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Implementation of Emergency Monitoring System using Anycast Routing

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Abstract **– This paper present a reliable transmission protocol which is based on anycast routing for wireless patient monitoring. This scheme automatically selects the nearest data receiver in an anycast group as a destination to reduce the transmission latency as well as the control overhead. This new protocol also shortens the latency of path recovery by initiating route recovery from the intermediate routers of the original path. On the basis of a reliable transmission scheme, we implement a RF device for fall monitoring, which integrates fall detection, indoor positioning, and ECG monitoring. When the triaxial accelerometer of the device detects a fall, the current position of the patient is transmitted to an emergency center through a RF network. This transmission scheme will ensures the successful transmission of these critical messages.**

Keywords **– Anycast, Broadcast, ECG, Multicast, Patient Monitoring.**

I. INTRODUCTION

In this we present a reliable protocol of packet forwarding that transmits emergency messages with vital signs on a multihop network. We deploy multiple data sinks in a network. Our protocol uses anycast to find the nearest available data sink. When the path to the original data sink fails, our protocol automatically selects another data sink as the destination. The transmission path is rebuilt from the last node before the failure link; hence, the latency of path recovery is shorter than that for the unicast-based approach. As compared with multicast/ broadcast approaches, our protocol significantly reduces the traffic overhead while maintaining the reliability at the same level.

System Overview –

In this we will employ RF modules to build a home physiological monitoring environment, as shown in Fig. 1. The data receiver is connected to a terminal through an RS-232 interface. When the sensor node detects a fall event, it determines the location of the sensor node by using the indoor location procedure. Then, it sends a fall event message with the address of the closest router node to the data receiver by using the proposed anycast routing protocol.

When the data receiver receives the fall event message, it forward the message to healthcare professional. The healthcare professional will received the fall event message with the patient location and ECG signals can display the patient information through a computer software.

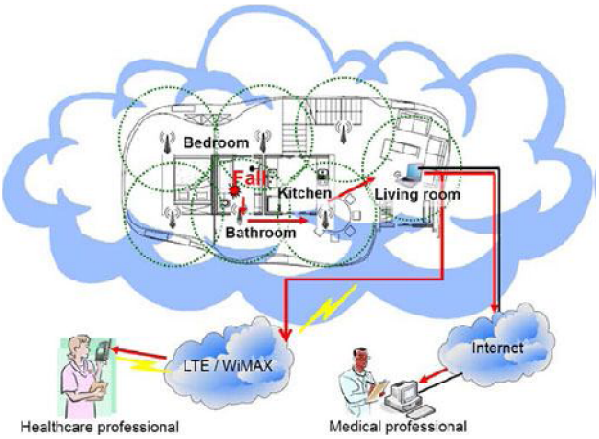

Fig.1. Architecture of wireless patient monitoring system.

Communication Modes –

Data transmission can be categorized into four modes, namely, unicast, multicast, broadcast, and anycast. Anycast is a new network routing approach in which messages from a sender are routed to the topologically nearest receiver in a group of potential receivers. The group is called an anycast group,[1] and the receivers in the same anycast group are identified by the same anycast address. Anycast can be treated as a subclass of multicast that finds the nearest receiver. As compared with the other communication modes, anycast has lower traffic overhead than broadcast and multicast. Anycast also has better reliability than unicast since it is capable of selecting a new receiver. However, anycast routing increases the complexity of the network devices. The pasth recovery latency of anycast is also longer than that of multicast/broadcast. A better balance between the implementation complexity and the path recovery efficiency is thus critical to the successful deployment of an anycast-based protocol.

We list the properties of these transmission modes in Table 1.

Table 1: Transmission Modes

Property \ Mode	Unicast	Multicast	Broacast	Anycast
Communication Mode	One to One	One to Many	One to All	One to Any
Membership	Single	Multiple	Multiple	Multiple
Destination	Node	Group	All	Group

II. METHODOLOGY OF SYSTEM

Purpose of this paper is to implement such a System for fall monitoring, which integrates fall detection, indoor positioning, and ECG monitoring [1]. When the tri-axial accelerometer of the device detects a fall, the current position of the patient is transmitted using the Anycast routing algorithm to an emergency center through a RF network**.** The developed system consists of 2 separate units. They are as follows :

1. Patient Unit:

This unit will contains all sensor nodes, controlling mechanism, fall monitoring mechanism, signal processing and conditioning and also anycast routing mechanism.

2. Server Unit

This unit will simply have data Rx and that data will be stored on PC. And after that using Internet will be transferred to the healthcare professionals for further analysis.

III. SYSTEM BLOCK DIAGRAM

Patient Unit

ECG signal is captured by electrodes and is allow to pass through the series of filters in order to remove spikes and noise component associated with an ECG signal. Opto-Isolator is used in order to preventing human body from getting electric shocks.

When fall event is detected by Accelerometer, ECG signal is captured and send to the server end using anycast routing. Also, When the sensor node detects a fall event, it determines the location of the sensor node by using the indoor location procedure. Then, it sends a fall event message with the address of the closest router node to the data receiver by using the proposed anycast routing protocol which is as shown in Fig. 2

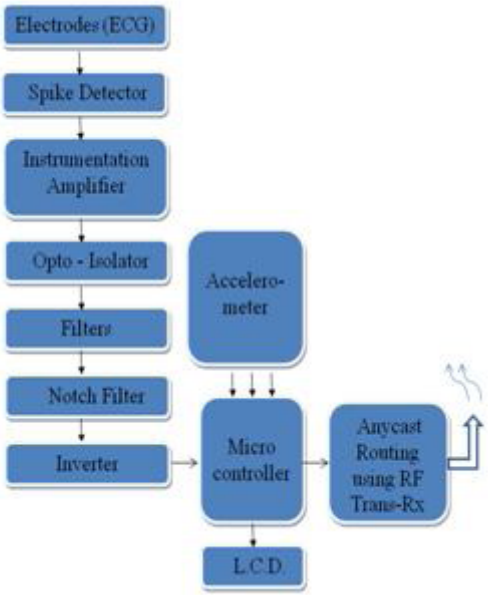

Fig.2. - Patient Unit

RF trans-receiver has an inbuilt RSSI system which we are going to use for the indoor location procedure. When fall is detected, the node that has highest value of RSSI among the other nodes will receive the ECG signal along with location. And that will be transmitted to server end using anycast routing.

Server Unit

At server end ECG signal will be collected on PC through RF Rx which is coming from patient end and through Internet the information will be send to the medical professionals for further analysis and controlling.

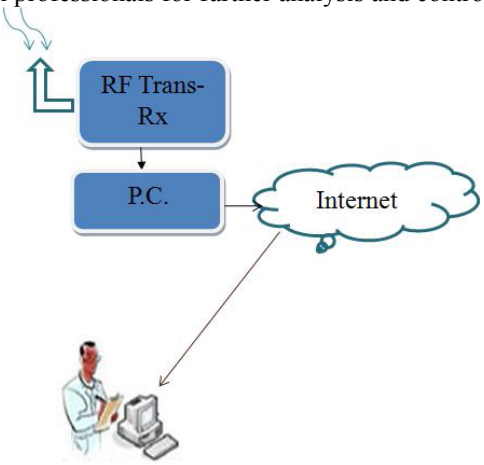

Fig.3. Server Unit

IV. IMPLEMENTATION

A. Hardware

1. ECG electrodes: Here we are using suction type of ECG electrodes.
2. Accelerometer Sensor: Here we are going to use accelerometer ADXL-335.
3. RF Transreceiver: RF Module used is CC2500.
4. Control Unit: The 32 bit ARM microcontroller LPC2138 is the main part of the control unit.

B. Software

Keil is used for coading of ARM LPC2138 and for fall detection algorithm.

Algorithm

First, it (Accelerometer Sensor) will calculates *SVMa* (sum vector magnitude of accelerations) continuously. As soon as the value of *SVMa* is larger than 6 G, the fall detection scheme will give alarm directly because the values of *SVMa* on daily activities are all under 6 G. If the value of *Sh* (acceleration on the horizontal) is bigger than 2 G, that means the body tilts forward or backward acutely. Then it will use continuous 0.3 s stable *SVMa* within 2 s to estimate whether the faller is at rest or not. If the faller is at rest, it will integrate *V*ref (reference velocity) during the falling duration.

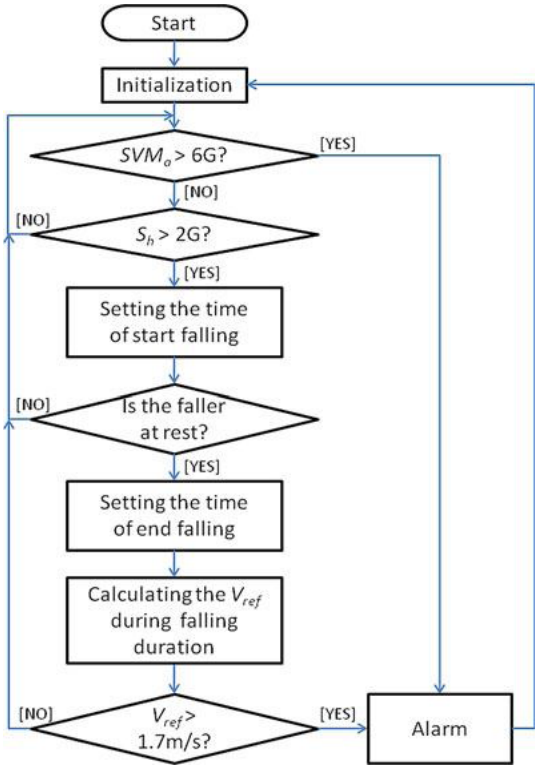

Fig.4. Fall detection algorithm

C. Advantages

1. Lower traffic overhead
2. Better reliability
3. Shorter latency of path recovery

D. Disadvantages

1. Expensive
2. More complex to deploy.
3. Anycast DNS is more difficult to manage and troubleshoot
4. Monitoring Anycast is also more difficult.

E. Applications

1. Elderly caretaking.
2. Nursing homes & hospitals.

V. CONCLUSION

In this project, we want to develope reliable anycast routing protocol for wireless patient monitoring. These scheme selects the closest data sink as the destination. Therefore, the latency of route query and the number of control messages can be reduced simultaneously. Therefore, We implement a prototype of fall monitoring system based on the new routing protocol. In the system, we integrate a tri-axial accelerometer and an ECG sensor to achieve real-time fall detection and physiological monitoring. When a fall event is detected, the closest router node to the sensor node is calculated by using the indoor location procedure. Then, it sends a fall event message with the address of the closest router node to the data receiver by using the proposed anycast routing protocol.

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