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Cyber Physical Self-Defense System for Women Safety with Integrated IR and Video Surveillance

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Abstract: In this modern era, around80% women feel insecure to step-out and fear regarding their safety as they are being harassed, assaulted and violated every day and every minute in all walks of life. Though the constitution of India speaks that women have equality, dignity and freedom of gender, based on statistics it is found that 65% of all women have experienced harassment. In this work, we propose a smart watch fitted safety device built on top of Cyber Physical System (CPS) with a speedy response mechanism for cases of emergency to help women in trouble.This work represents a promising step towards the safe and secure being with the help of real-time implementation. This system design provides advantage of personal security and also helps in decreasing the crime rate against women.

Keywords: Cyber Physical Systems (CPS); Alarm Communication System (ACS); Human Machine Interface (HMI); RFID tags/Reader; IR probe;

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I. INTRODUCTION

CPS is a network of interacting elements that embeds the virtual world and real world through a variety of intelligent terminals integrated with human society and physical system. This CPS safety model has an emergency push switch which is attached to the device. When triggered it activates the IR probe and sends the location information in terms of latitude and longitude collected by the GPS module along with the site image in real time through integrated video surveillance to the police control room. The objective of this work is to alert a special team for efficient rescue of women. Existing method use GSM, GPS and Spy camera based mobile tracking application with registered emergency numbers. This system seems to be inefficient if the mobile phone of the victim is thrown far from reach. The other disadvantage is that at places where there is little or no cell phone and internet service, this model cannot be used effectively. To prevail against these drawbacks, we propose a dual-mode (Online/Offline) safety device model that consists ofCPS with Terminal Equipment alarm integrated with InfraRed (IR) and Video Surveillance, GSM and GPS (SIM 908 – a combination module), Microprocessor (ARM7) and Voltage Regulator (IC 7805), UHF RFID tags.

The CPS terminal equipment has an Alarm Communication System (ACS) used to bridge the physical world with high confidence. The ACS uses ARM7 microprocessor that transmits real-time monitoring images through IR probe triggered video surveillance. This facilitates combination of monitoring and image analysis. Intelligent processing on the received data determines whether to send timely action to reduce false alarm trigger. Through the Human Machine Interface (HMI) information perception, transmission and sharing is controlled and managed on the network combine with the internet. RFID tags are used to transmit data in dead zones - places where mobile phone reception is very poor to non-existent.

This paper is organized as follows: Section II defines the model for Cyber Physical Alarm System. Section III addresses the performance results realized in a CPAS.

II. CYBER PHYSICAL ALARM SYSTEM MODEL

Cyber-Physical Alarm System (CPAS) enables two-way communication control mode, established over the Internet by intelligent network terminals. The functioning of CPAS can be categorized into three sets: (i) Information-perception, where information is observed from the physical world through Human Machine Interface (HMI) or sensor networks; (ii) Information-transmission, in which the sensed data is communicated through the internet by TCP/IP protocol; (iii) Information-Sharing, the virtual space for information computation and storage.

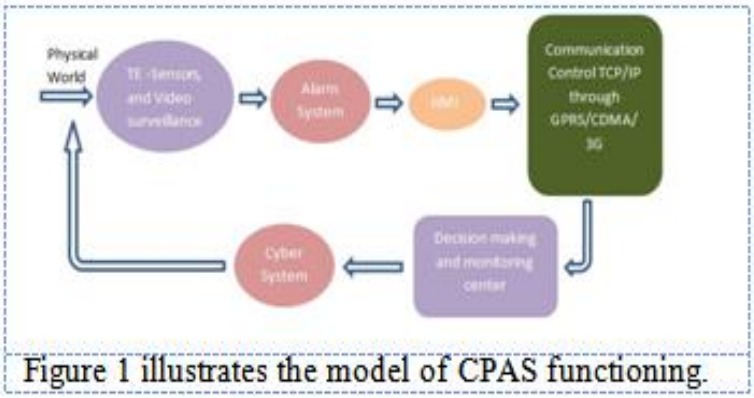

Figure 1 illustrates the model of CPAS functioning.

The alarm system is connected to the wireless sensors on the network to gain the perception of physical world. In our model for self-defense, the CPAS terminal equipment (TE) is embedded with Infrared (IR) and video surveillance. As soon as the IR probe senses an event, the video surveillance is triggered and real-time images of the site is transmitted to the monitoring center. For effective functioning of CPAS, three parameters are taken for study: scalability, mobility and reliability. Scalability is analyzed in terms of system/network capacity to handle information-flow and in its potential to accept additional improved features. The TE is not static. The information from these TE should be communicated at any time the IR triggers the surveillance regardless of the movement speed of TE. Thus the CPAS should hold good even in a state of motion.

The third parameter is reliability of CPAS on the communication protocol in network systems. The TE selects GPRS to establish a TCP/IP connection over the internet through AT commands. The average transmission rate ranges between 20kb/s to 30kb/s.

III. WORKING MODULES OF THE SYSTEM

The dual-mode (Online/Offline) safety device model that consists of five modules: CPS with Terminal Equipment alarm integrated with InfraRed (IR) and Video Surveillance, GSM and GPS (SIM 908 – a combination module), Microprocessor (ARM7) and Voltage Regulator (IC 7805), UHF RFID tags.

A. Power Supply Unit

The microprocessor and associated circuits require 3.5V. To power the circuit we use a battery of 9v. Voltage regulators 7805 are used to obtain a DC output of 5V.

B. Emergency Push Switch

An emergency push switch is attached to the CPS safety device. When triggered it activates the IR probe and sends the location information in terms of latitude and longitude collected by the GPS module along with the site image in real time through integrated video surveillance to the police control room.

C. Microprocessor

LPC2148 is a 32 bit, flash memory, high speed operator and low power consumption processor of ARM-7 family. It is loaded with inbuilt peripherals and is reliable for beginner and high end developers.

D. GSM and GPS

SIM 908 is a GMS/GPRS module which combines GPS technology for satellite navigation. It allows variable assets to be tracked at any location and any time with signal coverage.

E. UHF RFID tags

The UHF RFID covers a frequency range of 300MHz to 3GHz. The UHF frequency band is regulated by a single global standard called the ECPglobal Gen2 (ISO 18000-63) UHF standard.

IV. PERFORMANCE RESULTS OF PROPOSED MODEL

Any action that activates the emergency push switch attached to the device sends the victim's location and triggers the IR probe to send real-time image of the site. The information is transmitted to the nearest monitoring center and communication controls trigger video surveillance to check whether for false alarm.

The two-way communication control relieves user's security threats in a short while. The CPS terminal equipment has an Alarm Communication System (ACS) used to bridge the physical world with high confidence. The ACS uses ARM7 microprocessor that transmits real-time monitoring images through IR probe triggered video surveillance. This facilitates combination of monitoring and image analysis.

Intelligent processing on the received data determines whether to send timely action to reduce false alarm trigger. Through the Human Machine Interface (HMI) information perception, transmission and sharing is

controlled and managed on the network combine with the internet. RFID tags are used to transmit data in dead zones - places where mobile phone reception is very poor to non-existent.

V. CONCLUSION

The work in this paper provides safe environment to women and in most cases supports evidences as the CPAS allows video monitoring of the site. This same device can be used by senior citizen, handicapped or children inside home to ensure safety and to alert intrusion detection. This system design thus provides advantage of personal security and also helps in decreasing the crime rate.

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