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Drone 2 Drone Communication: A Review

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***Abstract*—**The Drone to Drone communication system (D2DCS) is an important area of research. As a basic concept the vehicular ad-hoc networking technology is used in this D2DCS. In this upcoming area too much project and research work is already completed in USA, Japan and the European Union. In this study, according to authors survey, the research on deployment of (D2DCS) is required. To achieve lot achievements in 2 Dimension and 3 Dimension. So that, the characterization of D2DCS, energy efficient routing in D2DCS and easy handoff can be expanded. The main target of this literature review paper is to explore the current ideas in D2DCS.

Keywords-*Dedicated short range communication (DSRC),*

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I. INTRODUCTION

D2DCS is defined as a newly introduced communication system between the stationary and moving drones. This technology is used in few countries for army, navy, air force applications. It is also efficiently used in lot of industries to achieve economical and organizational goals as per requirements. It is also useful for the marketing application. In this competition timing the fast delivery is a crucial requirement of the market. So as to reduce the reaching time of drones the D2DCS is very help full. The concepts of this D2DCS system is also can be used in micro electro mechanical system (MEMS). Which is recently introduced engineering branch in many technical educational organizations across the globe.

D2DCS is such an advanced network which mainly provides Intelligent Transportation System (ITS) services to the end users for providing fast delivery and safety. It uses different standards like DSRC and WAVE for fast data communication. Many routing protocols have been designed for implementation of routing in D2DCS. MANET routing protocols are used toimplement D2DCS.But it is difficult to implement D2DCS using these routing protocols (topology based) because ofits high mobility.

II. D2DCS OVERVIEW

(A). D2DCS architecture

D2DCS architecture mainly consists of Drones (D), RoadSide Unit (RSU) and Infrastructure Domain (I).Communication is conducted mainly by using wirelessstandards (e.g. IEEE 802.11p). RSU acts like a router andhas high range (coverage) than drones range. Drones areinstalled with an On Board Unit (OBU) for communication.It is also installed with a Global Positioning System (GPS)for knowing its own position as well as for tracking other drones. Electronic license plate (ELP) is also set in thevehicle for identification. Radio detection and ranging(RADAR)/light amplification by simulated amplification ofradiation (LASER) technologies are also used for knowingthe position of other vehicles. It is also supplied with highbattery power. A Certification Authority (CA) exists in thearchitecture for providing services (e.g. security and TCP/IP) and applications.

(B) Intelligent Transportation System

Intelligent Transportation System [1] means that the drones itself acts as a sender, receiver and router for broadcastinginformation. As discussed earlier, the D2DCS consists ofRSUs and the drones are installed with OBU, GPS, ELPand so on.

III. D2DCS STANDARDS

Standards are used for development of the product and toassist users to verify and compare the products. Manystandards are used according to the protocols used forexample, security, routing, services and so on. There are many standards used in D2DCS such as dedicated shortrange communication (DSRC) and wireless access indrones environment (WAVE).

A. Dedicated short range communication

DSRC [1, 2] is a standard developed by the USA. It is a shorttomedium range communication service. The US Federal CommunicationCommission sets 75 MHz of spectrum at 5.9 MHz for theDSRC. The DSRC spectrum has seven channels. Eachchannel is 100 MHz wide. In 2003, the American Society forTesting and Materials (ASTM) prepared the ASTM-DSRCwhich was totally based on the 802.11 MAC layer and IEEE802.11a physical layer [3].

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B. Wireless access in vehicular environment

The main problem with the IEEE 802.11a with a Data Rate of54 Mbps is that it suffers from multiple overheads [4, 5]. Drones scenarios demand high speed data transfer andfast communication because of their high topologicalchange and high mobility. For this, the DSRC is renamedto IEEE 802.11p WAVE by the ASTM 2313 workinggroup. This works on the MAC layer and physical layers.Deng et al. [6] also proposed a collision alleviationscheme to reduce delays in the system. WAVE consists of aRSU and an OBU. WAVE uses the OFDM technique tosplit the signals.

IV. ROUTING

Routing is a vast concept used in the D2DCS environment. Many routing protocols have been designedfor communication between the nodes in an ad hoc environment. In D2DCS, routing is a difficult task toachieve because of its high mobility. The main issues in D2DCS which require routing are network management,traffic management, broadcasting, mobility, topologicalchange, quality of service, fast data transfer and so on.

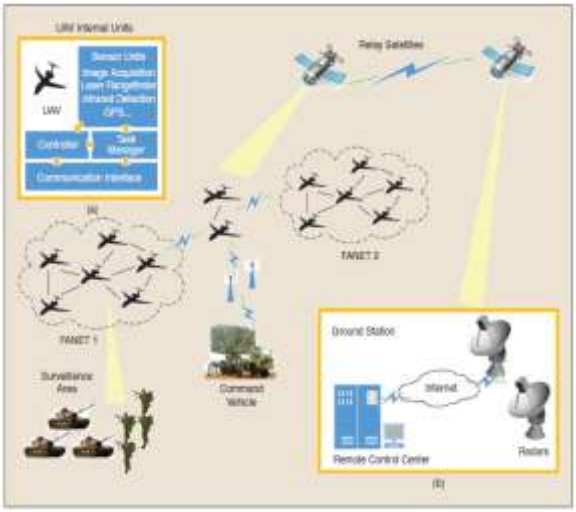

Figure 1 The multi-UAV network architecture and necessary UAV internal units. Specifically, both the small and mini drones should beequipped with (a) sensor units and control and management units, as well as with communication units to fulfill the tasks shown in (b).Except for some essential sensors, such as the gyroscope, global positioning system, and radar, the drones carry specific sensors dependingon their particular missions. Moreover, the control and management units are responsible for the stable operation and the collaborationofeach part. The communication units are composed of multiple modules configured by various protocols, such as IEEE Standards 802.11and 802.15, [8], [9] and long-term evolution, to support different communication scenarios [2]. GPS: global positioning system.

V. D2DCS SECURITY

Security in D2DCS [7–8] is a challenging problem forresearchers in the era of cyber threats. The message passingfrom one drone to another drone may be trapped orhacked by an intruder or imposter who creates vulnerabilityin the systems performance. In D2DCS, many types ofattack occur on the system like Position Cheating [9, 10],GPS Information Hacking, ID Cheating, MessageModification, Spoofing and so on. Malicious drivers cancreate problems in the traffic which leads to accident andtraffic jam. Hence, the drones should use securitymechanisms to resist these threats.

VI. D2DCS PROJECTS

D2DCS implementation in a real time system is a challengingtask. Many such implementations have been deployed inrecent years and implementing such projects in a real timesystem requires complete simulation by measuring theperformance of the system. Many new projects have beenconducted by the government to develop ITS. The USA,Japan and the European nations are using the ITS systems by implementing D2DCS in the urban areas. Earlydevelopments mainly focus on the protocol infrastructure(WAVE, IEEE 802.11p and DSRC). However, now it isacquiring the new concepts of messaging system andapplication architecture.

VII. D2DCS SIMULATION

The mobility model [11] is a model or a set of rules fordesigning random network topologies by using simulators.It establishes connections between the nodes and performssome processes and activities between them. Role-basedmobility model [12] is a mobility model which separatesthe nodes according to their roles. It provides differentstrategies according to micro and macro-mobility. The mainlimitation of this model ineffectiveness is that it createsdifficulty in simulating complex traffic scenarios forexample; it creates difficulty while simulating bridges,tunnels and so on. Liu et al. [13] designed a tool calledVGSim which is an integrated and microscopic levelsimulation platform to model the road traffic accurately. D2DCS simulation required a complete,accurate andrealistic mobility model which is gained by collectingpatterns from mobility traces.

VIII. FUTURE RESEARCH SCOPE

D2DCS technology is gaining momentum as drones areincreasing in a rapid manner. Deployment of this advancenetwork is a necessity for many safety applications. The future of D2DCS is very bright as new ideas and scopesare coming up in recent times. Researchers are working inthese upcoming areas to provide safety and security tomankind. There are many research scopes which are to bemined to obtain new ideas and to provide services to thepeople.

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IX Conclusions

In this paper, we mainly surveyed the fundamentals of D2DCS, its architecture, standards, routing issues, securitychallenges, current projects, simulations, emergingapplications and future research problems. Researchers allover the world are mainly working on the current issues of D2DCS like broadcasting, routing, security, implementationand so on to expand the area of D2DCS technology. In the future, security is a main issue toimplement in D2DCS because many new types of attacksare being generated. This survey helps future researchers toobtain ideas about D2DCSsecurity. We have alsodiscussed the current D2DCS projects running in someparts of the world such as the USA, Europe and Japan. Drone companies are collaborating with the WHO to design newarchitectures which provide safety to the customers and thedrivers. We have also reviewed some simulators which helpthe researchers to select the best one for the implementationof D2DCS. We have briefly described the mobility model,traffic simulators, network simulators, isolated models,embedded models and federated models. We have presentedthe current and emerging applications of D2DCS whichprovides better services to the end users. At last, we have briefly described someof the future research areas in D2DCS.

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