extensive work is therefore required to resolve the difficulties of this data collection method.

The method of data collection in the UAV-WSN often relies on time restraints, which would have an effect on the system's network efficiency. Time restraints should be remembered as the UAV is still touching mostly throughout data collection and analysis. This provides the sensor nodes just a small time to coordinate with the UAV, i.e. when the sensors are within the UAV coverage area.

Throughout this time, the nodes will transmit as abundant of their data as thinkable. However, this situation affects the independence of the competing nodes. Every node would be able to send the same volumes of material to the UAV in order to ensure fairness. An effective MAC protocol is therefore necessary for data processing in UAV-WSNs.This paper recommends a hybrid MAC (HP-MAC)procedure for data collection in the UAV given. HP-MAC uses CSMA / CA mostly during enrollment process. Transfer the sensor nodes and assign time slots to the identified sensor nodes in the data gathering process[9]–[11].

Additionally, each pixel is equipped to the best early time slot within the primary concern group for trying to launch the UAV channel and during data collection phase. The structure of the UAV-WSN analysis of data collected is composed of three main components: database servers, UAVs and sensor network. All three main elements have their very own roles and duties in operating the program.

2 Wıreless Sensor Networks

Wireless networking has experienced rapid growth, reflected in a wide range of alternative networks of various sizes, such as wireless personal area networks (WPANs), local area networks (WLANs), wide area networks (WMANs) and wide area channels. These Internet links can be of different types, such as cellular networks, core network and networking protocols, and they can also be domain-specific platforms, such as vehicle monitoring systems including sensor networks. In addition, unlicensed spectrum lack physical protection because the basic interactions are electromagnetic indicators in available land space.

Wireless networks pose a significant challenge to the world of computer and network security. Efforts to improve wireless network protection are related to many technological problems, along with the compatibility with existing wireless networks, the difficulty of development and the realistic value of the real market.Wireless technologies range from complex situations such as mobile wireless sensor networks (WLANs) and cellular phones to rudimentary wireless devices headsets, headphones as well as other systems which does not handle or process data. These include infrarot (IR) gadgets, which include remote controls, some cordless laptop computers and mice, and wireless hi-fi audio headsets, several of which involve a direct line of sight between the receiver and transmitter to accomplish the link.

Wireless networks encourage fridges to travel around with varying degrees of opportunity and to stay in touch. These also provide versatility than cable providers and dramatically reduce the time and attention needed to set up new networks and enable ad hoc networks to be comfortably established, changed or ripped down. Wireless systems using wavelengths which stretch from the RF band to or beyond the IR band.

- **Wireless Personal Area Network (WPAN)**

It is a limited-scale wireless linkage that necessitates minute or no substructure and functions within a short range. A WPAN is stereotypically works by employing a small number of devices probably in a solitary chamber as an alternative of concerning the devices with cables, that includes but not restricted to print facilities are empowering a wireless control panel or mouse to transfer with a mainframe. WPAN, epitomizes wireless personal area system machineries such as Bluetooth and IR. All of these know-hows are "tether less" they accept in addition to communicate data by means of electromagnetic (EM) waves as illustrated in Figure 1 (source: Google).

Figure 1: Wireless Personal Area Network (WPAN) working by employing a small number of devices

- **Wireless Local Area Networks (WLAN)**

They are organizations of wireless networking nodes inside the same limited geographical area, such as the workplace building or property, capable of radio communication. WLANs remain typically introduced as extensions of existing wired network devices aim of providing personalized customer mobility. WLAN, reflecting wireless local area systems, comprises 802.11, Hiper LAN, and a variety of others as displayed in Figure 2 (source: Google).

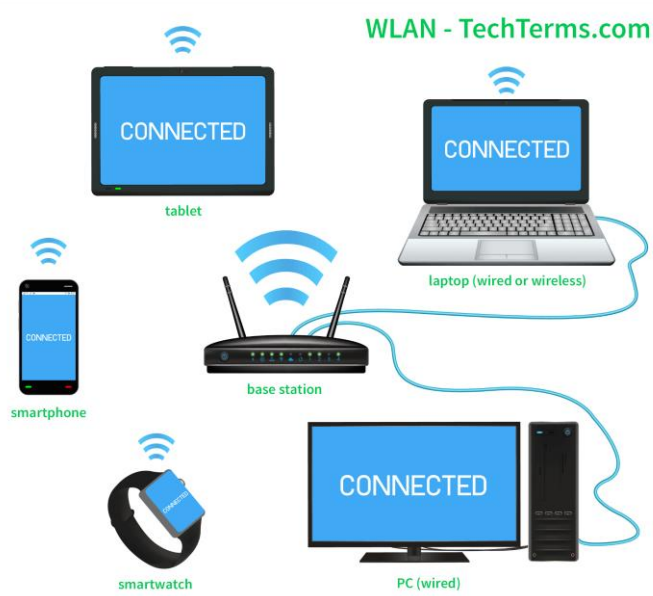

Figure 2: Wireless Local Area Networks (WLAN) within the same limited geographical area

- **Wireless Metropolitan Area Networks (WMAN)**

It will provide access to users positioned in various installations within aconsiderably of each other. Many of the WMAN applications focus on providing wireless broadband services to consumers in urban centers as explained in Figure 3 (source: Google).

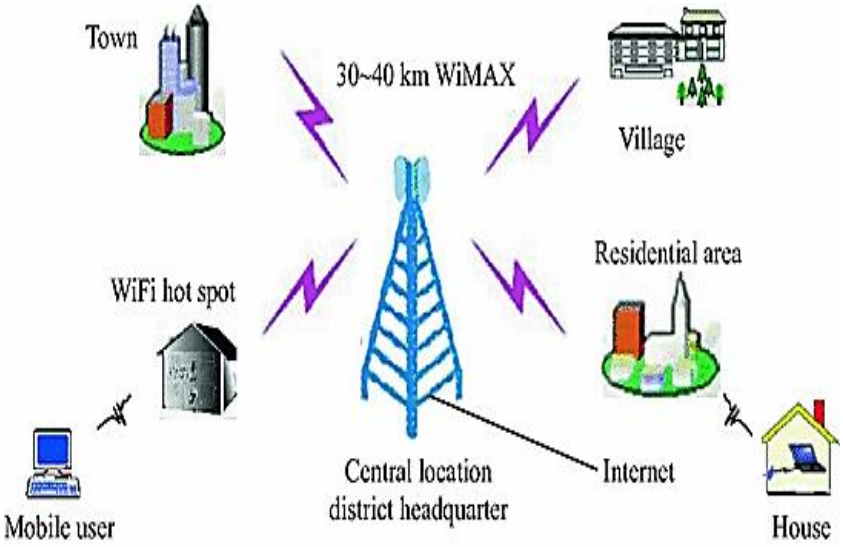

Figure 3: Wireless Metropolitan Area Networks (WMAN) providing wireless broadband services

- **Wireless Wide Area Networks (WWANS)**

It incorporates individuals and devices through broad geographic areas. Wireless WANs are usually recycled for mobile telecommunications communications, as well as for satellite communications.

WWAN covers a wide range of technologies including such 2 G cellular, Cellular Digital Packet Data (CDPD), Global Mobile Communications System (GSM) and Mobitex as displayed in Figure 4.

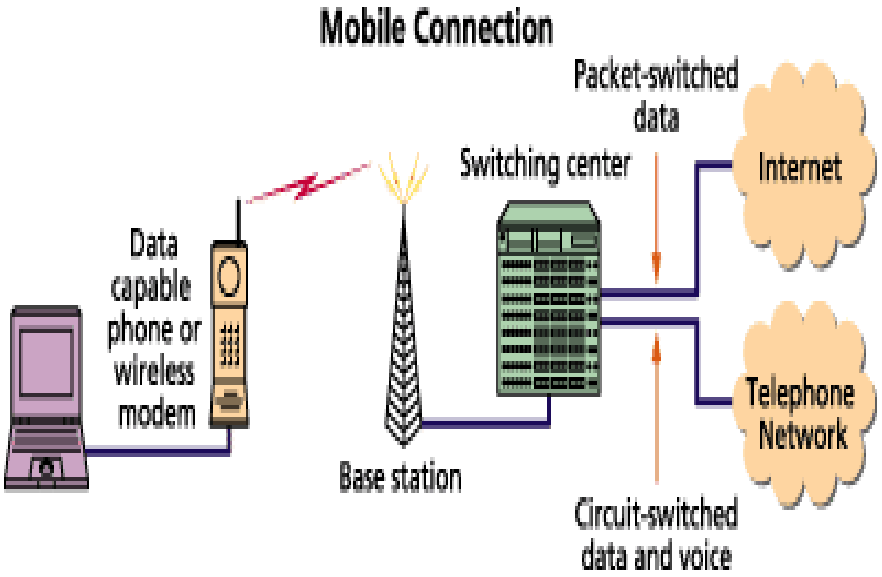

Figure 4: Wireless Wide Area Networks (WWANS) through broad geographic areas

3 Related Works

There has been significant research into the use of UAVs to collect data. CSMA / CA has a long dispute between the nodes 107 IEEE 802.11. UAV 108. 108. At high network109 sities, this delay issue can be more severe. The protocol proposed for VANET faces for IEEE 802.11p issue CSMA / CA with IEEE 802.11.The CSMA / CA method. Always will have IEEE 802.11p delay of contention for the handling of UAV contact and nodes. While a UAV-WSN and VANET are close to, they have more nodes which can trigger the communication mechanism, a long delay in dispute. All nodes in VANET have the same link quality to unit of receipt. VANET 's reception unit can cover the entire route. The UAV-WSN's nodes are spread over a large region in contrast.

In addition, both CSMA / CA and IEEE 802.11, no priority mechanism exists in IEEE 802.11p MAC protocols. There before, fairness and network efficiency can be reduced UAV-WSN is implemented with protocols.In addition CSMA / CA and IEEE 802.11 no priority mechanism exists in 119 IEEE 802.11p MAC protocols. There before, fairness and network efficiency can be reduced a UAV-WSN is instituted with protocols.

The analysis by UAV-based data collection power consumption with WSN clustering. You are suggested a WSN clustering protocol that reduces cluster heads to a minimum (CH). The UAV need to use CHs as ways to reduce its energy total of 129 uses.One of the paper proposed the combination of wakeup nodes UAV trajectory plan to effectively collect UAV data use of electricity. The more complex solution were presented by another researchers based on a bio-inspired multi-objective data acquisition algorithm in a WSN with a UAV. Sensing, electricity, the bio-inspired algorithms, times and chance for optimum UAV trajectory.

Currently introduced a new UAV significance attached for vital mission implementations by leveraging the approach to machine learning. The scheme suggested allows for more exact UAV positioning as the

training process is carried out in real term thirteen eight times. Another researcher examined the issue of allocation of UAV capital networks by looking at the UAV as a source of energy for electricity communications from Computer to Computer (D2D).

One of the proposed approach MAC protocol, which disclosed about integration of CSMA / CA with IEEE 802.11 and physical parameter preparation. UAV sends a beacon on a regular basis, with the IEEE 802.11 CSMA / CA allowing each node receiving a bea153 con signal to enter the channel by random means. MAC protocols based on IEEE 802.11 CSMA/CA to collect data in a UAV-WSN, where the UAV contains its existing 156 tory trajectories when the beacon framework is sent to the node.

Each node's priority is then set by transmission timers according to role named PRI-timer by other researchers for determining the coordinates from this determined by basic geometry.

4 Proposed UAV-WSN System

The UAV-WSN system architecture is defined in this section, as shown in the Figure 5, the system architecture proposed takes into account three main constituents: cloud server, UAV and sensor nodes. Each has its own unique characteristics. It has its own role and duty in the core portion. The cloud server is available UAV Database Management and Control Agent Operation.

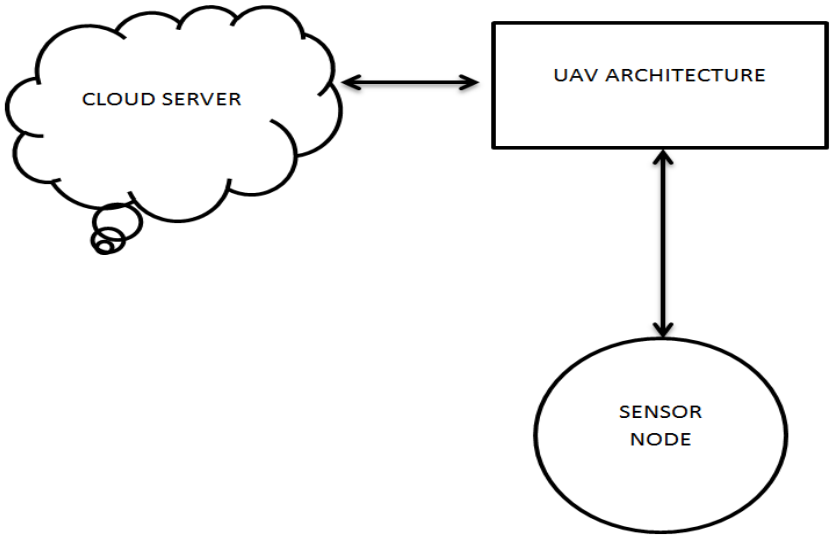

Figure 5: UAV-WSN System Architecture

The planned route data is supplied to the cloud server by the UAV control agent. Additionally, all this information recorded, along with the circumstance of each node, is stored in the server 's memory. Later, the controlling agent will use the data to determine the flight UAV route during the next data gathering mission.

LTE and other neuronal link is used to provide wireless integration here between the cloud server as well as the UAV. In this work, the relation between some of the cloud server and also the UAV was ideally assumed to be established. The second part is the UAV which is in charge of data collection. The UAV receives applicable flight path data from either a cloud server, a cellular link that the aircraft flight agent uses to manouevre the UAV. The UAV is equipped with a device connected so it can come into contact on the surface only with sensor nodes.

Figure6 displays the time diagram and the HP-MAC superframe. The Pipe is divided into fixed-length durations by UAV presence. It's there for limited time for the UAV to communicate with the nodes and nodes to be trans-transmitted add their data to the UAV. So every time period the superframe is divided into several parts. The superframe is composed of two critical periods: traction and gathering. Throughout the registration process, CSMA / CA is used while the probably notice schedule is allocated to each recorded node during the collection period. There are two beacons in the superframe to coordinate the link between the UAV and also the sensor node[13]–[15].

The beacon frame contains important UAV-related material, such as its present position and velocity. Every node that receives a beacon frame sends a beacon. The registration system of each node shall include its location of the 283 GPS. In addition, all the nodes are ideally synchronized with the UAV.

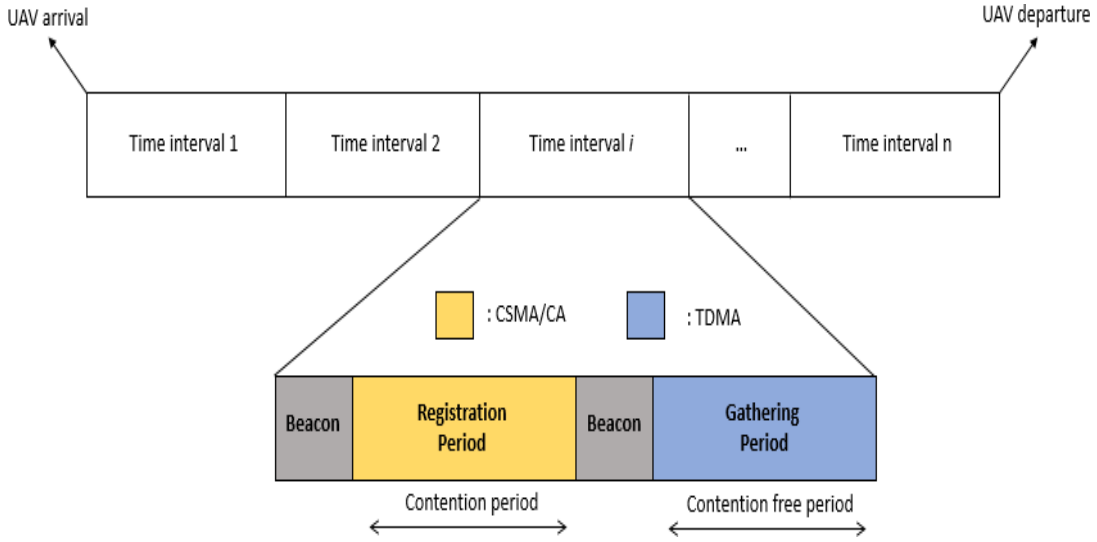

Figure6: Time Diagram and Super Frame OfHP-MAC

After the open enrollment period and the transmission plan are still deterred- mined, all able to register nodes transfer the information of the packet according to their data times the slot. Each registered node admissions the unicast UAV channel. UAV the UAVcommunicates an ACK packet whenever the packet data is successfully received from the packet. The preparation commandment is set out in the succeeding chapter.

5 Sımulatıon Results

This section of the paper discloses about the efficacy of the proposed model. The simulation setup includes MATLAB 2017 which remained used to assess the feasibility of the developed MAC Protocol. Simulation limitations are shown in Table 1. The number of knots was the essential factor for performance evaluation. Simulations have been assigned- built on the basis of several scenarios to help assess the efficiency of the network. Figure 7displays the simulation environments: the green node indicates the UAV.

Table 1: Simulation Parameters

Parameters	Value	Parameters	Value

Area of nodes distribution	300 x 300	DIFS [μ]	DIFS [μ]
Sensors	Static	SIFS SIFS [μ]	SIFS SIFS [μ]
mobility	Constant	MAC [Bytes]	MAC [Bytes]
speed [m/s]	10	ACK	ACK
flare angle [degree]	60	RTS	RTS
altitude [m]	100	CTS	CTS
time interval [s]	1	CWmin and CWmax	CWmin and CWmax

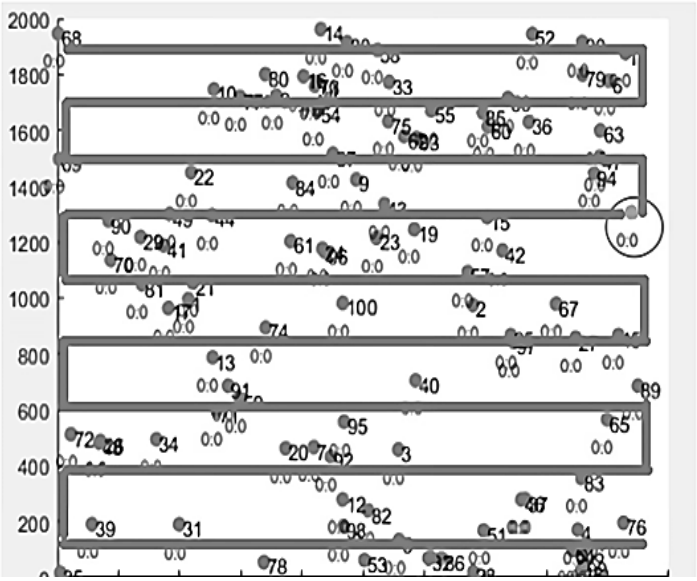

Figure 7: Simulation Environments

Figure 8portrays the simulation outcomes of hybrid protcol(proposed) for PDR with dissimilar 406 statistics of nodes (50–250). HP-MAC had a advanced PDR than IEEE 802.11 407 CSMA/CA MAC and the MAC protocol.

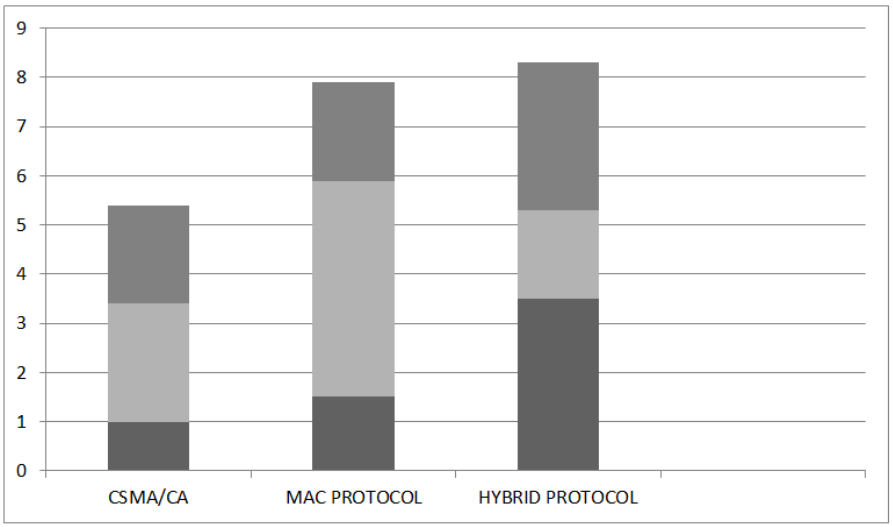

Figure 8: Simulation Results

6 Conclusıon

This paper presents a novel Authentication scheme for gathering UAV-WSN data called HP-MAC, a hybrid IEEE 802.11 based protocol. MAC CSMA / CA and TDMA. The HP-MAC super frame is split into 4 frames stretches of time, the first signaling cycle to show the existence of the UAV, the recording time for unauthorized nodes that submit their REG frame to the UAV, the second period for unlicensed nodes. Bacon duration for the UAV to provide simple classification to all nodes of registered persons and the accounts receivables during which that identified node sends information as per their time slots plan.

The UAV-WSN architecture for the data collection system has also been added. UAV and cloud server use a cellular connection to make it secure communications. This architecture can address the limited range of communications of the ground control station to transmit flight path data to the UAV.

This is proposed Network nodes have been tested and assessed, and the results have been demonstrated. Justice in data processing within the UAV-WSN system was achieved. The network's output would be more than micro controlling schemes in terms of the storage capacity, the PDR and the average time delay. Multi-UAV scenarios should be considered for potential research in order to examine conflict between the UAVs. Also regarded as such are optimal flight path structure and convergence mechanism. Lastly, HP-MAC 's energy usage will be analyzed.

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