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Virtual Security Zones for Student Tracking System Using GPS Watch

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Apbstract

This Project is to design and develop a smart **GPS** watch that will track the position of the attached person (ex: school children & elderly), monitors for a sudden fall and alerts the authority in the event of a fall or when that person crosses a given border line of a predefined zone using a combination of **GSM** and **WPAN** radio communication. Since this is a security system, GPS watch should be always attached to the monitored person and removing or damaging this device should be prohibited. To achieve this, a **Flexi Force Sensor** is attached to the back of the device and it senses the grip force of the device with the user skin. The device will send an SMS to the authorities if the device gets tampered or removed by any means. This system is going to implement a **ARM Cortex-M3** microcontroller.

Keywords: LPC 1313, 32-bit ARM Cortex-M3, ADC,GSM Cellular Modem, IEEE 802.15.4 Transceiver, Flexi Force Sensor

Introduction

Security for students in Children's School and Colleges has become a serious problem these days. The school/college authority and the parents want to know whether the student is within the campus area or not. Elderly citizens also need to be monitored for preventive within a zone like hospital. Elderly fall alert has been a researched subject for years. Securing could be achieved based upon a number of security lookouts making security checking rounds (on foot or by vehicles) inside the school. Other way is to use security camera-based systems. Nonetheless, such systems need to be monitored on the fly by a person and the attacker otherwise may be wearing a mask or dressed as a security guard which makes it undependable.It is an effective and low cost security system made by GSM and WPAN to secure the buildings and faculties of a school.

A wireless sensor network (WSN) is a wireless network consisting of spatially distributed autonomous devices using sensors to helpfully monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants, at different locations, and are now used in many industrial and civilian application areas, including industrial process monitoring and control, machine health monitoring, environment and habitat monitoring, healthcare applications, home automation, and traffic control.The system could be setup in either of the two modes OUT and IN. In the OUT mode, it helps school and college administration to prevent students from crossing an invisible fence that alerts school authority via SMS when they leave the zone. During the IN mode, the system could be used to prevent a student from reaching into a protected or dangerous area within the campus premises. Since this is a security system, GPS watch should be always attached to the monitored person and removing or damaging this device should be barred. To achieve this, a FlexiForce Sensor is attached to the back of the device and it senses the grip force of the device with the user skin. The device will send an SMS to the authorities if the device gets tampered or removed by any means. To disable this security lock feature an authorized user could simply press the enable-disable button in the central control unit using a Keypad.This system can also be applied in monitoring elderly. When an elderly falls, a 3-axis Digital MEMS Accelerometer sensor in the watch could sense this and alert the central unit via wireless communication which inturn will send SMS about the fall location to the necessary person or to the hospital.

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Related works

In [1] B. Najafi, K. Aminian, F. Loew, Y. Blanc, and P. A. Robert proposed a system to evaluating the characteristics of postural transition (PT) and their correlation with falling risk in elderly people is described.The gyroscope consists of vibrating element, activity as coriolis sensor, an apparent force that arises in the rotating reference frame and it is proportional to the rate of rotation.Then the coriolis acceleration measurement is used by piezoelectric gyroscope.

In [2] S. J. Preece, J. Y. Goulermas, L. P. J. Kenney, D. Howard, K. Meijer, and R. Crompton is to abstract the accelerometer signals from 14 subjects.Accelerometer data is collected by monitoring the three activities. They are waist, thigh, ankle. By using wavelet transform, the accelerometer signal is decomposed .Accelerometer signal is unglued by ac & dc component by using low pass filtering.By using more than one sensord they improve the accuracy.

In [3] L. Fernandes and A. Soares to describe the urban environment to predict the power level acknowledged in mobile communication systems**.** It considers the morphology of the environment as a function of area occupied by buildings.Building densities, ranging between 1% and 77% was evaluated for three different location.They are the signals in the 900-MHz frequency band, distances between the transmitter & receiver were between 100 and 2000 m, and transmitting antenna height was below the average building height.

In [4] T. Chiwewe and G. Hancke Capable of constructing networks to characteristics the sparser connectivity, lower transmission power, and a smaller node degree. It is used to design wireless ad hoc and sensor networks. By producing network topology, It can reserve global activities that the node in the network make decision about power transmission.

In [5] P. Pathak and R. Dutta to classify the fundamental wireless mesh networks(WMN).The design problems of interference modeling, power control, topology control, link scheduling, and routing, and deliver brief overviews, with special stress on joint design methods.

In [6] F. Bianchi, S. J. Redmond, M. R. Narayanan, S. Cerutti, and N. H. Lovell used a barometric pressure sensor, is used to decisive real fall events from normal activities of daily living. Here a fall detection algorithm was used to assessment the change in approach associated with a fall.It is used to reduce the false positive rate of the accelerometer.

In [7] L. Tang, K.-C. Wang, Y. Huang, and F. Gu is a series of measurements were made with IEEE 802.15.4-compliant sensor radios to know both spatial and temporal characteristics of the factory surroundings found in a university machine shop. Complex dependency on blocking, path loss is showed in path distance and multipath effects caused by the surrounding structures was showed.

In [8] D. M. Karantonis, M. R. Narayanan, M. J. Mathie, N. H. Lovell, and B.G. Celler presents the operation of real time system for the human movement associated with the data using waist mounted triaxial accelerometer unit.To develop this some constraints should be satisfied.The limited amount of data can be buffered.To determine postural orientation the gravitational component of the triaxial accelerometer is used to deal with static accelerometer.

In [9] B. Najafi, K. Aminian, A. Paraschiv-Ionescu, F. Loew, C. J. Büla, and P. Robert presented a method to observing the physical activity. It is detecting the body postures, transition and activity. Then a kinematic sensor is attached to the subjects to detect the body postures.To evaluate the system,three studies were performed.First testing on community dwelling on 11 elderly subjects,second system was tested for classifying PTs,third monitoring for performed.

In [10] T. Tamura, T. Yoshimura, M. Sekine, M. Uchida, and O. Tanaka developed a fall detection system that uses both acceleration and angular velocity signals.A fall detection algorithm has been used by thresholding technique with an accelerometer and gyro sensor. A triaxial, single-unit accelerometer and angular velocity sensor, the jacket's compact design, and its battery-powered are the key characteristics of fall sensor.

In [11] M. R. Narayanan, S. J. Redmond, M. E. Scalzi, S. R. Lord, B. G. Celler, and N. H. Lovell defines the derivation of fall risk model.physiological profile assessment (PPA) use the parameters of body sway, lower limb strength, visual activity, proprioception and reaction time.The fall risk factors and paramaters extracted from sit to stand (STS) transfer to high and low risk.

In [12] B. R. Greene, A. O. Donovan, R. Romero-Ortuno, L. Cogan, C. Ni Scanaill, and R. A. Kenny here Timed Up to Go (TUG) test was used for stability

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problems in older people.The body worn Kinematic sensors also used.Then it is used to quatify the TUG test and provide a comprehensive quantitative analysis of timing , gait and stability for each segments.

In [13] T. M. Chan, K. F. Man, K. S. Tang, and S. Kwong has proposed a jumping genes paradigm to improve the wireless local area network for an integrated circuit. A jumping-gene genetic algorithm (JGGA) is used to solve the WLANs base station placement for the environment of IC factory.Multiobjective evolutionary algorithms (MOEAs) is used.In a single simulation run, multiple Pareto-optimal solutions can be obtained without limiting the search space.

In [14] V. Gungor, B. Lu, and G. Hancke it presents a statistical characterization of the wireless channel in different electric-power-system environments. In IEEE 802.15.4-compliant wireless sensor nodes field test have been performed.The system is to measure the background noise , channel characteristics and attenuation.To measure the radio link quality, link quality indicator (LQI) and received signal strength indicator (RSSI) is used.

Results and discussion

There are various techniques by using sensors, wireless sensor networks (WSN), indicators and algorithms for the students (school/ college) security and also for the elder citizens in the hospital in this survey were studied.The GPS watch is used to track the position of the subject and it will alerts the authority when they cross the zone boundary using GSM and IEEE 802.15.4. The motes are constructed with ARM Cortex-M3 Microcontroller, which has low power and IEEE 802.15.4 is used as wireless radio communication standard.

Conclusion

In this survey, it has been concluded that there are several techniques discovered for the development of school/college campus securities. The system helps us to create any number of predefined security zones within a campus area which is not feasible with human securities.Since I concluded, that a virtual security zones for student tracking and elderly fall alert based on gps watch and skin pressure sensitive lock is my future work.

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