INTELLIGENT MOBILE SAFETY SYSTEM TO EDUCATIONAL ORGANIZATION

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Keywords: Swarm Intelligence, Active Ultra-High Frequency, RFID, Human-Computer-Interface, After-School Remedial Education.

Abstract: This study aims to develop safety system, and let the system become intelligent. We adopt the swarm intelligence and active Ultra-High Frequency RFID for safety system, and develop friendly human-computer-interface software for users use the personal digital assistants. We program the system and software with Extensible Markup Language (XML) and C sharp language. If the users begin to search, the kernel safety system automatically communicates with other RFID readers by agents, and the agents can search the closer camera for users. This study's result has successfully implemented to one educational organization, and it would be helpful for the paterfamiliases to hold all situations about their children at the educational organization. That will be great help in the grip of whole after-school remedial education, teaching and learning situation. We select 100 paterfamiliases to test this system and software. It is revealed that 93% of the paterfamilias are satisfied with the system (Strongly agree：25/100; Agree：68/100; Disagree：5/100; Strongly disagree：2/100). The software searching correctness is 95% (Strongly agree：30/100; Agree：65/100; Disagree：3/100; Strongly disagree：2/100).

1 INTRODUCTION

Technological developments in content-based analysis of digital video information are undergoing much progress, with ideas for fully automatic systems now being proposed and demonstrated (Hyowon, Alan, Noel, & Barry, 2006). Effective agent teamwork requires information exchange to be conducted in a proactive, selective, and intelligent way (Fan, Wang, Sun, & Yen, 2006). Self-managing systems (i.e. those that self-configure, self-protect, self-heal and self-optimize) are the solution to tackle the high complexity inherent to these networks (Barco, Lázaro, Díez, & Wille, 2008) Digital representations are widely used for audiovisual content, enabling the creation of large online repositories of video, allowing access such as video on demand (Justin & Timothy, 2006). Digital artifacts created via transformational technologies often embody implicit knowledge that must be correctly interpreted to successfully act upon the artifacts (Leonardi & Bailey, 2008) With continued advances in communication network technology and sensing technology, there is astounding growth in the amount of data produced and made available through cyberspace (Chen & Liu, 2006). Felfernig et al., (2009) focus on the first aspect and present an approach which supports knowledge engineers in the identification of faults in user interface descriptions. Chen (2009) adopts the Windows Media Player along the RTP/RTSP protocol in order to embed the mobile information system into the users' machines (personal digital assistants or smart phones), and provides a solution (including hardware solutions) to promote campus safety management. He also combines the swarm intelligence and Web Services to transform a conventional library system into an intelligent library system having high integrity, usability, correctness, and reliability software for readers (Chen, 2008, 2010). L. S. Chen, and S. L. Chen (2007) built the intelligent system and developed a knowledge base of the computer-parts. Jannach, Leopold, Timmerer, and Hellwagner (2006) present a novel, fully knowledge-based approach for

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building such multimedia adaptation services, addressing the above mentioned issues of openness, extensibility, and concordance with existing and upcoming standards.

This study adopts the swarm intelligence and active Ultra-High Frequency RFID for safety system, and develop friendly human computer interface software for users use the personal digital assistants (PDAs). We program the system and software with Extensible Markup Language (XML) and C sharp language. If the users begin to search, the kernel safety system automatically communicates with other RFID readers by agents, and the agents can search the closer camera for users.

2 RELATED WORK

2.1 For Mobile Communication

Malek and Frank (2006) have focused on determining a near-optimal collision-free path because of its importance in robot motion planning, intelligent transportation systems, and any autonomous mobile navigation system. A spanning tree is based on the autoconfiguration of mobile ad hoc networks and a novel approach for efficient distributed address autoconfiguration (Li, Cai, & Xu, 2007). Pavlou, Huigang, and Yajiong (2007) build upon the principal–agent perspective to propose a set of four uncertainty mitigating factors—trust, Web site informativeness, product diagnosticity, and social presence. A neural network is trained to learn the correlations and relationships that exist in a dataset (Kaikhah and Doddament, 2006). Gao and Zhang (2008) have proposed an effective technique to determine the number and distribution of equilibria and a new supervised linear feature extraction technique for multiclass classification problems particularly suited to the nearest-neighbor classifier technique (Masip and Vitria, 2008). Wang and Chen (2008) present a new method for evaluating students' answer scripts using vague values, where the evaluating marks awarded to the questions in the students' answer scripts are represented by vague values. Payne (2008) examines the Web service paradigm from an open multiagent system perspective and contrasts the formally grounded knowledge-centric view of agents with a pragmatic declarative bottom-up approach adopted by Web services. The location-based spatial queries having certain unique characteristics can be revealed, which traditional spatial query processing systems employed in centralized databases do not address (Ku, Zimmermann, & Wang , 2008). Lee and Wang (2009) present an ontology-based computational intelligent multi-agent system for Capability Maturity Model Integration (CMMI) assessment. Medium access control protocols have quality-of-service support—topology-independent link activation transmission scheduling—for mobile code-division multiple-access ad hoc networks (Su, Su, & Li, 2008). The context-aware query processing system enhances the semantic content of Web queries using two complementary knowledge sources: lexicons and ontologies (Storey, Jones, Sugumaran, & Purao, 2008). Yap, Tan, and Pang (2008) propose the Explaining BN Inferences (EBI) procedure for explaining how variables interact to reach conclusions.

2.2 For RFID Systems

Broekmeulen, and Donselaar (2009) suggest a replenishment policy for perishable products which takes into account the age of inventories and which requires only very simple calculations. Zhou (2009) takes a different perspective by modeling item-level information visibility in general. Delgado, Ros, and Vila (2009) present a system that is able to process the information provided by a Tagged World to identify user's behavior and to produce alarms in dangerous situations. Abad et al., (2009) present important advantages regarding conventional traceability tools and currently used temperature data loggers such as more memory, reusability, no human participation, no tag visibility needed for reading, possibility of reading many tags at the same time and more resistance to humidity and environmental conditions. Lee, and Chan (2009) propose a genetic algorithm to determine such locations in order to maximize the coverage of customers. Also, the use of RFID is suggested to count the quantities of collected items in collection points and send the signal to the central return center. Angeles (2009) looks at the perceived ability of components of IT infrastructure integration and supply chain process integration to predict specific radio frequency identification (RFID) system deployment outcomes exploration, exploitation, operational efficiency, and market knowledge creation.

2.3 For Swarm Intelligence

Tabu search and ant colony perform better for large-sized problems, whereas simulated annealing is optimal for small-sized problems and it is therefore essential that a maintenance scheduling optimizer can incorporate the options of shortening the maintenance duration and/or deferring maintenance tasks in the search for practical maintenance schedules. Allahverdi and Al-Anzi (2008) addressed a two-stage assembly flow-shop scheduling problem with a weighted sum of makespan and mean completion time criteria, known as bicriteria. The learners and lecturers agree that style-based ant colony systems can provide useful supplementary learning paths (2008). Ant colony intelligence (ACI) is proposed to be combined with local agent coordination in order to make autonomous agents adapt to changing circumstances, thereby yielding efficient global performance. This indicates that the ACO algorithm is an optional compromise strategy between preferable phase unwrapping precision and time-consuming computations.

3 METHODOLOGY

This study adopts the active Ultra-High Frequency RFID and swarm intelligence for safety system, and develop friendly human computer interface software for users use the personal computers or notebooks. The system is developed in the environment of: Microsoft Windows Server 2008, Internet Information Services 7.0 (IIS 7.0), Microsoft Structured Query Language (MS SQL) Server 2008, and Visual Studio 2008 (VS 2008). The programming languages are Extensible Markup Language (XML) and C#.

3.1 RFID System Framework

Figure 1 shows the framework of RFID system.

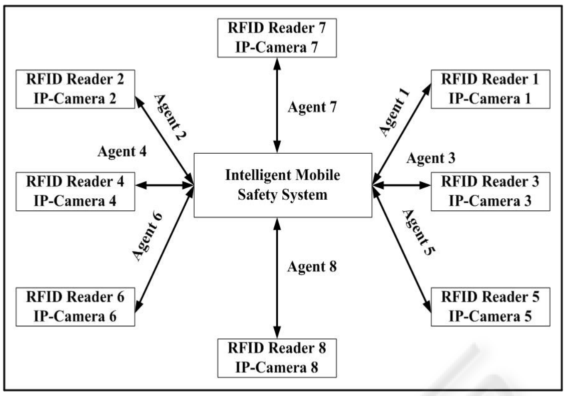

Figure 1: Framework of RFID system.

3.2 Searching Design

The searching path of this study is from (Agents Generator) to $(\text{Reader})_i$ and the distance of (Agents Generator) to $(\text{Reader})_i$ is the closest, as shown in Figure 2. The searching path begins at (Agents Generator), and it has two choice. One is $(\text{Reader})_1$, and the other is $(\text{Reader})_2$. Because the distance of (Agents Generator) to $(\text{Reader})_1$ is shorter than (Agents Generator) to $(\text{Reader})_2$, the optimum searching path is (Agents Generator) to $(\text{Reader})_1$. And so forth, the optimum searching path is "(Agents Generator) $\rightarrow(\text{Reader})_1$ $\rightarrow(\text{Reader})_3$ $\rightarrow(\text{Reader})_2\rightarrow\ldots$". Figure 2 shows the searching process. This study amends the ant algorithm of Birattari, Pellegrini, and Dorigo (2007). It can let the safety system become intelligent and mobility. The design of the "Agents Generator" is very important, and it is the kernel technology in this study. The developing process is described as below. (Note: The agents are seemed as the ants.)

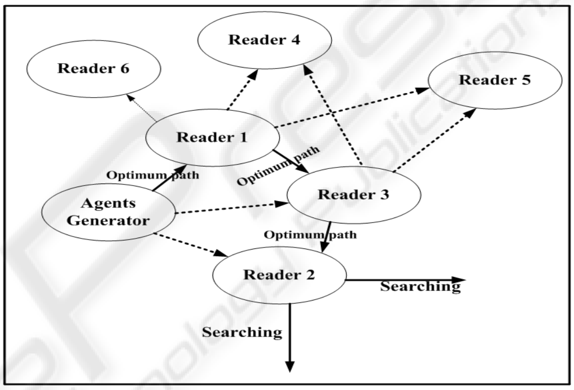

Figure 2: Searching Path.

3.3 Meaning of the Symbols and Nouns

(a) n: The numbers of RFID readers

(b) $m= \Sigma_{k= 1 \text{to} n}$
b_i (t): The total agents
b_n (t): The numbers of agents in the (Agents Generator)

(c) d_{ij}: The distant of (Agents Generator) to $(\text{Reader})_i$; This study considers that it is symmetrical; therefore, d_{ij} is equal to d_{ji}

(d) $\tau_{ij}(t)$: The intensity of pheromone upper edge

$$\tau_{ij}(t) = \rho\tau_{ij}(t) + \Delta\tau_{ij} \quad (1)$$

This study uses (Eq. 1) to update the pheromone.

ρ：The parameters of pheromone evaporation

$$\Delta\tau_{ij} = \Sigma_{k=1 \text{ to } m} \Delta\tau_{ij}^{k} \quad (2)$$

(e) $\Delta\tau_{ij}^{k}$: The kth agent remains pheromone going through the edge (i, j). It is defined as equation 3.

Q: The influential parameter of the pheromone

L_K： The total length of the route, and the kth agent goes all over the (Readers)

$\Delta\tau_{ij}^{k} = Q / L_K$, The Kth agent goes through edge (i, j) between time point t and $(t + t_l)$

$$\Delta\tau_{ij}^{k} = 0, \text{Otherwise} \quad (3)$$

(f) R：The cycles counter agent goes through all of the readers, and the R_{max} is the upper limit of R

(g) $Tabu_k(I)$: The record of the kth has gone through the re, anaders the "I "is to mak a visit to "Ith"reader. It can prevent the agent from going back to cities already visited.

(h) μ_{ij}: The inverse of the distance of (Agents Generator) to $(Reader)_i$

$$\mu_{ij} = 1 / d_{ij} \quad (4)$$

(i) $P_{ij}^{k}(t)$: The probability that kth agent goes from (Agents Generator) to $(Reader)_i$

Set $\Phi = k \in (n - Tabu_k(I))$

$P_{ij}^{k}(t) = 【\tau_{ij}(t)】^{\alpha}【\mu_{ij}】^{\beta} / \Sigma_{\Phi}【\tau_{ik}(t)】^{\alpha}【\mu_{ik}】^{\beta}$ (5)

if $j \in (n - Tabu_k(t))$

Otherwise $P_{ij}^{k}(t) = 0$ (6)

The α and β are the important controlled parameters of pheromone information and μ_{ij}.

3.4 Designing Steps

The designing steps are described below.

Step 1: Set t=0、R= 0 （"t" is the time counter, and "R" is the cycles counter）For all edge (i, j), Set $\tau_{ij}(t)$ = Constant, $\Delta\tau_{ij}(t) = 0$. To put m agents into n readers

Step 2: Set I=1 ("I" is Tabu list index). For k = 1 to m (The record of the kth agent is listed in $Tabu_k(I)$ at agents generator.)

Step 3: Set I= I +1. For k = 1 to m (Using equation 5 to decide $(Reader)_i$ and moving the kth agent to $(Reader)_i$ recorded in $Tabu_k(I)$.)

Step 4: For k = 1 to m do .To move the kth agent from $Tabu_k(n)$ to $Tabu_k(1)$ and calculate the total length of all paths recorded, and update the shortest path. To calculate each edge (i, j). For k = 1 to m do. $\Delta\tau_{ij} = \Delta\tau_{ij} + \Delta\tau_{ij}^{k}$

Step 5: By $\tau_{ij}(t + t_l) = \rho\tau_{ij}(t) + \Delta\tau_{ij}$, Calculates $\tau_{ij}(t + t_l)$ for each edge (i, j). Set $t = t + t_l$, $R = R + 1$ for each edge (i, j). Set $\Delta\tau_{ij} = 0$ for each edge (i, j)

Step 6: If ($R < R_{max}$) and (No entering in stop situation) Then clear the entire Tabu list . Go To Step 2. Else print the shortest path and stop.

4 RESULTS AND DISCUSSION

4.1 Results

The safety system has been successfully developed, as shown in Figure 3-8. Figure 3 is the "login frame", and Figure 4 is "Welcome frame". There are eight areas in this system; (1) The left side of the gate, (2) The right side of the gate, (3) The eastern side of the house, (4) House Back, (5) Classroom 1, (6) Classroom 2, (7) Office, (8) Leisure area, see as Figure 5. Figure 6, Figure 7, and Figure 8 are searching results. For example, the user "missyang" logins to the system. The system will tell her that she has three children in the educational organization. One is in the classroom 1,

Figure 3: Login Frame.

Figure 4: Welcome Frame.

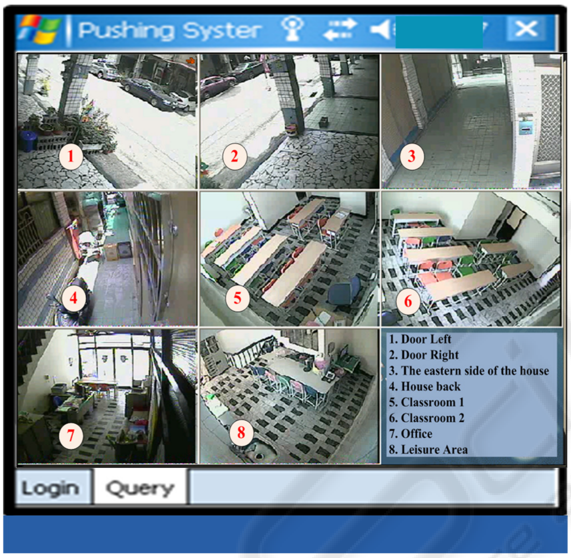

Figure 5: Eight area.

another is in the classroom 2, and the other is in the leisure area. The missyang can push the "Welcome" key, and enter the choosing frame "Figure 5". She can choose and push the ⑤, ⑥, or ⑧ to watch her children's situations.

Figure 6: Searching Results.

Figure 7: Searching Results.

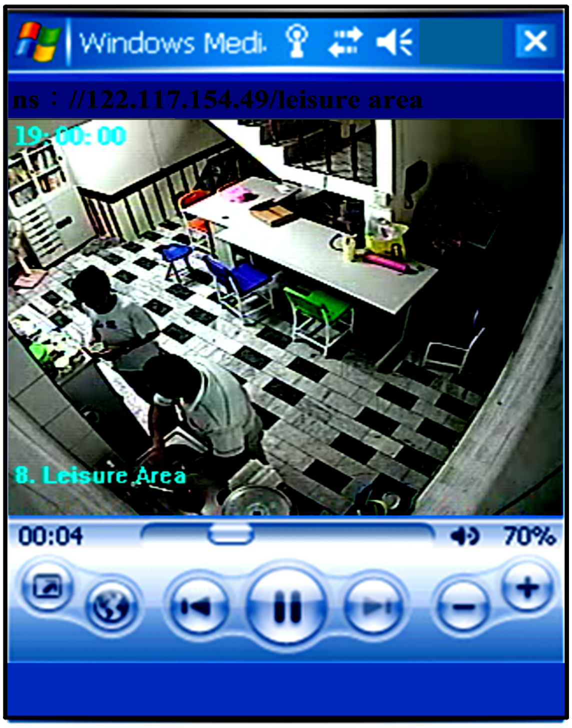

Figure 8: Searching Results.

4.2 Discussion

In this study, we select 100 paterfamiliases to test this system and software. It is revealed that 74% of the paterfamilias are satisfied with the system (Strongly agree：25/100; Agree：68/100; Disagree：5/100; Strongly disagree：2/100), see as Figure 9 and Figure 10.

The software searching correctness is 95% (Strongly agree ：30/100; Agree ：65/100; Disagree：3/100; Strongly disagree：2/100), see as Figure 11 and Figure 12.

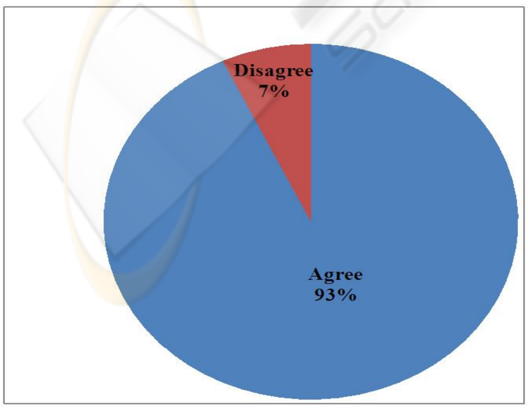

Figure 9: Satisfaction and Dissatisfaction.

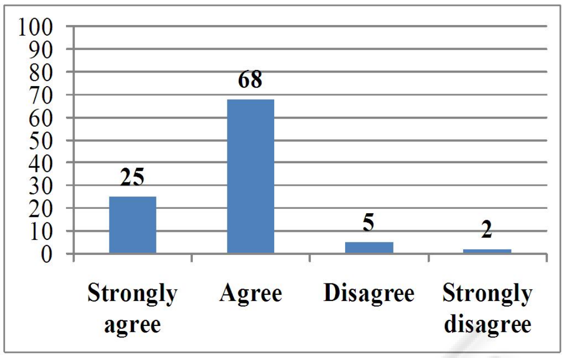

Figure 10: Detail of satisfaction and dissatisfaction.

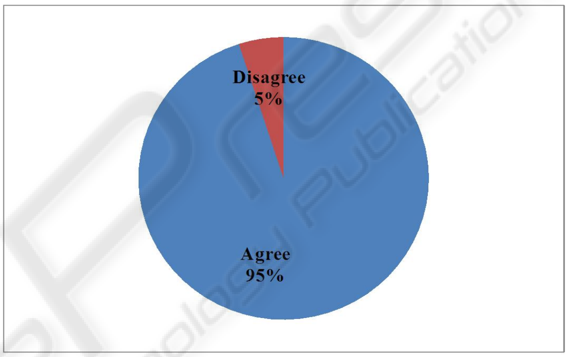

Figure 11: Software searching correctness.

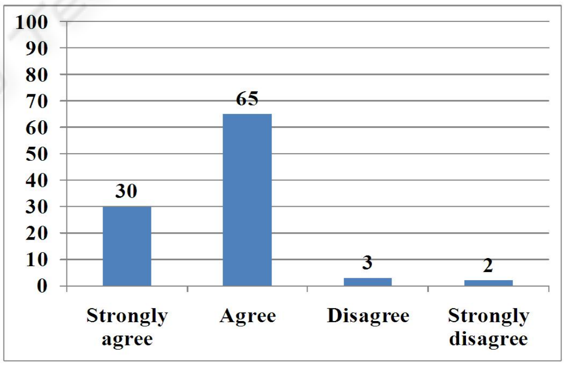

Figure 12: Detail of software searching correctness.

5 CONCLUSIONS

This study aims to developed safety system, and let the system become intelligent. This study used artificial intelligence and active Ultra-High Frequency RFID directly to guide paterfamilias monitoring their children's in-time images. Thus, it could save the paterfamilias' time on operating the instrument. Even someone who has not the professional knowledge about information technology could use them skillfully. This study also develops friendly human computer interface software for users use the personal digital assistants. The size of the software is 22 kilobits; therefore, the software is not a liability for the users' tools. This study has successfully implemented to one educational organization, and it would be helpful for the paterfamiliases to hold all situations about their children at the educational organization. That will be great help in the grip of whole after-school remedial education, teaching and learning situation.

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