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Virtual Security Zones for Student Tracking and Elderly Fall Alert Based on GPS Watch and Skin Pressure Sensitive Lock

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ABSTRACT—Security for students in the college campus, children's in the school campus has become a critical issue in 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 confining within a zone like hospital. The proposed system is to design and develop a smart GPS watch that will track the position of the attached person, 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. It is derived from GPS satellites; the clock shows the universal time and is as accurate as an atomic clock. Integrating our system within a device like watch would make the user comfortable, for not carrying additional device like a mobile phone. This system helps school and college administration to prevent students from crossing an invisible fence that alerts school authority via SMS when they leave the zone.

Index terms—Central monitoring unit, Flexi force sensor, Global positioning system, GPS watch unit, GSM cellular modem, RF signaling, WPAN radio communication.

I. INTRODUCTION

In these days security for students in college campus and children's in the school campus has become a critical one. Mostly this type of security alerts are performed by using RF signaling and human securities. When we going for these types of security the students cannot be properly controlled. To overcome these types of problem my proposed system uses the combination of hardware and software. It is also called as embedded systems. In this system hardware is controlled by software. Software is designed using 'C'. The previous system uses the RF sensor for monitoring the student's activity. It uses the RF signaling to monitor the students without going anywhere from the campus. A RF sensor is attached with the person like a minute watch in his hand. Using RF signal they monitors all the movements of the student while they crossing the campus area or not. Using a monitor we can the watch unit. If they crossing the campus area the signal gets weakens. By the range of the signal we can monitor the student while crossing the campus area. The range is measured by using monitor. This method is not accurate. If any dangerous places

inside the school campus, while student is going, it cannot be determined correctly. And depend upon signal only we can make the security. To overcome these drawbacks my proposed work uses a smart GPS watch to monitor the students accurately. This smart GPS watch is attach to the person. It will monitor the students while crosses a given border line of a predefined zone using a combination of GSM and WPAN radio communication. Since it is a watch unit, the watch shows the universal time and is more accurate than the atomic clock. Integrating our system within a device like watch would make the user comfortable for not carrying additional device like mobile phone etc. A monitoring system is used to monitor the watch attached person and alerts the authority. This surveillance system helps school via SMS when they leave the zone. Alternatively the system could also be used to prevent a student from reaching into a protected or dangerous area within the campus premises. This system can also be applied in monitoring elderly and is not limited to students alone. 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 (FFS) 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. Importantly when an elderly falls, a 3-axis MEMS Accelerometer sensor in the watch could sense this and alert the central unit which will send SMS about the fall location to the necessary person or to the hospital.

II. GPS AND GPS WATCH UNIT

A. Global Positioning System

The Global Positioning System (GPS) is a location system based on a constellation of about 24 satellites orbiting the earth at altitudes of approximately 11,000 miles. GPS satellites are orbited high enough to avoid the problems associated with land based systems, yet can provide accurate positioning 24 hours a day, anywhere in the world. Uncorrected positions determined

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from GPS satellite signals produce accuracies in the range of 50 to 100 meters. When using a technique called differential correction, users can get positions accurate to within 5 meters or less. Today, many industries are leveraging off the DOD's massive undertaking. As GPS units are becoming smaller and less expensive, there are an expanding number of applications for GPS. In transportation applications, GPS assists pilots and drivers in pinpointing their locations and avoiding collisions. Farmers can use GPS to guide equipment and control accurate distribution of fertilizers and other chemicals. Recreationally, GPS is used for providing accurate locations and as a navigation tool for hikers, hunters and boaters. Many would argue that GPS has found its greatest utility in the field of Geographic Information systems (GIS). With some consideration for error, GPS can provide any point on earth with a unique address (its precise location). A GIS is basically a descriptive database of the earth (or a specific part of the earth). GPS tells you that you are at point X, Y. Z while GIS tells you that X, Y, Z is an oak tree, or a spot in a stream with a pH level of 5.4. GPS tells us the "where" GIS tells us the "what" GPS/GIS is reshaping the way we locate, organize, analyze and map our resources. GPS determines distance between a GPS satellite and a GPS receiver by measuring the amount of time it takes a radio signal (the GPS signal) to travel from the satellite to the receiver. Radio waves travel at the speed of light, which is about 186,000 miles per second. So, if the amount of time it takes for the signal to travel from the satellite to the receiver is known, the distance from the satellite to receiver (distance=speed x time) can be determined. If the exact time when the signal was transmitted and the exact time when it was received are known, the signal's travel time can be determined. In order to do this, the satellites and the receivers use very accurate clocks which are synchronized so that they generate the same code at exactly the same time. The code received from the satellite can be compared with the code generated by the receiver. By comparing the codes, the time difference between when the satellite generated the code when the receiver generated the code can be determined. This interval generated the code can be determined. This interval is the travel time of the code. Multiplying this travel time, in seconds, by 186,000 miles per second gives the distance from the receiver.

B. GPS WATCH UNIT

For integrating our system we are going for GPS watch unit. This watch shows the universal time and is as accurate as an atomic clock. The GPS watch have a GPS receiver, for tracking the person. It is having a Flexi Force Sensor attached to the back of the device and it senses the grip force of the device with the user skin. 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. To disable this security lock feature an authorized user could simply press the enable-disable button in the central control unit using a keypad. The watch unit have a GPS receiver, Flexi Force Sensor, MEMS Accelerometer, Transceiver, Analog to Digital Converter. The monitoring system is used to monitor the watch attached person. The monitoring unit will monitor the entire watch attached person. The monitoring system will alerts the authority if any alerts came from watch unit. The alerts are given through SMS. The monitoring unit have a keypad for activating or deactivating the watch unit. The central monitoring unit will alerts the authority if any person crossing the given border line.

III. METHODOLOGY

Students tracking is mainly based on two units GPS watch unit and central monitoring unit. The GPS watch unit contains a GPS receiver, Flexi Force Sensor, MEMS accelerometer. This watch unit is attached to the hands of the person. Using the GPS receiver we can monitor the movement of the students. This GPS receiver will work under the control of GPS satellite and then if the watch unit is removed or gets tampered the Flexi Force Sensor will alert the authority. This Flexi Force is available in the bottom of the watch which makes a grip we can monitor while they removing the watch unit from the hand. MEMS accelerometer present in the watch unit is used for monitoring the sudden fall of the senior citizen. This watch unit will send the signals to the central monitoring unit WPAN (Wireless Personal Area Network) radio communication. The fig. 1 shows the watch unit.

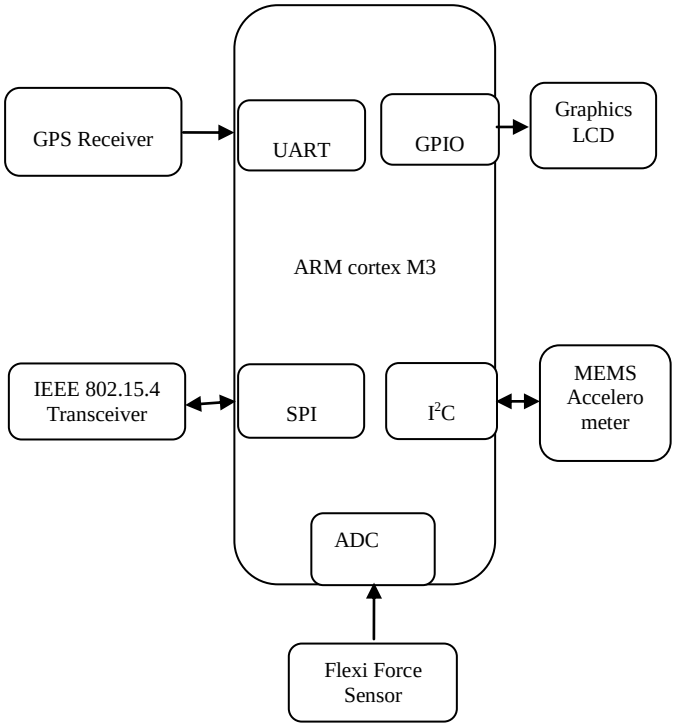

Fig. 1. GPS watch unit

A border line is given to the watch attached person, if the person crosses the given border line the GPS watch unit sends the signals to the monitoring unit. The monitoring unit mainly consists of GSM cellular modem keypad. If any signal is received by the monitoring unit it will alert the authority via GSM cellular modem. A keypad is available in the monitoring unit to activate or deactivate the watch unit. The ARM Cortex-M3 processor is used. This is industry-leading 32-bit processor for highly deterministic real-time applications and has been specifically developed to enable partners to develop high-performance low-cost platforms for a broad range of devices including microcontrollers, automotive body systems, industrial control systems and wireless networking and sensors. Fig. 2 shows monitoring unit.

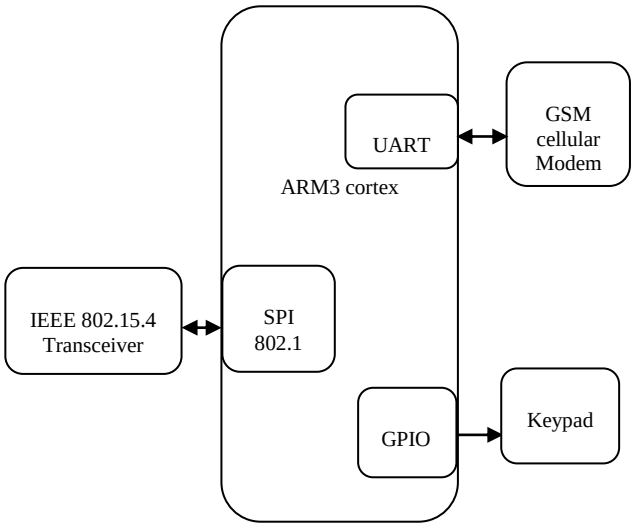

Fig. 2. Central Monitoring Unit

If the student crosses the given border line the signals will be send to the monitoring unit using the GPS receiver present in the GPS watch unit. The monitoring unit sends the signal via SMS to the authority using GSM cellular modem present in the monitoring unit. Removing the watch unit from the hand or gets damaged is prohibited. If it happens, it will alert the authority using the Flexi Force Sensor. If the children go inside any dangerous zone present inside the school campus it can also be monitored using the GPS receiver. Sudden fall of the elders can also be monitored using GPS watch unit.

IV.CONCLUSION

Virtual Security Zones for Student Tracking and Elderly Fall Alert based on GPS Watch and Skin Pressure Sensitive Lock is a security system used for security in college campus or in a school campus. By using this security system, alerts are given to the authority if the watch attached person crosses the campus area. This proposed work reduces the works of the human beings and also perfect security in college or school campus and alerts through SMS to the authority. By using this perfect security will be given to college or school campus. Elders can also be monitored easily. By learning about this type of securities, increase the number of predefined security zones within a campus area which is not feasible with human securities.

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