

Disaster Prevention Information System Based on Wireless/Mobile Communication Networks

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ABSTRACT

Due to the rapid increase of human population, lots of fragile hillslopes near to the populous counties and cities lead to the high occurrence probability of natural disasters. When the heavy rainfalls or typhoons occur, many counties are unavoidable to suffer the debris-flow and flood disasters. It is urgently required to design an effective disaster information system to assist the disaster protection and alerting works. The designed Disaster Prevention Information System (DPI) is a three-tier system composed of the mobile users, multimedia servers, and disaster decision server. Based on DPI system, mobile users can utilize mobile appliances via the GPRS and wireless networks to transmit and retrieve the disaster information including news, pictures, audios, and videos in real-time. To accurately identify the disaster locations, DPI system adopts the Convex Hull Algorithm and Spatial Interpolation Methods to effectively determine the GIS illustration and GPS position function. DPI system provides the realistic flood disaster simulation and the determined emergent escape route using 3D virtual reality technology.

KEY WORDS: Disaster prevention system; Disaster simulation; Escape route; Handheld devices.

1. INTRODUCTION

There are more and more nature calamities happen in Taiwan in recent years. Those disasters cause often the serious nature destruction after torrential rain, an earthquake, and then creating the heavy losses of people's lives and properties. After the torrential rain and typhoon (Haitang, Matsa, and Talim) would be battering every area of Taiwan in June of 2005, and it had heavy rain and typhoon (Bilis, Kaemi, and Bopha) in Taiwan in May of this year (2006), there were no safe counties in Taiwan. For example, the "0612 torrential rain" was flood Pingtung country in 2005. The strong typhoon Haitang destroyed Fang-Guang bridge on Hengchun Peninsula, the south circle railway and highway broke down from Kaohsiung to Pingtung totally. There are many sediment disasters in mountain area to cause the damage of people's lives and properties. When disaster happened that the survivors didn't know how to communicate, and rescue teams didn't know where the survivors let the rescue work very slow in the same time.

Therefore, disaster happened how to use the handheld devices via the wireless network to transmit the multimedia information of disaster including image, sound, and characters etc., which is one of the important issues. But disaster really happened that may have some problem as follows:

- (1) The communication maybe breaks after disaster, it can't transmit the disaster information and alter to people, and it will cause disaster area to be serious.
- (2) Rescue center unable to understand disaster distribution situation, disaster influence degree of area, and the relevant problem of rescue resources allocation, because it is unable to slow down the disaster and defend the disaster enlargement.
- (3) Rescue team don't have the disaster information of area and geography information of the environment, it is unable to improve the efficiency of disaster relief effectively.
- (4) The disaster information only still adopts telephone to report through speakers descript disaster situation, and rescue workers don't sure disaster any situations.
- (5) Collecting disaster data still need use computer to input at some special places, it can't be got real-time data immediately.
- (6) The bandwidth of wireless network is limited, using compress technology to transmit a large amount of disaster image fluently.

In view of this, this research will adopt Embedded Multimedia Communication technology to design the "Disaster Prevention Information System (DPI)", it can overcome the space and time limiting. Users can use the handheld devices with high mobility via wireless network (3G/GPRS/GSM) to get disaster multimedia stream service. In addition, this research also combines Customized Services, Location-Aware Service, wireless Sensor Network, Multicast, Web GIS, Intelligent Agent, and Virtual Reality, etc. The DPI transmits the VR of the disaster to the server, and overcoming the space and time with the end-server to exchange information. The DPI system will automatic to descript the best adaptable escape route, which provides and guide users the escape route and harbor place (Tai, 2003; Yang, 2002), and monitoring the great natural disaster effectively such as Sediment, floods, earthquake, landslide, forest fire. The DPI system also provides rescue center to make best decision.