Swarm UAVs Task and Resource Dynamic Assignment Algorithm Based on Task Sequence Mechanism

ABSTRACT

A UAV task gathering and a powerful asset distribution calculation dependent on the assignment arrangement instrument are proposed. By setting up a progression of missions, each automaton Separate the necessary errand time and synchronization holding up time. For new targets found, each UAV will rapidly decide its accessible timespan. As per the accessible time and undertaking assets, the offering calculation and agreement calculation are utilized to deteriorate the errand allotment into the underlying dispersed distribution stage and the gathering agreement stage to create task arrangements. Continuous clash free automaton swarms. Reenactment tests demonstrate that the calculation can allot various assignments to UAVs continuously with restricted assets.

I. INTRODUCTION

A calculation for dynamic assignment designation and UAV swarm asset portion dependent on task arrangement component is proposed. Each UAV can rapidly ascertain its accessible assignment timespan in a disseminated constant way dependent on the errand grouping component. On the off chance that the automaton has time and assets accessible for task designation, it will offer for new targets dependent on accessible errand cutoff times, task rewards and accessible assets. All automatons accessible for the new objective will arrange a contention free undertaking task arrangement.

II. COOPERATIVE TASK ASSIGNMENT IN DYNAMIC ENVIRONMENT

A. TASK RESOURCE MODEL

Given N heterogeneous UAV gatherings, U = {U1, U2,. . . , UN} and a lot of M targets T = {T1, T2,. The UTM armada performs two sorts of undertakings for each target, and the assignment set is S = {I, A}. I speaks to the electronic sticking errand, and A speaks to the assault task. The motivation behind the under taking task calculation is to discover a match between the errand and the automaton to amplify the general prize.

These automatons are heterogeneous, and each automaton conveys various sorts and measures of assets. As indicated by the mission type, the

UAV gathering can be isolated into two subsets U = {UI,UA}, UI is the assortment of electronic sticking UAVs, and UA is the assortment of assault UAVs. Each automaton has a place with just one in the assortment. Simultaneously, each automaton conveys n sorts of mission assets. The assault drone conveys weapon assets, and the mission asset vector is controlled by resSuA I, I = 1,. No; the sticking electronic UAV conveys the sticking payload, and the mission asset vector is spoken to by resSui I, I = 1., No. Assault and electronic sticking missions have relating mission asset prerequisites. resReA j, j = 1,. . . , M speaks to the sort and amount of weapons needed to play out an assault task on the objective; resRej,j = 1,. . . , M speaks to the sort and amount of sticking payload needed to perform electronic sticking undertakings on the objective [20].

Notwithstanding known focuses, there are obscure focuses in the mission region. During the execution of the arranged automaton swarm mission, a few automatons may find new targets and afterward broadcast the status data of the new focuses to the whole multitude. All accessible automatons will consequently offer for new targets and structure task bunches for new focuses through tasks and circulated assets and an enormous number of agreement measures.

Because of the restricted mission assets of each UAV, it may not be sufficient to finish the missions of all Tx targets alone. Accordingly, it is important to welcome different automatons to frame a man-made intelligence team. Eventually, the aggregate sum of undertaking assets conveyed by the assignment group must meet the errand necessities.

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$$\sum_{U_i \in I_A} x_{i,k}^{A} \cdot resSu_{i,k}^{A} \geq resRe_{x,k}^{A}, \forall k \in \{1, 2, \ldots, n\}$$

(1)

$$\sum_{U_i \in I_A} x_{i,k}^{I} \cdot resSu_{i,k}^{I} \geq resRe_{ix,k}^{I}, \forall k \in \{1, 2, \ldots, n\}$$

Among them, x An i,k and x I i,k individually show whether to utilize the k-th weapon asset or the sticking payload of Ui to play out the objective assignment; resSuA i,k and resSuI i,k separately demonstrate the k-th weapon asset or Ui's The quantity of sticking payloads.

B. TASK REWARD MODEL

Definition 1 (the underlying prize of the assault task): Assuming that the likelihood of Ui's harm to the objective is pi, a, the underlying compensation of the assault task is characterized as

$$G_{i,j}^{A} = V_j p_{i,a} - D_j \quad (2)$$

where Vj and Dj are the worth and danger of target Tj . The assignment of assault diminishes the danger level of the objective, thusly the danger of target Tj that has been assaulted is

$$D_j^{*} = \left(1 - p_{i,a}\right) D_j \quad (3)$$

Definition 2 (Initial compensation for electronic sticking assignments): As appeared in Figure 1, the electronic sticking reactor

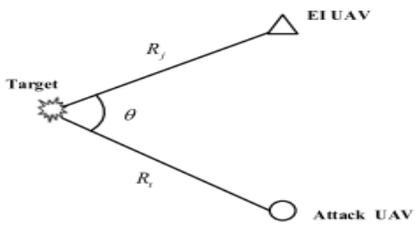

FIGURE 1. Schematic diagram of electronic interference process.

Connected to the assault task, and should be executed a specific time before the assault task. The UAV swarm initially appoints the assault errand to the objective, and afterward gauges the beginning season of the electronic sticking undertaking as per the hour of the assault task [21].

Radar impedance condition

$$\frac{P_j G_j}{P_t G_t} \cdot \frac{4\pi\gamma_j}{\sigma} \cdot \frac{R_t^4}{R_j^2} \cdot \frac{G_t'}{G_t} \geq K_j \quad (4)$$

Among them, Pj, Gj and γj separately speak to the transmission force, addition and misfortune coefficient of the fundamental projection of the electronic sticking UAV; Rj speaks to the separation between the electronic sticking UAV and the objective; G 0 t speaks to the radar recieving wire to the UAV The increase of; Pt and individually speak to the send influence and primary flap addition of the objective radar. Kj speaks to the pressure factor of the radar; σ speaks to the reflection zone of the assault UAV. Subsequently

$$R_t \geq \sqrt[4]{\frac{P_t G_t \sigma R_j^2 G_t}{P_j G_j 4\gamma\gamma_j G_t}} K_j \quad (5)$$

where

$$G_t^{'}(\theta) = \begin{cases} G_t & 0 \leq \theta \leq \dfrac{\theta_{05}}{2} \\ K\left(-\right)^2 G_t K\left(\dfrac{\theta_{05}}{\theta_{0590}^{\theta}}\right)^2 G_t & \dfrac{\theta_{05}}{\theta^2} \geq < \theta < 9090 \end{cases}$$

(6)

Among them, θ0.5 speaks to the width of the objective radar reception apparatus projection; θ speaks to the point between the view of the electronic sticking UAV and the view of the assaulting UAV. The greatest obstruction separation Rt is a component of Rj and edge θ,

$$R_t = f\left(R_j, 0\right) \quad (7)$$

The prize of the electronic obstruction task is characterized as [22]

$$G_{ij}^{I} = \begin{cases} 0 & R^a < R_t \\ \delta G_{i,j}^{I} & R^a \geq R_t \end{cases} \quad (8)$$

where, Rt demonstrates the greatest impedance separation of UAV Ui , R a speaks to the separation between the UAV Ui and the objective Tj

C. TASK ASSIGNMENT MODEL

The task and resource assignment model of the UAV swarm is described as:

$$\max\left\{J = \sum_{i=1}^{N}\sum_{j=1}^{M} X_{ij} \cdot C_{i,j}(p_i) / \sum_{i=1}^{N} X_i \,,\ {}_jLen_i(p_i)\right\} \quad (9)$$

$$\text{s.t.} \sum_{j=1}^{M} X_{i,j} \leq L, \forall U_i \in U$$

$$X_{i,j}^{k} \cdot resSu_{ij}^{k} \leq resSu_i^k$$

$$\sum_{i=1}^{N} X_{i_d}^{k} \cdot resSu_{ij}^{k} \geq resRe_j^k$$

$$X_{ij} \in \{0,1\}, \forall (i,j) \in U \times T \quad (10)$$

Among them, Xi,j show whether to dispense UAV Ui to target j. L speaks to the greatest number of errands for each UAV. The vector pi∈(TU{Ø})L speaks to the arranged succession of Ui's undertaking way. Leni (pi) speaks to the way length of the UAV to execute the current mission succession. The score work Ci,j(pi) speaks to the all out remuneration of the errand, and the figuring technique for the all out remuneration is as portrayed in recipes (2) and (8). X k i,j shows whether to apportion UAV Ui with the kth asset to target j. resSuk I, j speaks to the quantity of Ui assets assigned to target j, and resSuk I speaks to the quantity of Ui assets. resRek j speaks to the quantity of the k-th asset following up on track j.

III. TASK AND RESOURCE DYNAMIC ASSIGNMENT ALGORITHM BASED ON TASK SEQUENCE MECHANISM

A. TASK SEQUENCE MECHANISM

Because of the restricted errand assets of each UAV, the UAV swarm must make task crews for each target. Each UAV must show up at the assignment objective at the predefined time. Since the position status and flight way of each UAV are extraordinary, the separations to the assignment objective are unique and the occasions to arrive at the objective are conflicting. For this situation, the assignment start season of every crew is controlled by the automaton that shows up at the most recent.

The coordinated time for each UAV to hang tight for different individuals from the assignment group is known as the errand inactive period. Along these lines, the flight season of each UAV can be separated into required undertaking time and synchronization hold up time. Figure 2 shows the errand arrangement of a UAV, where (t 1 d-1, t 0 j) is the flight time required for the UAV to fly from target Tj-1 to target Tj; (t 1 j, t 2 j) is the assignment time required for the UAV to play out an undertaking on the objective Tj. (t 0 j, t 1 j) is the synchronization holding up time between the main second when the automaton hypothetically arrives at the objective and the beginning season of the errand, for example the time of latency of the undertaking.

At the point when another objective is discovered, the automaton multitude can utilize the undertaking

grouping to relegate the errand of the new objective progressively, embed the new undertaking into the extra season of the proper assignment, and afterward rapidly allot the errand. New errands without influencing built up undertakings. Conveyance plan.

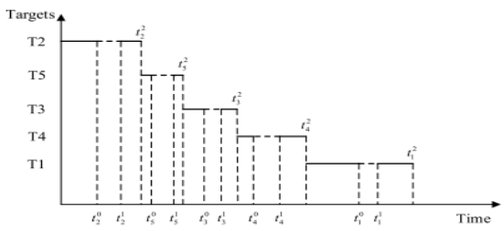

FIGURE 2. The task sequence of a UAV.

So as to utilize the inert time of the assignment as a feature of the errand grouping component, it is important to explain the beginning time and end season of the idle time of the undertaking. For the new objective Tj, the beginning season of the latent timespan of the undertaking alludes to the first run through t ai,j at which the UAV Ui can arrive at the situation of the new objective Tj without influencing the allocated task.

For various circumstances, the beginning time t an i,j of the assignment dormancy period is talked about in three circumstances.

1, The automaton is searching for another objective, and there are no errands in the built up task designation plan. For this situation, the automaton can fly straightforwardly to the objective, and the beginning season of the mission's latent period is

$$t_{i_d}^a = t_{c,j}^a + t^c \quad (11)$$

where, t c speaks to the current time, t a c,j speaks to the flight season of the UAV Ui from the ebb and flow position to the situation of new objective Tj .

2. In the built up task designation plan, the automaton possesses a more extended synchronization sitting tight energy for the objective To, and the assignment of the new objective Tj can be executed by the automaton first. For this situation, the strategy for computing t an i,j is equivalent to the above technique, and the ideal opportunity for the automaton to play out the errand for the objective To is:

$$t_{i,0}^a = t_{i_d}^w + t_{j,0}^a + t_{i_d}^a \quad (12)$$

3, In the set up task dispersion plan, the UAV possesses a shorter synchronization hanging tight energy for the objective To, and simply after the assignment is executed on the objective To, can the undertaking be executed on the new objective Tj. Situating, for this situation, the beginning season of the inert time of the assignment is

$$t_{i,j}^a = t_{i,0}^l + t_{o,j}^a \quad (13)$$

For the new objective Tj, the end season of the idle time of errand t l i,j Alludes to the last second when the automaton Ui leaves the new objective and flies to the following objective without influencing the set up work appropriation plan. The automaton must finish the undertaking of target Tj before that. The end season of the errand idleness period is:

$$t_{i,j}^l = t_{i,0}^a - t_{j,0}^a \quad (14)$$

The errand arrangement component decides if the objective Tj can be embedded into the UAV task grouping varying dependent on the beginning time and end season of the mission latency period. The guidelines communicated by conditions. Accepting that the objective Tj is embedded into the k-th position of the errand grouping, the appearance season of the past assignment and the following undertaking in the built up task designation plan must be watched:

$$t_{i,k-1}^a + t_{i,k-1}^p + t_{k-1_j}^a \le t_{ij}^a \le t_{i,j}^l + t_{ij}^p \quad (15)$$

$$t_{i_d}^a + t_{ij}^p \le t_{ij}^l \le t_{i,k+1}^a - t_{j,k+1}^a \quad (16)$$

Among them, these conditions separately guarantee that the beginning and end seasons of the new errand meet the time connection between the past undertaking and the resulting task in the set up plan. As indicated by the errand arrangement system, after each automaton gets the inert time of the assignment comparative with the new objective, just automatons with covering latent periods can propose new undertakings to be prepared. Undertaking group for new objectives. Expecting wi is the idle timespan of the UAV task, the idle timeframe of the undertaking group is:

$$wA = \bigcap_{i=1}^{n} w_i \neq \emptyset, \forall U_i \in I_A \quad (17)$$

B. TASK AND RESOURCE ASSIGNMENT

We stretch out the CBBA calculation to UAV swarm assignments and dynamic asset allotment issues. In the bundle creation phase of the CBBA calculation, each UAV autonomously computes the award for each errand and consistently refreshes its assignment bundle. There are two kinds of undertaking successions: bi is an assignment bunch dependent on the request for adding each errand to the dissemination plan, and pi is a way group dependent on the way arrangement of undertaking execution.

Furthermore, the scaling calculation should likewise decide the measure of assignment assets dispensed to the objective. In this way, when the automaton offers on the objective, it should likewise offer on the undertaking assets associated with the objective. The automaton figures the prize for the assignment, yet in addition ascertains the measure of undertaking assets that can be contributed.

So as to show the allotment status of the errand assets of the UAV Ui to the objective Tj, notwithstanding the undertaking group bi and the way pack pi, the asset group ri is added to the calculation. r q, j I speaks to the amount of the qth task asset gave by Ui to Tj.

The CBBA calculation must react to the negligible decay of errand compensations during the group development stage. As such, as the length of the assignment bunch expands, the determined undertaking reward should progressively diminish. Accordingly, the principal task added to the undertaking set has the biggest assignment reward, and each errand has the current greatest prize when it is added to the undertaking set. This is in accordance with the standard of boosting the utilization of assets that is, appointing the best assets to the assignments that get the best return.

$$r_i^{qj} = \min\left\{resSu_{i,q}, resRe_{j,q}\right\} \quad (18)$$

where, $resSu_{i,q}$ indicates the number of q - th resources of U_i, and $resRe_{j,q}$ indicates the number of q - th resources required by the target T_j.

After completing the resource assignment, UAV U_i updates its own resource supply vector:

$$resSu_{i,q} = resSu_{i,q} - r_i^{q\sqrt{\ }} \quad (19)$$

C. TASK AND RESOURCE CONSENSUS

After each UAV develops a neighborhood task bundle bi, a way bundle pi, and an asset bundle ri, they speak with one another to determine strife tasks between each undertaking gathering.

Each automaton will get a proposal for each undertaking from neighboring automatons through correspondence and contrast it and the assignment reward offer of the nearby errand gathering. On the off chance that another automaton has a higher award for an errand, the undertaking ought to be promptly eliminated from the nearby assignment gathering.

The compensation of the errand is identified with all undertakings recently added to the assignment set. In the wake of erasing an undertaking from the assignment gathering, all resulting errands after the undertaking ought to likewise be erased from the errand gathering.

Each automaton analyzes the nearby and other automatons' errand assignment and asset designation, and settles on distribution choices dependent on specific guidelines. This is the agreement cycle. The agreement cycle requires data transmission between drones, principally using three data vectors, which are the comparing rundown of the triumphant offer rundown yi and the triumphant assignment asset zi, and the correspondence time list ti.

The triumphant offer rundown and the correspondence time list are two-dimensional vectors, and the asset rundown of the triumphant undertaking is a three-dimensional vector. y l, j I speak to the privately distributed winning award for the objective Tj in Ui, and zl, j, mi speak to the quantity of m-th task assets that Ul can give to the objective Tj. t I, l I speak to the hour of the last correspondence among Ui and Ul. Correspondingly, y l, j k, z l, j, m k and t l, j k speak to a similar data in the nearby distribution consequence of Uk.

A gathering of automatons playing out a similar assignment on the objective Tj is called Ij, where Ij⊆U. In the agreement stage, all up-and-comer drones that perform undertakings for the objective Tj will be chosen lastly framed into an errand gathering. Choice rules include:

1) Play out the assignment in the briefest time. This standard is set to wipe out objective dangers at the earliest opportunity and to guarantee the endurance and wellbeing of the automaton gathering.

2) The mission scale is the littlest and the UAV assets are the least involved. This standard is set to improve the asset utilization of the undertaking and to guarantee the compelling execution of the errand.

3) Each colleague arrives at the objective situation simultaneously. This standard is set to permit every part to perform undertakings on the objective simultaneously and to guarantee successful execution of assignments.

4) The whole of assets of each colleague meets the mission necessities. This standard is set to guarantee the achievement pace of the assignment.

In the agreement stage, each UAV gets data from neighboring UAVs and looks at them. When Ui gets message from the Uk , it analyzes yi and yk , zi and zk , ti and tk , to decide the last errand task answer for each target. For the errand task of target Tj , the cycle of agreement choice is as per the following:

5) The Determination Cycle: Looking at yi and yk , and choosing the offering reward Bidj of each UAV to target Tj and the relating asset task result Resj as indicated by the choice standard of Table 1. Bidj(x) and Resj(x) speak to the outbid prize and asset task consequence of UAV Ux to target Tj separately.

TABLE 1. Rules for UAVs to Decide the Bidding Reward.

UAV	Results of Bidding Reward	Results of Resource Assignment
U_i	$Bid_j = y_i^{i,j}$	$\mathrm{Res}_j = z_i^{i,j}$
U_k	$Bid_j = y_k^{k,j}$	$\mathrm{Res}_j = z_k^{k,j}$
$U_m m \neq i,k$	If $t_i^{i,m} \geq t_i^{k,m}$,Then $Bid_j = y_i^{m,j}$	If $t_i^{i,m} \geq t_k^{k,m}$,,Then $\mathrm{Res}_j = z_i^{m,j}$
	If $t_i^{i,m} < t_i^{k,m}$,Then $Bid_j = y_k^{m,j}$	If $t_i^{i,m} < t_k^{k,m}$,,Then $\mathrm{Res}_j = z_k^{m,j}$

where, w j shows the heaviness of the j-th task asset; R j A demonstrates the amount of j-th assets that the assignment crew actually requires; D j x = min{R j x , R j A } shows the commitment of existing j-th asset of Ui to the errand crew; R j x shows the amount of j-th task assets of Ui . As indicated by resCox , the UAV with the littlest asset commitment is killed thusly, and the absolute assets of the errand crew are diminished likewise:

$$\mathrm{Res}\left(I_j\right) = \sum \ \mathrm{Res}_j\left(\arg\max Bid_j(x)\right) \quad (20)$$

UX can be effectively taken out from the undertaking group, in this manner further lessening the group size. On the off chance that the absolute errand assets of the assignment group don't meet the asset necessities in the wake of erasing Ux, the end cycle will stop. The current Ij is the whole undertaking group that eventually plays out the assignment on the objective.

$$\mathrm{Res}\left(I_j\right) \geq \mathrm{resRe}_j \quad (21)$$

Update measure: As indicated by the last assortment of the Ij task gathering, the triumphant rundown of automatons, the triumphant asset list and the relating correspondence time list are refreshed, and the refreshed data is communicated to different automatons.

$$resCo_x = \sum_{j=0}^{n} w^l \frac{1 y_x}{\left(R_x^l - R j_A\right)^2} \quad (22)$$

IV. SIMULATION

In the reenactment analyze, the automaton swarm in the mission zone looks for the objective naturally, and when another objective is discovered, the undertaking of electronic sticking or assaulting the objective will be relegated to the objective. A multitude of automatons.

The mission region is characterized as a rectangular territory of 10 km×10 km in which there are 4 known targets and 2 obscure targets. The automaton bunch comprises of 14 automatons, including 7 assault automatons and 7 meddling with drones. The speed of the automaton is 50m/s, and the greatest recognition separation is 300m. The recreation try initially dispenses errands and assets for UAVs dependent on realized focuses to shape an underlying UAV bunch task arrangement. Subsequent to finding the obscure objective, the cycle of dynamic portion of assignments and assets will be set off. The length of the assault mission is fixed at 10 s; the electronic sticking UAV must show up at the objective position 5s preceding the assault mission to perform electronic sticking until the assault mission finishes and exit, so the mission span electronic sticking is fixed at 15s.

A. TASK AND RESOURCE ASSIGNMENT FOR KNOWN TARGETS

Among the 14 automatons, U1-U7 are assault automatons and U8-U14 are electronic sticking automatons. The underlying positions and asset vectors all things considered and targets are arbitrarily created. Each UAV has three assets, in particular, the assault UAV has three weapons, and the electronic jammer UAV has three obstruction loads. Essentially, each target's assault mission and electronic sticking mission likewise require three sorts of assets.

The underlying conditions of the assaulting drone and the electronic sticking automaton are appeared in Tables 2 and 3. The underlying condition of the objective is appeared in Table 4.

TABLE 2. The Initial State of Attack UAVs.

U_i		
U_1	(5313, 4085)	(0, 2, 3)
U_2	(9085, 3371)	(2, 1, 0)
U_3	(6441, 6490)	(4, 0, 1)
U_4	(1191, 2594)	(3, 3, 0)
U_5	(3568, 7959)	(0, 2, 4)
U_6	(2644, 1174)	(2, 0, 4)
U_7	(9321, 9148)	(2, 3, 0)

TABLE 3. The Initial State of Interference UAVs

U_i		
U_8	(6069, 1642)	(4, 0, 3)
U_9	(3990, 5324)	(2, 3, 0)
U_{10}	(1435, 8812)	(2, 0, 2)
U_{11}	(8752, 6590)	(3, 4, 0)
U_{12}	(7876, 1260)	(0, 1, 3)
U_{13}	(7248, 7995)	(4, 0, 2)
U_K	(1091, 6346)	(2, 0, 3)

TABLE 4. The Initial State of Targets.

T_j	Initial Position	Requirement for Attack Resources	Requirement for
T_1	(2446, 5429)	(1, 3, 2)	(1, 1, 1)
T_2	(7809, 5219)	(1, 0, 2)	(1, 1, 2)
T_3	(9319, 1471)	(1, 2, 2)	(1, 2, 1)
T_4			
T_5	(4627, 2718)	(2, 1, 1)	(1, 1, 2)
T_6	(8510, 3261)	(1, 1, 1)	(1, 2, 1)

All things considered, the underlying circumstance of the reproduction try is appeared in Figure 3. Assaulting drones, electronic sticking automatons and realized targets are spoken to by marks of various shapes. Each automaton is spoken to by an alternate shading. Targets T5 and T6 are focuses to be found in the underlying circumstance. For the known objectives, the errand arrangement system and circulated undertaking and asset assignment calculation proposed in this paper are utilized to distribute these four objectives thus. Undertaking time and assignment bunch results are appeared in Table 5. The consequences of UAV mission asset allotment are appeared in Table 6. The UAV bunch is appeared in Figure 4 and Figure 5 separately. The aftereffects of errand task show that a solitary UAV can be doled out up to two assignments, for example, U1 and U3. A few automatons are not allocated any errands, for example, U7 and U10; most automatons are relegated an assignment, for example, U12.

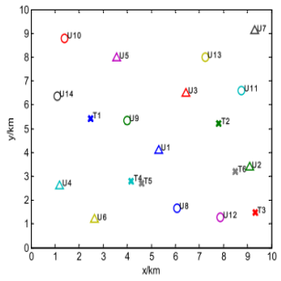

FIGURE 3. The initial situation of task assignment scenario.

TABLE 5. The Result of Task Assignment.

T_j		Task Squad
T_1	(169, 174, 184)	$\{U_3, U_4, U_5, U_9, U_{14}\}$
T_2	(47, 52, 62)	$\{U_1, U_3, U_{11}, U_{13}\}$
T_3	(162, 167, 177)	$\{U_1, U_2, U_6, U_{11}, U_{12}\}$
T_4	(56, 61, 71)	$\{U_4, U_6, U_8, U_9\}$

into simultaneous holding up time, important flight time and vital errand time. The synchronization holding up time is to guarantee that the errand crew dispatches the undertaking simultaneously. This aspect of the time can be utilized to look for targets or handle new targets.

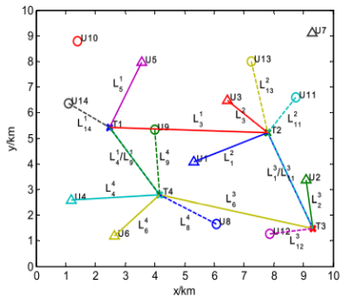

FIGURE 4. The approximate trajectory of UAVs.

As appeared in Figure 5, (1) The circumstance requirements between the electronic thinking task and the assault task. Before the automaton can assault a similar objective, electronic sticking must start. For instance, U1 and U3 will arrive at the objective T2 early, and afterward sit tight for U11 and U13, they will meddle with the objective T2 for 5 seconds before U11 and U13 assault the objective T2.

TABLE 6. The Result of Resource Assignment

U_i					Remained Resource
U_1	T_2	(0, 0, 2)	T_3	(0, 2, 0)	(0, 0, 1)
U_2	T_5	(1, 0, 0)		None	(1, 1, 0)
U_3	T_2	(1, 0, 0)	T_3	(1, 0, 0)	(2, 0, 1)
U_4	T_6	(0, 1, 0)	T_7	(0, 1, 0)	(3, 1, 0)
U_5	T_7	(0, 2, 2)		None	(0, 0, 2)
U_6	T_4	(2, 0, 1)	T_3	(0, 0, 2)	(0, 0, 1)
U_7		None		None	(2, 3, 0)
U_8	T_4	(2, 0, 0)		None	(2, 0, 3)
U_9	T_6	(0, 1, 0)	T_7	(0, 1, 0)	(2, 1, 0)
U_{10}		None		None	(2, 0, 2)
U_{11}	T_2	(1, 0, 0)	T_3	(1, 1, 0)	(1, 2, 0)
U_{12}	T_5	(0, 1, 1)		None	(0, 0, 2)
U_{13}	T_2	(0, 0, 2)		None	(4, 0, 0)
U_{14}	T_7	(1, 0, 1)		None	(1, 0, 2)

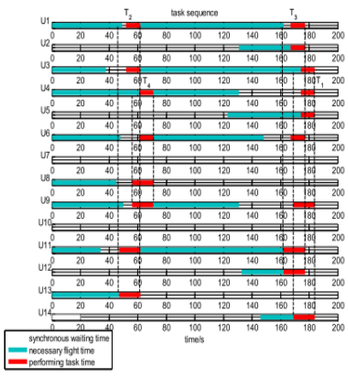

FIGURE 5. The task sequences of UAV swarm.

TABLE 7. The Result of Task and Resource Assignment for New Targets.

T_j	Requirement for Attack Resources	Requirement for Interfering Resources	Critical Task Time	Task Squad
T_1	(2, 0, 1)	(1, 1, 2)	(78, 83 93)	$\{U_4, U_6, U_8, U_9\}$
T_6	(1, 1, 1)	(1, 0, 2)	(101, 106, 116)	$\{U_1, U_2, U_3, U_{12}\}$

It relies upon the separation between each automaton and the objective. Additionally, for targets T4, U6, U7 and U8 must hang tight for U4. For the objective T3, U2, U6 and U9 must sit tight for U1 and U10. This model can demonstrate the viability of the UAV split assignment and asset distribution calculation. The calculation can sensibly design the request for assignments and the extent of assets as per the time arrangement of undertakings. Simultaneously, the set up task grouping system can likewise work viably. Through this assignment grouping, the time status of each UAV can be plainly explained, and the synchronization holding up season of each UAV can be determined to offer help for the following unique undertaking portion.

DYNAMIC ASSIGNMENT FOR NEW FOUND TARGETS

At the point when the automaton swarm floating over the previously mentioned errand and asset portion arrangement, obscure targets can be found. For instance, U8 discovers target T5 while traveling to target T4, while U2 discovers target T6 inside the synchronization holding up time. For new targets found in a powerful situation, the automaton multitude will promptly dispense errands and assets dependent on the aftereffects of the underlying assignment. In the wake of finding the obscure objective and reallocating the UAV gathering, the surmised mission direction of the UAV bunch is appeared in Figure 6. L j I shows the course from Ui to the objective Tj. Table 7 shows the mission time and consequences of the UAV swarm missions for targets T5 and T6.

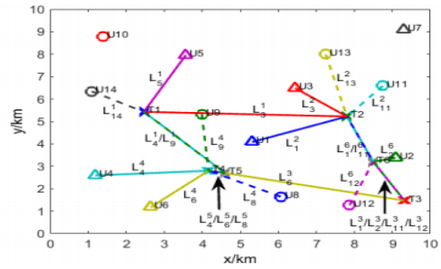

FIGURE 6. The approximate trajectory of UAV swarm after find new targets.

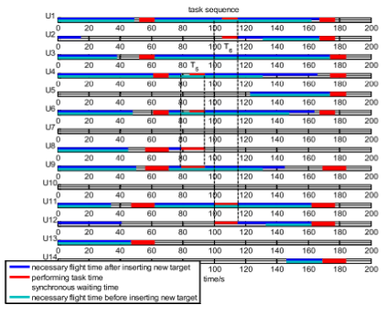

FIGURE 7. The comparison of task sequences of UAV swarm before and after inserting targets.

TABLE 8. The Bidding Information of Each UAV.

U_i	Target Reward		
U_1	47.10	(74, 106)	(3, 1, 0)
U_4	52.14	(74, 85)	(0, 0, 1)
U_6	47.51	(74, +)	(2, 0, 3)
U_9	49.64	(74, 106)	(2, 1, 0)
U_{12}	28.35	(85, 96)	(0, 0, 2)

For similar investigation, Figure 7 places the undertaking succession of each automaton of the new objective on a similar plan. On the timetable of each automaton, the lower layer shows the grouping of assignments before finding another objective, steady with Figure 5. The top layer shows the refreshed errand grouping in the wake of finding the new objective. Figure 7 shows the time and assignment colleagues on track T5 and target T6.

TABLE 9. The Initial State of Targets.

T_j	Initial Position	Requirement for Attack Resources	Requirement for
T_7	(7531, 3924)	(2, 1, 1)	(1, 1, 2)

When the automaton swarm finds another objective, each automaton will quickly check the nearby assignment grouping and asset vector, and acquire the locally accessible synchronization holding up time in the current undertaking distribution plan. . In the event that the inactive time and assets meet the necessities of the objective, the automaton will offer for the new objective, decide the timespan of the comparing task, apportion its assets, and afterward compute the compensation for the assignment, and afterward broadcast the prize data to different automatons. In the wake of getting citations from other automated flying vehicles, each automated elevated vehicle will settle clashes as depicted in Area 2.3 and update the consequences of mission and asset assignment. This cycle doesn't need a focal hub for facilitated control, and each automaton is totally self-sufficient, and the multitude is over Dispersed undertakings and asset portion.

Let us take target T5 as an illustration to represent this cycle. When U8 identifies target T5 and gets its status data, each UAV checks the neighborhood task arrangement and asset vector. U4, U6, U8, U9 and U12 can utilize the first synchronization sitting tight an ideal opportunity to offer for the objective T5 work. These automatons freely ascertain their own errand awards for the objective, the inactive season of the assignment in the ebb and flow task arrangement, and the rest of the undertaking assets. The definite offering data of each UAV is appeared in Table 8. After the way toward arriving at an agreement, U12 was kicked out of the activity group because of the least compensation and negligible asset commitment. The rest of the automatons can meet the objective asset prerequisites.

As per the assignment arrangement, it tends to be seen that U4 and U6 can utilize the synchronization holding up season of 40 seconds to execute the undertaking on the objective T5 before executing the errand on the objective T1. This won't influence resulting undertakings on track T1.

DYNAMIC ASSIGNMENT AFTER TARGETS LOST

In a unique domain, a few objectives might be lost because of vital movements. At the point when the objective is lost, the automaton swarm should rapidly alter the mission succession all things considered.

As in the past investigation, the UAV swarm performed errands as per the underlying undertaking allotment plot appeared in Figures 4 and 5. Target T2 will vanish before the automaton arrives at its position. Target T7 will be found as another objective. Table 9 shows the underlying condition of the beforehand obscure objective T7.

When U11 arrived at the objective T2 position (37 seconds) and found that the T2 target was feeling the loss of, the automaton bunch quickly balanced the mission succession. Subsequent to leaving objective T2 from the undertaking grouping, the times of idleness of U1, U3, U11 and U13 increment in like manner. When the inert season of these four automatons expands, it is conceivable to offer for different focuses on a subsequent time. These four UAVs ascertain the accommodation data of the objectives T1 and T4. The itemized data is appeared in Table 10.

It tends to be seen from Table 10 that the vital flight season of U1 and U11 is excessively long for target T1 or target T4, and there is no inactive opportunity to begin the following undertaking before embeddings another assignment. Because of the beginning season of the following assignment, U3 can't play out the errand on track T4, and the compensation for target T1 is the most noteworthy. Because of the low compensation for the undertaking, U13 won't have the option to offer for the objective T1 task.

When performing undertakings on track T3, U2 and U12 expect U1 and U11. After the objective T2 vanishes, U1 and U11 will arrive at the objective T3 early, so the assignment gathering of the objective T3 will begin the mission likewise.

After computation, U2, U3, U8, U11 and U12 can utilize the first synchronization holding up an ideal opportunity to perform undertakings on the new objective. The assignment reward, task inert time and weapon asset allotment are freely determined by the assaulting drones U2 and U3, as appeared in Table 11.

Table 12 shows the assignment rewards, task inert time and impedance payload allotment for U8, U11 and U12.

As appeared in Table 12, despite the fact that U8 has more assets, the assignment reward is the littlest. Since it is a long way from the new objective, the inactive timespan of the errand begins later. It very well may be seen from Table 11 that the undertaking inert season of U3 closes in 115s, so if U8 is chosen, the assignment group needs more time (10s) to finish the errand. Facilitated obstruction and assault on new targets. Subsequently, U8 was eliminated from the assignment gathering, and U11 and U12 turned into the last offered victors.

TABLE 10. The Bidding Information for Potential Targets of Four UAVs.

U_i	Start Time of Next Task/s	Remained Resource	Reward for T1	Time Flying To T1/s	Reward for T4	Time Flying To T4/s
U_1	163	(0, 0, 3)	13.20	261	26.51	172
U_3	168	(3, 0, 1)	51.26	91	33.48	148
U_{11}	163	(2, 2, 0)	12.65	284	25.48	189
U_{13}	NONE	(4, 0, 2)	25.21	105	30.48	96

TABLE 11. The Bidding Information of Candidate Attack UAVs

U_j	Target Reward	Task Idle Period	Available Resource
U_7	40.24	(89, +)	(1, 1, 0)
U_3	47.84	(85, 115)	(3, 0, 1)

TABLE 12. The Bidding Information of Candidate Electronic Interference UAVs.

U_j	Target Reward	Task Idle Period	Available Resource
U_8	35.41	(112, +)	(2, 0, 3)
U_{11}	54.17	(81, +)	(2, 2, 0)
U_{12}	43.48	(101, +)	(0, 0, 2)

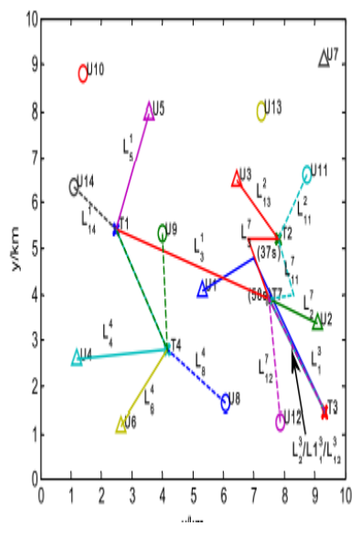

FIGURE 8. The approximate trajectory of UAV swarm after targets lost.

At long last, the new objective working gathering is | U2, U3, U11, U12 | Task term is 96 to 111 s. The rough direction of the automaton is appeared in Figure 8, where L j I speaks to the direction course from Ui to Tj. For near investigation, Figure 9 shows the mission succession of each UAV. It tends to be seen from these recreation tries that the proposed calculation can understand the planned distribution of undertakings and assets. At the point when a gathering of automatons locate another objective in a powerful domain, the calculation can utilize the errand arrangement component to rapidly get the accessible season of the automaton. Since the calculation doesn't influence the first assignment and asset portion plan while embeddings another objective, it isn't important to totally re-allot every incomplete errand (counting known targets)), accordingly guaranteeing ongoing execution.

A. ADVANTAGES ANALYSIS

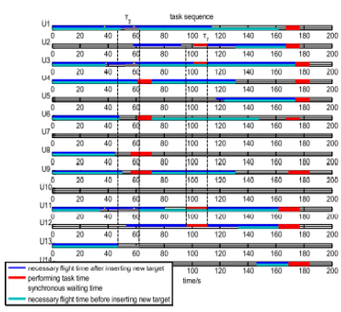

FIGURE 9. The comparison of task sequences of UAV swarm before and after targets lost.

Partition without redistributing built up task results. This system permits the calculation to assign errands continuously.

Since there is no compelling reason to redistribute the current portion results, the count time and correspondence volume of the calculation are extraordinarily diminished.

V. CONCLUSION

In light of the constant prerequisites of errand portion in a unique situation and the restricted assets of everybody in the UAV gathering, this paper proposes an assignment succession instrument dependent on task-based powerful undertakings and asset designation calculations. The calculation doles out all recently known undertakings and new errands found to the automaton swarm in an appropriated, constant way, and is entirely reasonable for powerfully appointing assignments in the automaton multitude to dole out them to drones. Huge scope. It can utilize the accessible time and assets of each automaton in the gathering and improve the effectiveness of the automaton gathering.

The reproduction results show that the calculation can successfully unravel the ongoing designation of assignments and assets when the UAV finds another objective in the earth or the objective is lost. dynamic. Another examination bearing is to assign undertakings and assets continuously when certain automatons are added to the multitude or demolished in a powerful domain. In view of the assignment arrangement component, all together not to change the first request and season of the undertakings, the automatons added to the work move or enduring automatons are progressively balanced by the accommodation data of the new automatons to improve task prizes and asset usage. Another bearing of exploration is to dispense errands and assets progressively under the restricted correspondence conditions between drone gatherings.

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