

Indoor Positioning System for Moving Objects on an Indoor for Blind or Visually Impaired Playing Various Sports

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Abstract – We have proposed an indoor positioning system for moving objects and / for the blind or visually impaired to play various sports. [for a blind or visually impaired playing various sports.] This system consists of a wireless heart rate monitor, wireless sensor network and / 4 ultrasound satellites [configuration with four ultrasound satellite modules) at the corners of the room. This system provides / the real-time measurement of the location and heart rate of the person in the room[non-invasive measurement method of the heart rate and the location of a person in real time], and will help the [a] blind or visually impaired enjoy sports more easily.

Keywords: Indoor positioning system, the blind or visually impaired, / sports assist[sports assistance] systems.

1. Introduction

Today, the blind or visually impaired have improved their quality of life using various technologies. [People who are blind or visually impaired are using various technologies to improve quality of life in today]

Recently, they have begun to use walking assist[assistance]systems using [with using] GPS and Ultrasound technologies, various visual assist[assistance] tools and / computer programs for more developed walking and learning [more developed computer programs for their walking and learning]. But /enjoying sports is not as easy for them. [it is not as easy as they enjoy playing sports] Sports require the use of many visual senses and / few sports assist systems are available. [Assistance systems are available in few sports]



Fig. 1. Blind sports example, soccer

Currently, only trained blind people can enjoy soccer and table tennis due to their sensitive hearing and touch. / This research responds to these needs by developing a sports assist system. [In responds to these needs, this considered a sport assistance system.] We use ultrasound satellite [modules] and wireless sensor network technologies /to detect an opponent's location [to detect locations of opponent] and /deliver this information to a vibration belt used by the blind or visually impaired.[this information of location is delivered to a vibration belt on the blind or visually impaired.] This system will help them enjoy the sports [will help them to enjoy sports] more easily and will improve their quality of life, sociality and confidence[self confidence].

2. Background

This system uses 3 background technologies consisting of a body area network, an indoor positioning system and a wireless sensor network.[This system equips with a wireless body area network, an indoor positioning system and a wireless sensor network consisting of technologies of 3background] / In the body area network [In wireless body area network[BAN]], / the heart rate measurement belt[A measurement of heart rate] is worn on the chest of the individual's body. The [A] measured heart rate information is delivered to a display device on / a wrist [a wrist watch or band] and headband-type transmitter through a 5 kHz magnetic field link. Indoor positioning systems use a 40 KHz ultrasound link. The ultrasound wave is generated by the headband device and delivered to

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an ultrasound satellite [satellite modules] / at the corner of the ceiling [on a ceiling of a corner] to detect the [a] location of the [a] person. The wireless sensor network uses a 2.4 GHz UHF band link and delivers a heart rate, location information and ID number of each person in[on] the network.

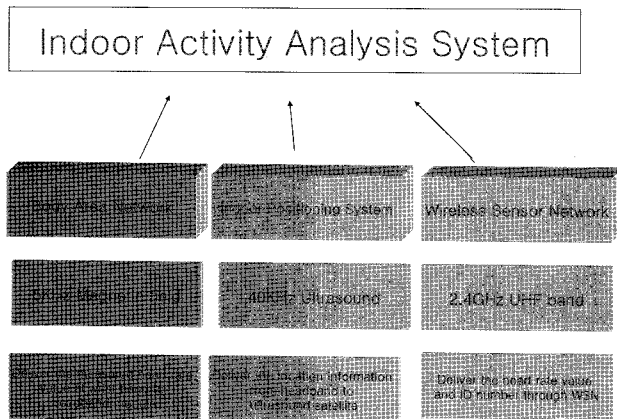


Fig. 2. Overview of indoor activity analysis system

3. Organization

This system consists of a heart rate monitor worn on the [a]wrist, ultrasound and RF transmitters on the[a]head and ultrasound satellite [modules] on the ceiling. For the construction [system construction] of a wireless sensor network, the system includes a fixed-node, wireless repeater, base station and / location detection monitoring software. [monitoring software of location detection system]

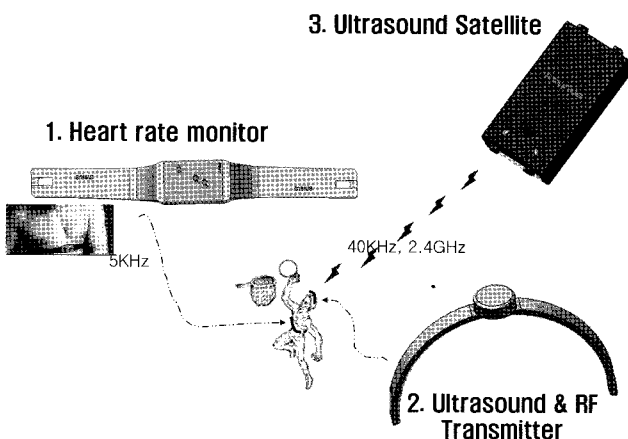


Fig. 3. Organization of the system

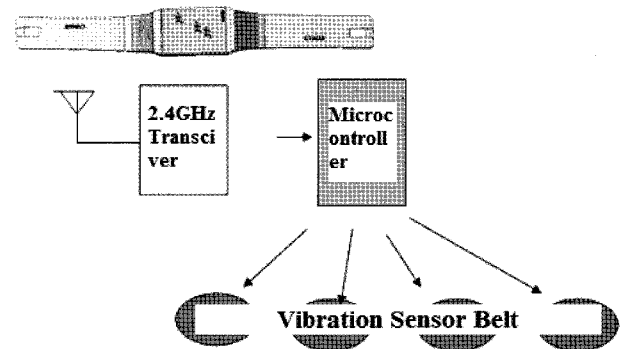


Fig. 4. Vibration sensor belt for the blind or visually impaired [A belt sensor vibration for a blind or visually impaired]

Especially, this system uses / belts vibration sensor [belt vibration sensor is used to this system] for the[a] blind or visually impaired. / Vibration sensor belts give direction and distance information to them [Belts vibration sensor give them information of direction and distance]. The belt has 4 vibration sensors representing 4 directions, so the vibration sensor can provide / an[x] individual with accurate direction information [individual information with accurate direction]. /Also, the length and strength of the vibration signifies the distance. [Also the length and strength of the vibration signifies that the distance between the sensors]

4. Operation

The heart rate monitor worn on the wrist sends the[a] data to the[a] headband using a magnetic field pulse [a magnetic field pulse generator]. The headband's microcontroller receives the data and transmits it with the headband's ID number through the UHF band. Ultrasound pulses are also generated /in the same way [in the same way as UHF] with an RF wave. Ultrasound and UHF band waves /are transmitted simultaneously[are transmitted simultaneously to the heart rate monitor], but UHF band waves are faster than ultrasound waves. /The delay[The delayed time] is [within] a few milliseconds. Four ultrasound satellites are installed /at each corner of ceiling[on a ceiling in each corner] . The ultrasound satellite [module] consists of an ultrasound receiver, UHF transceiver and a wireless sensor network module.

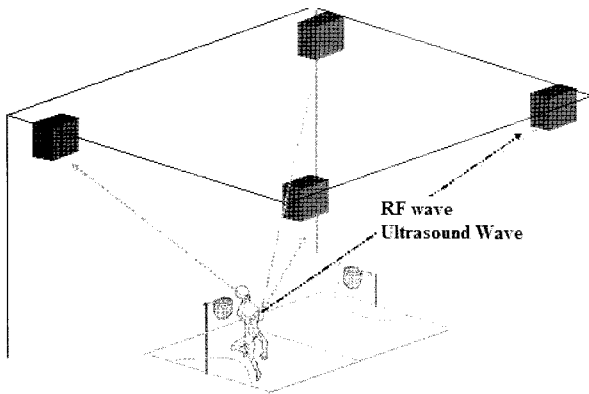


Fig. 5. Operation process of the system 1

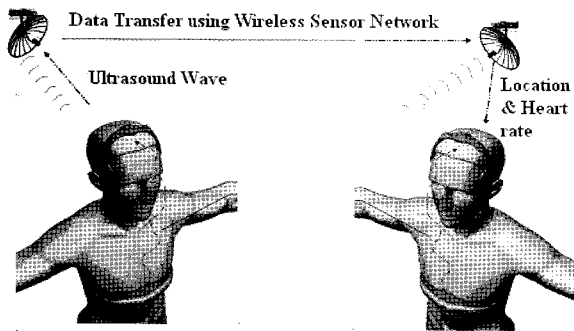


Fig. 6. Operation process of the system 2

Depending on the subject's location, /ultrasound pulse arrival time [an arrival time[data] of ultrasound pulse] is different [from those system]. However, the UHF band wave arrives simultaneously so each receiver starts counting time as soon as the UHF band wave begins to measure the arrival time of the ultrasound pulse. Using [By using] this method, we can calculate the location of the person. /This location and heart rate data [those data of the location and heart rate] is transmitted to the wireless sensor network with an ID number.

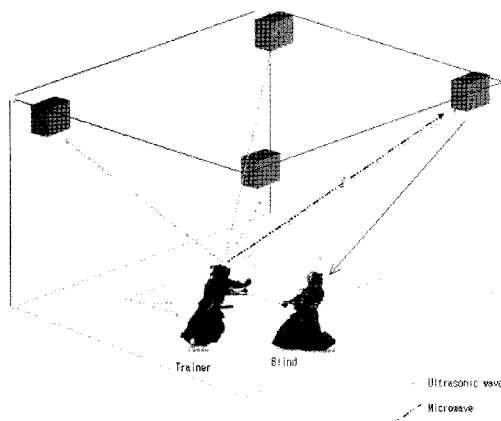


Fig. 7. Operation process of the system 3

Fig 7 shows the operation process of the[a] sports assist [assistance] system for the blind or visually impaired. / The example is Gumdo, a popular sport in Korea [For example, there is Gumdo, one of the popular sports in Korea]. When the trainer approaches a blind person, the[a] direction and / distance information are delivered to the blind person by this system. [Information of a direction and distance is delivered to a blind person with this system] Consequently, the blind person can prepare / for defense or attack. [for defense or attack behavior]

5. Conclusion

In this research, we explain the background technologies such as / body area networks[wireless body area network], indoor positioning systems and wireless sensor networks. We also show the organization [structure]of the system consisting of a heart rate monitor worn on the wrist, ultrasound and RF transmitters worn on the head and ultrasound satellite[modules] located on the ceiling.

Lastly, we confirm how this system can be used in indoor activity analysis by[through] the operation process of this system. We use ultrasound satellite [modules] and wireless sensor network technologies to detect the opponent's location [a location of opponent] and deliver this information to a vibration belt used by the blind or visually impaired.[this information of location is delivered to a vibration belt on the blind or visually impaired.]. This system will help them enjoy sports[will help them to enjoy sports] more easily, and will improve their quality of life, sociality and confidence[self confidence].

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