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Optimal UAV Deployment for Data Collection in Deadline-based IoT Applications

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Abstract:

The deployment of UAVs is one of the key challenges in UAV-based communications while using UAVs for IoT applications. In this article, a new scheme for energy efficient data collection with a deadline time for the Internet of things (IoT) using the Unmanned Aerial Vehicles (UAV) is presented. We provided a new data collection method, which was set to collect IoT node data by providing an efficient deployment and mobility of multiple UAV, used to collect data from ground internet of things devices in a given deadline time. In the proposed method, data collection was done with minimum energy consumption of IoTs as well as UAVs. In order to find an optimal solution to this problem, we will first provide a mixed integer linear programming model (MILP) and then we used a heuristic to solve the time complexity problem. The results obtained in the simulation results indicate the optimal performance of the proposed scheme in terms of energy consumption and the number of used UAVs.

Keywords: Data Collection, Deadline Time, Energy Efficiency, Internet of things, Mixed Integer Linear Programming, Unmanned Aerial Vehicles.

Introduction:

It is expected that millions of unmanned aerial vehicles (UAVs), which are also called drone, become active in our daily life in recent future and provide wide services (1). Unmanned Aerial Vehicles (UAVs) have also significantly improved for many important applications in commercial, civil and military are very useful. Typically, UAVs require working with other systems to achieve their mission. Wireless Sensor Networks (WSNs) are an example of these systems (2). The optimal route and deployment of UAVs are used as the main air stations to collect data from the internet of things (IoT). In fact, UAV can play a key role in the IoTs, which consist of devices with a small battery size, such as sensors and health monitors (3). Because of their energy constraints, these devices can not normally be transmitted over long distances. In such IoT scenarios, UAVs can move dynamically towards IoT devices, collect IoT data and transfer it to other devices that are outside the communication range of the IoT devices. See Fig.1. In this case, UAVs play the role of mobile for IoT networks (4).

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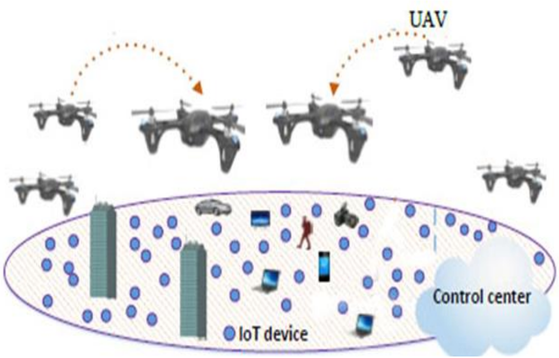

Figure 1.The relationship between UAVs and IoT devices

The main objective of this article is to determine the optimal deployment of UAVs to collect data from the network level in a predetermined deadline time, which should be performed efficiently in terms of the energy consumption of UAVs and IoTs. In fact, the problem posed is a Vehicle Routing Problem (VRP). In addition to the problem of UAV routing, the data collection has been added in a certain time range and the Vehicle Routing Problem with Time Window (VRPTW) is raised. Of course, in this article, we solve the mathematical formula of the problem as MILP optimization model. Some applications that are real-time, soft, or hard need to process or send data at a specific deadline time (5). In this research, we take into account energy in addition to deadline time, to make routing such that applications with this particular constraint to be included. The aspects of novelty and innovation in this research can be defined as follows:

1) Providing an energy-efficient data gathering framework using the number of UAVs in the IoT network, by optimizing the deployment and mobility of UAVs.
2) The problem is formulated in a MILP model.
3) The output of the proposed model is compared with a greedy method that selects the closest node to move UAV at each step.

The rest of the article is as follows: In the second part, related work is to be examined in WSN/IoT networks. In Section 3, the steps are taken to proposed strategy. Section 4 describes the system limitations and assumptions. Section 5 describes the system model and proposed solution. In Section 6, the simulation and evaluation of the proposed framework will be discussed, and in the final section we present at the results and future work.

Related Work:

Data collection problems in wireless sensor network nodes can have different types of targets. There are two common goals to minimize the time/distance needed to collect data, as in (6), and minimize energy consumption when collecting data, as in (7), (8). In (6), the problem is the window-time constraint, which means that the sensor nodes must be met in their time windows, which is the period when the node is awake and capable of communicating. This is a straightforward adaptation to the issues of Vehicle routing with time windows (VRPTW) routing in a wireless sensor network .

In (7), the problem is to create a path for an animated data collector robot to minimize the total cost of data collection (ie, the total energy transfer of sensor nodes and the robot's motion energy) in a sensor network. In (8), the calculation of routing aware of mobile data collectors is discussed. Both (7) and (8) can be viewed as routing issues.

In order to enable reliable uplink communication for IoT devices with minimum energy consumption, authors in (9) suggested a new approach to optimized UAV mobility. First, with a fixed ground IoT network, the total power output of devices is minimized by clustering appropriate IoT devices with any cluster served by a UAV. Then, in order to maintain energy efficient communications in the IOT time-varying networks, the optimal paths for UAVs are determined using the optimal transmission theory framework.

In (10), the point-to-point link between the UAV and a terrestrial user is aimed at optimizing the UAV route under a UAV energy consumption model that is counted for the effect of the speed and acceleration of UAV's.

In (11), the issue of optimizing the UAV route for UAV delivery of material goods by minimizing the total cost of energy under the constraints of delivery, as well as minimizing the total delivery time under the energy budget. Sub-optimal solutions for the problem are presented using an empirical refrigeration algorithm.

In (12), analyzes the coverage and performance rates of wireless UAV-based communications in the presence of D2D communication links. In particular, they consider a network in which a unit of UAV should provide support for downlink transfer to a number of users in a specified area. In this area, a subset of the devices is also working on D2D transmissions that are used in the field of UAV transmissions. In fact, the optimal deployment and route of a separate UAV to maximize downlink coverage has been investigated. However, the proposed model does not consider multiple UAVs.

In (13), a multimodal optimization model for UAV route planning is proposed to monitor the road section, which aims to minimize the UAV distance and minimize the number of used UAVs. An evolutionary algorithm is proposed based on the Pareto optimization method for solving a multi-objective UAV route planning problem.

In (14), the authors reviewed the energy efficiency of the UAVs in the target tracking scenarios by setting the number of active UAVs. However, in this work, the authors assumed that the location of the targets was already known and they did not take into account the randomness of the network.

In (15), an UAV-based moving cloud computing system has been studied in which UAVs are moving with computational capabilities to provide computational offloading opportunities to MUs with local processing capabilities. This system aims to minimize total energy consumption. Offloading is enabled by using downlink and uplink communications between mobile devices and UAVs. The problem of optimizing bit allocation for uplink and downlink communications, also solved for successive convex approximation strategies (SCAs), also solved for calculating the UAV, along with the cloud slot line under the UAV energy budget constraints and the latency.

In (16), several data gathering algorithms are presented based on the data transfer rate (DR) and Central Daylight Time (CDT) between the sensors and the UAV. A weight-of-weight benchmark calculation is also proposed to evaluate algorithms. Since all algorithms are focused on using a single UAV unit, the design of distributed distributed algorithms is not based on a set of UAVs. In fact, it would be interesting to see whether a group of UAVs can increase the data collection process and ensure low latency.

Material and Methods:

The Proposed Method:

As discussed earlier, the main problem of this study is to determine the optimal deployment of UAV to collect data from ground IoTs in a predetermined deadline time, which should be performed efficiently in terms of the energy consumption of UAVs and IoTs. In fact, the problem posed is a VRP problem. In addition to the problem of UAV routing, the data collection has been added at a specific deadline time and the VRPTW problem is raised. Of course, the problem of finding the optimal deployment of UAVs required to cover the area has also been added, which in turn adds to the complexity of the problem, modeling and solution.

The steps required for implementing the proposed strategy in order to provide energy efficient data gathering according to the assumptions and network conditions are as follows:

Step 1: First, we cluster the nodes into distributed nodes in order to determine the locations for the placement of UAVs to receive data from the network nodes. In order to efficiently cluster efficiently in terms of energy consumption of IoTs for data transmission to the network, a preliminary clustering will work so that the average distance of cluster members is minimized and the IoT spend the minimum energy possible to send data to the cluster head. In order to do this, in the network boundary, by considering the threshold energy parameter, the threshold for sending the nodes of the IoT is determined, and then each node identifies its neighbors at this distance. In the following, based on the network density (depending on the number of nodes and the size of the network area), the threshold is the number of nodes in each cluster and the neighbors of which are more than equal to this threshold. In this case, the number of clusters needed to send effective data is determined by the IoTs, and the centers of these clusters are considered as the place of UAV deployment. After the formation of the cluster and the UAV deployment in the center of each cluster, the data is sent from the IoT to the UAV and the UAV receives data from the cluster in deadline time.

Step 2: At this stage, after completing the clustering step and determining the UAV meeting points, we are trying to solve the main research problem. In this step, we assume that the IoT nodes are stationary in the network. In order to determine the effective path in the network, this is the form: Considering the center of the clusters selected in the previous step, the UAV meeting points are considered as network nodes. In addition, as stated in the main form of the problem, determining the optimal number of UAVs for network coverage is one of the problem solving goals, which means that the problem solution should propose a number of paths for moving UAVs at these nodes, which simultaneously scroll through points and receive data. In order to control the number of these paths, in order to control the number of UAVs present on the network, the virtual nodes 0 and n + 1 are considered as the beginning and end nodes of the route of all UAVs. Thus, by considering nodes 1 through n as centers of clusters and virtual nodes, we define the set of N as the nodes of the network as follows:

In order to determine the network graph to perform a routing problem, we define the network graph as follows:

$$\mathrm{G} = (\mathrm{N}, \mathrm{E})$$

$$N = \{0,1,2, \dots\dots, \mathrm{n}, \mathrm{n}+1\}$$

Where E (i, j) denotes the euclidean distance between the nodes. In this way, the research problem is raised as follows: Find the shortest u route from node 0 to the n+1 node with the following conditions:

- The time of each route should be less than the predetermined deadline time.
- The routes do not share the edges and nodes except the source and destination nodes.
- Routes should be the possible shortest route.

Of course, the number of routes (u) that are actually the same number of UAVs must be the possible minimum number.

System Limitations and Assumptions

The assumptions and limitations that we consider in this article are:

A-Assumptions and Limitations of the IoT Network:

To provide a method for optimizing data collection in IoT/UAV networks, the assumptions and limitations of the network should be determined as follows:

- **Uniform distribution of IoT nodes in the network**: Because of many IoT network applications, nodes in the network are distributed in the same way, we also assume that the distribution of IoT nodes in the network is uniform.
- **Division of nodes:** The nodes of the IoT are assumed to be two types: CH (cluster head) and CM (cluster member). CHs and CMs are randomly assigned to the network.
- **Ground-to-air communications**: Each device typically has a LoS[1] view toward a specific UAV

[1] Line of Sight

with a given probability. This probability of LoS depends on the environment, location of the device and UAV, and the elevation angle between the device and the UAV.

- **Transfer rates for IoT nodes**: In this study, it is assumed that each of the IoT nodes has the ability to set their own rates as well as the transmission radius.
- **UAV awareness of the position of the IoT nodes in the network:** In this research, we assume that each IoT measures the parameters that are required for the decision to send it to the UAV.

B-Assumptions and Limitations of the UAV network:

- **UAV node layout on the network:** We assume that the distribution of UAV nodes in the network is distributed in the form of adhoc network.
- **The ability to move at a constant speed:** In this paper, each UAV has the ability to move at a constant speed.
- **Ability to move at constant flight altitude:** In this paper, each UAV has the ability to move at a constant hieght.
- **Ability to perform heavy computing and processing:** UAV with high memory and high processing power.
- **The Obstacles-free:** In this paper, the obstacle to UAV movement is not assumed, and each UAV has the ability to move with no obstacles.
- **Collision-free:** In this paper, each UAV has the ability to move with no collision.

Proposed Model and Solution

In this section, we first present the proposed method and system model, on the basis of which the optimal deployment of UAV problem is formulated.

1) Proposed Model:

As discussed in previous sections, in order to solve the main problem of the research, first, in accordance with the initial stage of the proposed solution, in order to minimize the amount of energy consumed in the data transmission of IoT nodes, efficient clustering was performed and then, by forming the network graph and according to description of the second step of the proposed solution, the main problem of the research in the context of the IoT node scenario is solved by MILP model, which is explained in this section.

Problem's Assumptions:

- UAVs are moving at a constant speed.
- IoTs are fixed in the network.
- Each UAV is limited to the maximum distance it can travel.

Problem's Objectives:

- Minimum energy consumption of IoTs and UAVs in sending and collecting data.
- Determine the optimal number of UAVs to collect data from the network level.

Problem's Constraints:

- Network data must be collected from the network level in a predetermined deadline.
- The distance traveled by any UAV does not exceed the threshold set for the UAV.

Problem's Parameters:

In this section, definitions of symbols used in MLIP formula are presented in Table 1.

Table 1. Problem Parameters

UAV Movement speed	v
Maximum distance traveled by each UAV	d_k
Maximum number of UAVs	U
IoT network nodes	N
Euclidean distance from node i to j	$d_{i,j}$
The deadline time of data collection	τ
Number of clusters	n
Time required to receive data by UAV per cluster	t

Problem Variables:

Variables The problem is explained in Table 2.

Table 2. Variables

Relationship of node i with node j by UAV with index k (Represents the movement of the UAV with the number k from node i to node j, where the nodes i, j are in fact centers of clusters)	$x_{i,j}^k$
Number of needed UAVs	u
Integer free variable to examine existence of round in route	y_i

It can be explained that the maximum number of UAVs is determined in such a way that, in fact, the total length of the route to be collected for collecting data from the network is calculated, and by calculating the time required to traverse this route at the speed of the UAV, and comparing this time to the data collection deadline time is approximately the maximum number of UAVs for doing this.

$$U = \left(\left(\left(\left(\left(\max(E) + \min(E)\right)/2\right) * (n-1)\right)/v\right)/\tau\right)$$

Suggested Mixed Integer Linear Programming model:

$$\boldsymbol{min} \sum_{k=1}^{U} \sum_{i=0}^{n} \sum_{j=1}^{n+1} d_{i,j} . x_{i,j}^{k}$$

$$\boldsymbol{min}\ u$$

Subjected to:

$\sum_{k=1}^{U}\sum_{j=1}^{n+1} x_{i,j}^{k} = 1 \quad \forall i \in N - \{0, n+1\}$	Each middle node must only be connected to one output. node
$\sum_{k=1}^{U}\sum_{j=0}^{n} x_{j,i}^{k} = 1 \quad \forall i \in N - \{0, n+1\}$	Each middle node should only be connected to an input node.
$\sum_{k=1}^{U}\sum_{j\in=1}^{n+1} x_{0,j}^{k} = u$	The number of outputs of node 0 is equal to u.
$\sum_{k=1}^{U}\sum_{j=0}^{n+1} x_{j,n+1}^{k} = u$	The number of inputs of the node n + 1 is equal to u.
$\sum_{k=1}^{U}\sum_{j=1}^{n+1} x_{n+1,j}^{k} = 0$	The number of inputs of node is 0.
$\sum_{i=0}^{n} x_{i,p}^{k} - \sum_{j=1}^{n+1} x_{p,j}^{k} = 0, \forall p \in \{1, \dots n\}, \forall k \in U$	In each intermediate node, the input current is equal to the output current.
$x_{i,i}^{k} = 0, \forall i, \forall k \in U$	Lack of loop in the node
$y_i - y_j + N.\sum_{k=1}^{U} x_{i,j}^{k} \le N - 1, \forall i, j \in \{1, \dots, n\}, i \ne j$	Lack of round in route
$\sum_{i=0}^{n}\sum_{j=1}^{n+1} x_{i,j}^{k}.d_{i,j} \le d_k \quad \forall k \in U$	The maximum distance of each UAV is predefined and the path you have traveled should not be more than that.
$\sum_{i=0}^{n}\sum_{j=1}^{n+1} x_{i,j}^{k}.\left(\frac{d_{i,j}}{v} + t\right) \le \tau, \forall k \in U$	The time spent on each route should not be longer than the deadline time. Each UAV stops at the center of the cluster head to process data and spends time t.
$\sum_{k=1}^{u}\sum_{j=1}^{n+1} x_{0,j}^{k} = u$ $u \le U$	The minimum number of active UAVs should be less than the maximum number of UAVs.

2) Proposed Solution:

As stated in the presented model, the goal of the proposed model is multi-objective function, which considered as following for solving the proposed model,

$$\boldsymbol{min \sum_{k=1}^{U}\sum_{i=0}^{n}\sum_{j=1}^{n+1} d_{ij}.x_{ij}^{k} + u}$$

Based on the proposed model, the objective function in the proposed model is in multi-objective form. Different approaches have been proposed to solve such problems (17). Before we solve the proposed model, we apply the following two steps:

1) **Objective Normalization**: In order to have a balanced objective function, both parts of the objective function are approximated to normalize the values of the numerical order by calculating the approximate total traveled paths traversed by U to UAV at the network level:

$$\boldsymbol{maxtotalpaths = \left(\left(max(E) + min(E)\right)/2\right) * (N - U)}$$

And taking into account the ratio of the optimal number of UAVs taken to this maximum value in the objective function; in fact, this part of the objective function is normalized and the number will be in the range [0,1]. To perform normalization in the second part of the objective function, we divide the optimal number u by the value of U

2) **Weighting Coefficients**: Also, for weighting each of the objective section, the significance of each section is defined by the coefficients α, β as the weight of the importance of each section of the objective function.

According to the above, the objective function of the proposed model is considered to be:

$$\boldsymbol{min\ \alpha.\frac{\sum_{k=1}^{U}\sum_{i=0}^{n}\sum_{j=1}^{n+1} d_{i,j}.x_{i,j}^{k}}{maxtotalpaths} + \beta.\left(\frac{u}{U}\right)}$$

In the table below, the effect of selecting the α and β parameters on the solution of the proposed model is presented in two different scenarios with |N| = 10 and different deadline values τ:

Table 3. The effect of selecting α and β parameters on the proposed model solution with | N | = 10

$\mathcal{N}$	τ	α	β	U	u	u_{ch}	u_{trj}	Path Len
10	50	0.1	0.9	6	4	1	3	105
		0.9	0.1	6	6	4	2	26
	70	0.1	0.9	7	4	1	3	107
		0.9	0.1	7	7	6	1	17

In table 3, taking into account $\boldsymbol{u_{ch}}$ and $\boldsymbol{u_{trj}}$, the number of UAVs, which move in network and number of UAVs, which are assigning only to a cluster, respectively. We attempt to minimize UAVs trajectory in scenarios where coefficient of minimuim energy objective is dominant value, by assigning the UAV to each cluster, while in the event that the target factor is minimize the number of UAVs, the number of UAVs assigned to each cluster is reduced, and UAVs try to cover all clusters and collect data along the path.

Simulation and Performance Evaluation:

In this section, we will compare the proposed method and the method of greedy in different scenarios. We use a performance evaluation metric for our proposed method. This metric is the maximum traveled distance, defined as the average length of the tour used by all UAVs to end one round.

1) Simulation Settings

In this simulation, the size of the 600 × 600 square meter network. Evaluation using Python software as a heuristic implementation platform, the pulp library has been implemented to perform the MILP optimization function on a system with a core processor unit of Core i5-2410M 2.30 GHz and 4 gigabytes of main memory. Other simulation parameters are summarized in Table 4.

Table 4. Simulation Parameters

Parameter	Value
Area size	600 × 600 m^2
No. of sensors	300
No. of CHs	7 10
No. of UAV	2 3 4 6
Speeds of UAV	20 m/s
Heights of UAV	70 m
Deadline Times τ	50 70
Sojourn Times t_i	30 s
Transmission range	40 m
UAV Elevetion Angles	45 deg
Transmission bit rate f	200 kbps
Initial energy E_0	0.1 J
Packet size	2000 bit
d_{max}	200 km

2) Comparison of the Distance Traveled by UAVs in the Greedy Method and the Proposed Model

Here, in order to compare the efficiency of the proposed model, we compare the output of the model with a method that selects the closest node in each step for UAV movement. In this greedy method, using the parameter value u, which is the output of the MILP model, at first, the node from the cluster centers of the network is considered as the initial location of the UAVs, and then each of the UAVs to cover the network and visit all the cluster centers in each step. Moves to the nearest cluster until all the clusters are covered and the relevant data is collected. In the next scenario, the proposed solution and this greedy method are compared in terms of energy consumption. It should be noted that since energy consumption has a direct dependence on the distance traveled, then we use the distance traveled as an energy comparison scale.

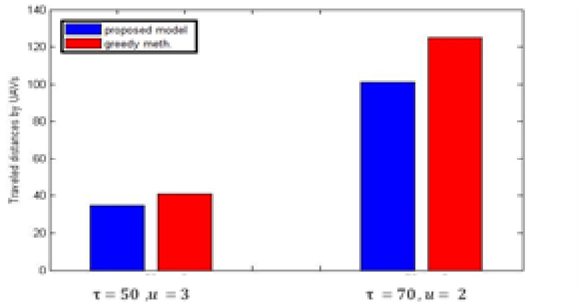

Figure 2. Comparison of the distance travelled by UAVs in the proposed method and the greedy method with τ = 50.70 and α = 0.9 and β = 0.1

Fig. 2 shows the comparison of the travel distance of the UAVs in the proposed method and the greedy method in a scenario with | N | = 7 at a different time deadline τ that activates a different number of UAVs. As explained in the explanation of the method, in the greedy method, the reason for the random selection of the starting nodes of the traversed path is compared to the proposed optimization model that attempts to select the appropriate location in choosing the source nodes to locate the start of the UAVs, A longer route goes through.

In the following, as described in the explanation of the selection section of the objective function, in the same scenario, the effect of different values of the alpha and beta coefficients on the output of the proposed model can be seen. In Fig. 3, the comparison of the trajectory of UAVs in the proposed method and the greedy method in the scenario with | N | = 10 in different t with a value of α = 0.1, β = 0.9 is shown.

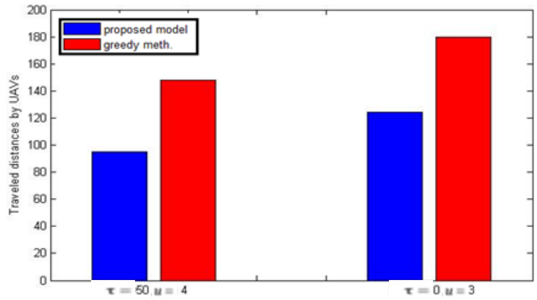

Figure 3. Comparison of the path taken in the proposed method and the greedy method with τ = 50.70 and α = 0.1 and β = 0.9

In Fig. 4, the comparison of the trajectory of UAVs in the proposed method and the greedy method in a scenario with | N | = 10 in different τ with a value of α = 0.9, β = 0.1 is shown.

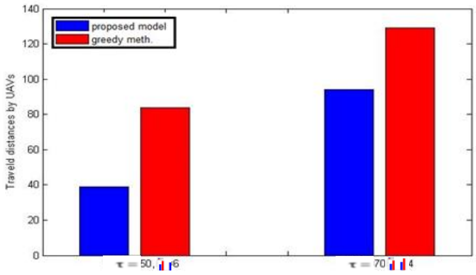

Figure 4. Comparison of the travel distance in the proposed method and the greedy method with τ = 50.70 and α = 0.9 and β = 0.1

In the table 5, the effect of selecting α, β parameters on the solution of the proposed model is presented in two different deadline time τ = 50, 70 and with the number of cluster heads |N| = 7, 10.

Table 5. Comparison of the paths taken by UAVs in the proposed method and the greedy method with |N | = 7, 10 and τ = 50, 70

$\mathcal{N}$	τ	α	β	U	u	u_{ch}	u_{trj}	Path Len.	method
7	50	0.1	0.9	3	3	2	1	35	Prop. model
		0.9	0.1	3	3	2	1	35	Prop. model
		-	-	-	3	1	2	41	Greedy meth.
	70	0.1	0.9	2	2	0	2	101	Prop. model
		0.9	0.1	2	2	0	2	101	Prop. model
		-	-	-	2	0	2	125	Greedy meth.
10	50	0.1	0.9	6	4	1	3	95	Prop. model
		0.9	0.1	6	6	4	2	39	Prop. model
		-	-	-	4	0	4	148	Greedy meth.
		-	-	-	6	4	2	84	Greedy meth.
	70	0.1	0.9	4	3	0	3	124	Prop. model
		0.9	0.1	4	4	1	3	94	Prop. model
		-	-	-	3	0	3	180	Greedy meth.
		-	-	-	4	0	4	129	Greedy meth.

Conclusion:

In this article, a framework is proposed to solve the problem of increasing the efficiency of data collection. To minimize the UAV deployment cost, at first, the IoT network is split into clusters with each cluster has cluster head, cluster heads are considered as the location of UAVs. Then, initial and final virtual nodes are considered for controlling minimum number of UAVs. We formulated this problem as a MILP model and then we solve the model to find the minimum UAV deployment cost with regard to the energy and deadlines constraints for the critical level of the base applications.

Simulation is performed to compare the performance of the MILP optimization method and the greedy method in different scenarios. The results show that the proposed framework is able to provide efficient data collection with the satisfaction of energy constraints and deadlines when it is related to the critical level of the application. Simulation results showed that the MILP optimization method was significantly better than the average energy consumed and the total deployment cost that was used by the greedy method.

Conflicts of Interest: None.

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النشر الأمثل للطائرة بدون طيار لجمع البيانات في تطبيقات إنترنت الأشياء المستندة إلى الموعد النهائي

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الخلاصة:

في هذه المقالة ، يتم تقديم نظاما جديد لجمع بيانات كفوء الطاقة مع تحديد موعد نهائي لإنترنت الأشياء باستخدام الطائرة بدون طيار. سنحاول تقديم طريقة جديدة لجمع البيانات، والتي سيتم تعيينها لجمع بيانات عقد إنترنت الأشياء من خلال توفير النشر والتنقل الفعال للعديد من الطائرات بدون طيار لجمع البيانات من أجهزة إنترنت الأشياء (IoT) في مهلة زمنية محددة. في الطريقة المقترحة، سيتم جمع البيانات باستخدام الحد الأدنى من استهلاك الطاقة من IoTs وكذلك الطائرات بدون طيار. من أجل إيجاد حل أمثل لهذه المشكلة ، سنقوم أولاً بتقديم نموذج برمجي خطي مختلط، ثم سنستخدم الحل التجريبي لإيجاد حل لمشكلة تعقيد الوقت. تشير النتائج التي تم الحصول عليها في نتائج المحاكاة إلى الأداء الأمثل للمخطط المقترح من حيث استهلاك الطاقة وتعداد طائرات بدون طيار.

الكلمات المفتاحية: جمع البيانات، الموعد النهائي، انترنيت الاشياء (IoT)، كفاءة الطاقة، نموذج برمجي خطي مختلط، الطائرات بدون طيار .UAV