Global Educational Journal of Library and Information Science

Extended Abstract OpenAccess

Robotics-Edge M2M Communication Framework: A Study

AlaaBadokhon and Ammar Al Nahari

King Abdulaziz City for Science and Technology, Saudi Arabia

Introduction

Today, a spread of robots designed for various purposes is employed to help our lives. Network robot platforms are studied so as to enable service robots to supply services by working with sensors and appliances via a network instead of being standalone. Such network robots can take the shape of physical entities, software agents on appliances or sensors embedded within the surroundings. These three sorts of robot are respectively mentioned as “visible robots”, “virtual robots” and “unconscious robots”. A serious application of service robots is guide robots that provide direction guidance information to visitors to a mall. However, there has been no study on the way to identify malfunctioning robots from among many collaborating robots. In recent years, there has been a growing interest in machine-to-machine (M2M) communication. Systems are being studied that use interactions between machines via M2M communication to supply services to humans (end users) without requiring human intervention. While M2M communication is predicted to enhance the efficiency, safety or comfort of a spread of business operations, it also can be used for inter-robot communication. M2M communication protocols that are studied thus far assume communication over the web or mobile communication networks, like GSM, LTE, 4G or wireless LAN. No studies are made on store-carry and forward-type communication protocols, which are used for near field communication with mobile users. This study concerns a service during which virtual guide robots (simply mentioned as “robots”) and users’ mobile terminals work together using near field communication to guide individual users to their destinations. During this service, robots only display arrows to point the directions individual users should take. If a robot is flawed or infected with an epidemic, it displays an incorrect direction. This paper proposes a way of identifying such malfunctioning robots. Specifically, information on whether a particular robot is malfunctioning is transmitted employing a distributed cooperative protocol supported store-carry and forward M2M communication, which relies on user mobility. The paper also proposes a way of identifying malfunctioning robots using the Byzantine algorithm. The robots don't directly communicate with one another, but exchange information via users’ mobile terminals. For the identification of malfunctioning robots, we've introduced the concept of the pseudo-synchronization number, which makes it possible to spot malfunctioning robots even when items of data altogether of the robots aren't synchronized. Using simulation, we've evaluated the effectiveness of the proposed method in terms of the speed of identifying malfunctioning robots, the speed of reaching the destination and therefore the average length of your time to succeed in the destination. This paper is structured as follows. Section 2 provides an summary of existing studies. Section 3 presents the proposed architecture for enabling multiple robots to figure together. Section 4 proposes a way of identifying malfunctioning robots using the Byzantine algorithm. Section 5 describes the system wont to evaluate the proposed method. Section 6 presents the evaluation results.

Network Robot Services

Communication robots are studied as new devices that provide navigation or information services. samples of robots that mainly interact with a person's on a one-on-one basis and supply a service during a relatively static environment include people who explain exhibits in museums, people who act as receptionists at university buildings, people who support learning at elementary schools and people that assist healthcare at the hospital or reception. Additionally, standalone robot systems that provide an information service during a dynamic environment where people move around, like shopping malls, and networked robot systems, during which multiple robots work together, are developed. There are two sorts of networked robot systems. Within the first type, different robots play different roles (function sharing service). Within the second type, all robots play an equivalent role, are distributed within a given environment and work together to supply a service (collaborative service).

M2M Area Network A framework for M2M systems is being standardized in ETSI. Three sorts of M2M network are defined: M2M core network, M2M access network and M2M area network. The M2M area network supports networks on the device side. Two communication types are defined for this network. Within the first type, the gateway and devices are connected during a star-shaped network. Within the second type, devices communicate with one another directly. The latter communication is named D2D (device-to-device) communication. The M2M area network is meant with a stress on lowering power consumption by reducing the communication speed and distance. Communication systems used for this purpose are ZigBee, which supports PANs (personal area networks) designed for low-power networks, Bluetooth and wireless LANs, like WiFi. However, ETSI's framework doesn't cover the small print of D2D communication. The network being addressed by this paper falls within the category of D2D communication in an M2M area network. It's an inter-robot unplanned network using users' mobile terminals as conveyors of data. A store-carry and forward-type communication protocol is proposed for robot-to-robot (R2R) communication. 2.2.2. Security of M2M Area Networks a bit like the web, M2M area networks are subject to threats. Attacks may come from inside the M2M area network or from an external network. If the M2M area network may be a D2D unplanned network, it's going to be subject to passive or active attacks from malicious devices. An example of a passive attack is that the region attack. Active attacks are often classified into spoofing, falsification of control packets, excessive transmission of false packets et al. at the packet level, also as illegal operations at the appliance level. The proposed M2M area network may be a store-carry and forward-type R2R unplanned communication network. Typical attacks on this network are often classified. This paper proposes a way of detecting active attacks at the semantic level. Function sharing services Collaborative services (addressed by this research) Dynamic environment during which people move around Relatively static environment Heterogeneous robots work together Homogeneous robots work together Robot services Standalone robot system System during which multiple robots work together Standalone services Environment Whether robots work together Homogeneous/ Heterogeneous robots Service provision type Same. Classification of robot services and therefore the position of this research. 2.2. M2M Systems and Security 2.2.1. M2M Area Network A framework for M2M systems is being standardized in ETSI. Three sorts of M2M network are defined: M2M core network, M2M access network and M2M area network. The M2M area network supports networks on the device side. Two communication types are defined for this network. Within the first type, the gateway and devices are connected during a star-shaped network. Within the second type, devices communicate with one another directly. The latter communication is named D2D (device-to-device) communication. The M2M area network is meant with a stress on lowering power consumption by reducing the communication speed and distance. Communication systems used for this purpose are ZigBee, which supports PANs (personal

area networks) designed for low-power networks, Bluetooth and wireless LANs, like WiFi. However, ETSI's framework doesn't cover the small print of D2D communication. The network being addressed by this paper falls within the category of D2D communication in an M2M area network. It's an inter-robot unplanned network using users' mobile terminals as conveyors of data. A store-carry and forward-type communication protocol is proposed for robot-to-robot (R2R) communication.

Abstract

In the context of modern manufacturing and the industrial revolution, robotics and communication technologies are playing a major role in effectively enhancing manufacturing process overall. Though with recent technological advancements, more challenges in robotics process automation and context-awareness are arose, demanding more intelligent robotics systems. Thus, we studied and analyzed implementing an edge-computing communication framework in the context of stationary and mobile robotics. In this study specifically we demonstrate the differences between non-connected robotics, centric cloud connected robotics, and edge-computing coordinating robots. In addition, we illustrate that edge-computing and coordinating robots help in resolving some of the challenges in current robotics systems, including distributed systematic adaptability, rapid manufacturing and robot teaming in the industrial context.

Conclusion

This paper concerns a service during which robots guide users to their destinations. It's proposed a store-carry and forward-type M2M communication protocol enabling robots to figure together and a way of identifying malfunctioning robots using the Byzantine algorithm. The effectiveness of those has been evaluated using simulation. It's been shown that malfunctioning robots are often identified correctly by making robots share information about how other robots judge other robots. The speed of identifying malfunctioning robots improves because the number of users increases because a rise within the number of users, who pass information about malfunctioning robots from one robot to a different, provides a greater opportunity for robots to share this information. We've introduced the concept of the pseudo-synchronization number. Use of this number makes it possible to spot malfunctioning robots at a percentage of 70 or 80, even when each robot has not collected information about malfunctioning robots from all of the opposite robots.