Chapter 9
Search and Rescue System Based on NB– IoT Wearable Device

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ABSTRACT

This chapter presents the design and development of a search and rescue (SAR) system, for the location and provision of aid to people who are missing or in imminent danger, especially those belonging to population groups with a particularly high probability of getting lost. With the use of low-power wide area network (LPWAN) technology, such as narrow band internet of things (NB-IoT), the authors are able to provide search and rescue solutions for individuals, especially those belonging to groups of people who are more likely to get lost. The central part of the system is a modular "wearable (portable)" device, while in the framework of the implementation of this system, the authors have seriously taken into consideration the aspects of energy efficiency in order to provide better battery life.

INTRODUCTION

Nowadays, Internet of Things (IoT) has been established in our everyday life, as it offers several capabilities. So, more and more devices and systems are being created in order to offer solutions that need technologies that can interconnect wireless devices over long distances. One candidate that tries to solve this is Narrow Band Internet of Things (NB-IoT) technology as part of 5G networks. So, it is necessary to study this kind of technology, because the IoT market is gaining exponential popularity introducing more solutions, and our lives can be improved in various ways.

Among other applications, NB-IoT provides some very appealing applications in the field of search and rescue (SAR). NB-IoT's low power consumption and long range transmission can support many SAR scenarios including emergency situations due to natural disasters, missing people, accidents both on land or sea areas, supports of children wandering, and support of people with specific diseases like dementia.

This chapter presents the design and development of a SAR system, named WeSAR (Wearable Based Search And Rescue system), for the location and provision of aid to people who are missing or in imminent danger, especially those belonging to population groups with a particularly high probability of getting lost. The central part of the system is a modular "wearable (portable)" device, while the algorithms for locating the person(s) carrying the device and indicating her/his/their vital signs/condition will play an important role in its effectiveness.

The basic feature of the WeSAR wearable device, in the framework of project WeSAR, is its basic communication capability with base stations located even at several kilometers away from the device using low-power and long-range communication protocols like NB-IoT. In addition, the basic parameters of communication, such as the rate and power of data transmission, will be tailored to the specific conditions of the application, so that the battery life of the device functions properly for several days and even weeks.

The development of the algorithms will be done using simulation to detect underperformance and optimize the results. The implementation of the prototype will be based on the combination of modules on a dedicated IoT development board. Software development will be done through a continuous integration methodology to test the developing system at an early stage.

The WeSAR system will be used in situations where people are at risk, due to moving away from a controlled area. These cases can be due to the impaired mental state or inability to react, while they are away from their familiar environment. Indicatively:

- People in autism spectrum disorders (Lord, C.et al. (2000)).
- People suffering from some form of dementia (Cummings, J. L. (1990)).
- Toddlers and children wandering in large open-air entertainment places.
- Workers at work sites or other sites with high levels of activity and increased risk.
- Missing people out of range of local or broadband networks, such as in the case of maritime accidents.

The WeSAR wearable communication with the base station will be two-way so that the missing person knows that his position has been received as well as to receive instructions or estimated rescue time. The device will support an emergency alert function with the press of a panic button. With the appropriate sensors, it will be able to inform rescuers about the physical condition of the missing person so that, in conjunction with positioning, they can make the right decisions about rescue strategy.

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