Chapter 6
Wireless Mesh Communication Technologies and Protocols for a Full-View Camera Sensor Network Used in Maritime Surveillance

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ABSTRACT

Maritime oil exploration and transportation has increased more steeply due to the expansion of the world crude oil and natural gas production. The probability of oilrig pollution, burning, and explosion continues to rise. All these factors stimulate a greater danger for vessels, oil operation safety, and maritime environment. The continuous surveillance of the offshore oil fields and container vessels is essential to secure the production flow, avoid trespassing, and prevent vandalism from intruders and pirates. However, developing a large-scale camera sensor network (CSN) for a maritime surveillance is a challenging problem due to the environment complexity and network connectivity. Maritime wireless mesh networks (MWMNs) are envisaged to provide network connectivity in maritime environment and enable users to access the terrestrial communication networks. The high cost and low data-rate of satellite and other legacy maritime communication technologies and systems deployed in MWMNs pose a major limitation to establishing reliable and affordable maritime communications.

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INTRODUCTION

Due to the immense evolution of terrestrial wireless communication systems, numerous services and applications are brought to mobile users. However, the development of high data-rate maritime applications still requires more reliable communication technologies and routing protocols to meet the requirements of maritime communications (Boreli, Ge, Iyer, Dwertmann, & Pathmasuntharam, 2009). Despite the rapid development of satellite-based maritime communications, the satellite communication technology remains expensive due to the cost of launching satellite into orbit and the required stabilizers for on-board antennas. Legacy ultra-high (UHF) and very-high (VHF) frequencies based maritime communications have small capacity and cannot support high data-rate applications (Bekkadal, 2009). The existing maritime wireless and radio communication technologies can only support basic applications and services, such as text messaging, email, and web surfing (Son, 2011; Ta, 2011). On the other hand, maritime business applications show a steep ramp in deploying onboard ship management systems for logistic, surveillance, telephony or email applications, security and other transport-oriented applications. In addition, more maritime shipping companies are offering staff social multimedia communications onboard their ships. The trend to provide high data-rate applications for maritime users ultimately increases and diversifies the requirements of maritime communications, which cannot be converged with the basic maritime communication technologies such as satellite and legacy communication systems, from the data-rate, quality-of-service (QoS), and cost perspectives.

In the literature, a lot of research works have focused on the development of new and better maritime communication technologies; however, less attention has been devoted to integrate multiple maritime wireless networks and systems or expand terrestrial networks to the sea. To address this, a wireless mesh technology based on long-range wireless technology (WiMAX) is, therefore, a right candidate to expand existing terrestrial networks to form large-scale maritime networks in water environments (e.g. sea or ocean). The satellite broadband very small aperture terminal (VSAT) service is rapidly changing maritime communications, as it can provide high data-rate transmission, acceptable QoS and compatibility with IP networks along with the last-mile wireless access technologies, such as IEEE 802.11, IEEE 802.16 and 3GPP standards for cellular access networks (Mu, Kumar & Prinz, 2011). To efficiently utilize these wireless communication technologies, network resources have to be allocated in an optimal manner such that communication services can be provisioned to users with high quality. Seamless handover between different networks is also necessarily to automatically switch to the best underlying communication network and take the advantage of the readily available services within this network.