**Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)**

**Submission Title:** IG DEP Development of Wireless System for Social Public Services

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**Re:** IG DEP Development of Wireless System for Social Public Services

**Abstract** Reliable and secure wireless remote sensing system for social public services including water pipeline and gavage collection systems using wireless networks

**Purpose:** This document has been prepared for response to call for interest(CFI) of IG-DEP(Dependability).

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IEEE 802.15 IG DEP

Review of Responses to Call for Interest (CFI)

Development of Wireless System for Social Public Services

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Agenda

Background

Updated New Type of Equipment Diagnosis System by using wireless sensor devices

Required specification

Future Activity
Expecting Major Applications of Dependable Wireless Networks

All current serving network systems for social public services are requested to be renewed more reliable, secure, resilient, heavy duty, robust and safer by local and national governments.

Major applications for
- Disasters such as earthquake, tsunami, typhoon, hurricane, water flood etc:
  - Disaster prevention
  - Rescue and evacuation
  - Recovery

- Social service infrastructures:
  - Water supply and control networks
  - Gas supply and control networks
  - Electricity supply and control networks
  - Public wastes collection system
  - Other city services
Demands for Dependable Wireless

Population Ageing & Medical crisis
Healthcare Service (Medical ICT)

Cost of energy ... fuel supply & demand
Energy Network (Smart Grid)

Increasing environmental requirements
CO_{2} Reduction, Green Innovation

Escalating security concerns
Public Safety, National Defense

Heightened investor demands
Global Borderless Economics

Dependable Wireless BAN: IoT & M2M

Reliable and Secure Social Public Services by Government
Water Pipeline Maintenance System

- Control terminal with communication module
- Remote controlling robots inside a pipe using remote video image
- Image recognition system to detect damages
  - Autonomous Remote Sensing damages inside pipes with images and maintaining systems using existing sensors as well.
- Gap of Connection, Cracks in Pipes
- Compact install in a small vehicle
- Sensor Network inside water pipes
- Dependable Sensing and Controlling With low coast
- Central controlling robots using video image and record
- Realtime Remote Monitoring by Implant Mobiles
- Remote Maintenance Systems for Pipelines of Water and Gas need highly reliable and secure wireless links which should be robust against any interference.
Public Wastes Collection System

Social Facility of Smart City Santander in Spain
The Santander testbed is composed currently of around 2000 IEEE 802.15.4 devices deployed in a 3-tiered architecture.

Key Functions
Validation of approaches to the architectural model of the IoT. Evaluation of the key building blocks of the IoT architecture, in particular, IoT interaction & management protocols and mechanisms; device technologies; and key support services such as discovery, identity management and security.
Evaluation of social acceptance of IoT technologies and services.

Refereed from http://www.smartsantander.eu
Wireless Sensor Network for Public Wastes Collection

Optimization of wastes collection by utilizing sensor and M2M network has been operated since 2014 with ASCAN as the first practical application of Smart City.


- Transmit volume of wastes with its location information via M2M network in real time.
- Analyze above information and display the optimized route and timing on onboard monitor in collection vehicles.
- NEC and ASCAN to launch pioneering smart waste collection service in Santander
- Real-time data on bin levels enables city to optimise collection intervals and routes and reduce refuse vehicle emissions and running costs

Combination of sensor, M2M network and big data analytics

- Efficient collection
- Cost reduction
- CO2 reduction
- Relaxation of traffic jam
- Improved community environment
Have Current and Challenged Wireless Solutions

- Several trials using existing wireless technologies of
  - Mobile phones (3G, 4G),
  - WiFi, Bluetooth,
  - 900MHz public services
  for mature and reasonable cost technologies.

- Designed and implemented some prototypes for
  - Disaster rescue
  - City social services such as water supply and maintenance and waste collection

- Required dependable performance has not been satisfied.
- Radio regulations do not approve for frequency allocation.
Further Demands for Current Systems

- Social insurance services request much reliable and secure wireless connection and permissible feedback delay in sensing and controlling than existing CE applications.

- Performance not sufficient for their requirements
  - Guaranteed network connection not sufficiently robust.
  - Localization and Ranging capability of damage position should be accurate with permissible delay in real time monitoring and maintaining systems.
  - Governmental social public serves should be guaranteed to reliability, efficiency, effectiveness, regular services with reliable and secure networks.
Expecting Performance Requirements for Forthcoming Services (1/2)

- Single radio solution for both normal and emergency use cases.
- Variable communications range, max. 1 kilometer link distances.
- Requirement, standard definition video transmission.
- Max. 100 devices within communications range.
- Prioritized access for rescue personnel, lower priorities for normal users.
- In emergency environment, on-demand coordinator conflict resolution.
- According to variance of service environment, government social public service system should be guaranteed stability.
Expecting Performance Requirements for Forthcoming Services (2/2)

- Pseudo real time sensing and controlling with permissible in disaster places and social service infrastructure systems.
- Federal and local government have to guarantee such emergency public safety and public supply services.
- Collaborative sensing with sensor arrays and sensor networks can solve these problems technically but radio regulation may not assume reasonable topologies such as star, tree, multi-layer topologies.
  - Multiple access control scheme matched with wireless remote sensing and controlling systems with limited feedback delay.
- Applicable for both emergency case and usual case.
Required specification
Specification for Social Public Services System

1. Public Satisfaction
   1. Local and national government services should satisfy taxpayers with enough high QoS in any environment.
   2. Services should be adaptive for varying environment.

2. Economical and Efficient Services
   1. In order to prolong a life time of measuring device to save energy and have good efficiency regarding communication power.
   2. System should be robust against any wireless communication environment.

3. Dependable Social Infrastructure
   1. In order to adapt varying environment, the system should sensing environment as well as targeting services and adapt the system by remote controlling.
   2. Social services should be guaranteed worst performance enough high rather than average performance.
Assumed Upper Layer IoT/BigData/DataMining System for Dependable Wireless Social Public Services

Various transmission media available
- Wired
- Satellite
- Cellular
- WiFi
- Etc.

Interrelated data sources
- Vital data
- Social interaction
- Location information
- Environmental data

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Future Activity

1. Improving Current Social Service Systems with Dependable Short Range Wireless Networks
   1. Highly reliable real-time measuring with short range radio sensor network
   2. Highly secure decision immediately with measured data by wireless network of various sensors and past recorded data
   3. Strongly protected alarm and commands to equipment in a line for dependable remote monitoring and maintenance

2. Entire Social Public Service System Using IoT/Big Data/Mining through Cloud Network Using Dependable Wireless Real-time Feedback
   1. Build up individual dependable wireless networks corresponding to different demands and requirement.
   2. Entire common central management system using various dependable wireless networks through IoT/Data Mining server with cloud network

3. International Standard for Dependable Social Public Service Network Establishment with All other Institutes and Companies
   1. According to demands and requirement, various manufactures should make a common standard social public service system using wireless dependable short range sensing and controlling network with economical and efficient social services.
   2. IEEE802.15 may be the best venue of establishing a standard of dependable wireless feedback network for global common social public service systems.