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Environmental awareness Automation Monitoring System for Training Dog Kennel

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Abstract

Environmental awareness is currently significant caring in all industrial sectors, particularly in the animal industries. Animals are directly affected by environmental conditions and climate changes. Working dog is costly production in time and money to be successful. Health and temperament are key factors to be successful in training dog program. Working training dog school, NPUST is located in mountainous areas. The weather has frequently extreme change in temperature and humidity. The changes cause the heat in in-house and humidity in the air that may cause the dog illness. Therefore, working training dog school has to provide an appropriate kennel environment for all dogs throughout the training program. In order to secure the dogs, the automatic environmental sensing should be deployed. Web sensors and radio frequency identification (RFID) technologies were integrated, and have been implemented that are the weather sensing system and in-out control system, combining with health care management. Web based monitoring systems have provided based on user-friendly interface along with real-time information. In addition, it is very attractive use when the system operating via more convenient for computer and mobile communication devices.

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1. Introduction

Throughout the dogs has been trained to carry on a variety of human-directed works. They have been

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trained by the professional school with high cost and high quality treated in most of its health, husbandry and training programs. Although, the training dog is high cost [1], the success rates of training dog was 56% approximately. Furthermore, the 39% of them had been passed during a training program for the behavioral reasons in four months standard program [2]. Thereby housing dog environment is very important and relevant to temperaments which influence the success of dog training. In addition, Rooney et al. [3] studied in a series of working dog welfare, these researches have shown that many working dogs exhibit high levels of physiological stress in response to kenneling. The environment enrichment of the kennel can affect the welfare and working ability [3-5]. Low temperatures can result in high levels of stress hormones in several breeds of dog and can make cold body. Whereas, it is more comfortable for living in heated kennel that is recommended to arrange temperature within the range 10–26°C [3].

Climate changes affect the average weather conditions as well as the animal life on the globe. Temperature changes may cause frequency or severity of extreme weather events, such as storms, flooding, high winds, and other disasters that threats to people and property [6].

Wireless sensor networks (WSNs) have experienced a significant applying for environmental awareness. WSNs was applied for detecting forest fire [7-8], measurement of temperature, humidity and light [9-10], and drought forecasting model [11]. WSN layer is primarily responsible for providing the service provider to collect all kinds of sensor data to the service management platform based on monitoring conditions. Furthermore, RFID technology has been applied for livestock management. The platform apart from using a data repository through RFID tag numbers which are associated with animal data records. [12-15].

In Taiwan, abruptly change in temperature cause heavy storm, typhoon, as well as frequently caused earthquake [16]. Therefore, to secure dogs and efficient management and to be successful in working dog training, the automatic monitoring systems on environmental conditions are required for implementation.

2. Research background

The working dog training school of the National Pingtung University of Science and Technology (NPUST) was established the working dog training school since 1993. This school has provided training of professional trainers, working dog training courses and techniques, breeding techniques, kenneling techniques, disabled services, and research in the relevant areas to enhance the efficiency monitoring management systems. The working dogs have been trained in the enriched environment with a wealth of experiences. In addition, this school has been providing with several knowledge based resources, for instance, the outdoor exercise area, detecting dog training center, breeding center and vet care center [17]. Furthermore, the school has provided standardize of other facilities for successful training. Every working day, all dogs are taken to the outside kennel for training and its health care activities based on schedule.

3. System Framework and Design

The working dog training school has main activities as mentioned above, since this study is focused on the environmental awareness in dog kennel which all training dogs are living in a kennel. In the working dog training kennel has been providing the system to automate capture temperature and humidity, and then transmit the captured climate data to the server. The design of the system combined with the kennel environment sensing, automated of incoming and outgoing during the day and dog health monitoring system as shown in the Fig. 1.

- Client (User end): The client or user end system comprises two parts, including working dog trainer and visiting guest parts. The trainers can operate the system through the PC client or mobile user end. Likewise, the dog quests can view the geographical environment of the kennel places using smart phones.
- Kennel environmental sensing monitoring: The real-time information about environmental kennel is

captured and recorded using the sensing system. Sensing system sense and then capture the temperature degrees, humidity and light level and other environmental factors. All automated environmental information is transmitted to the database system in the server. Whenever the abnormal conditions cause, the system will set up to communications management and immediately submit to caretaker.

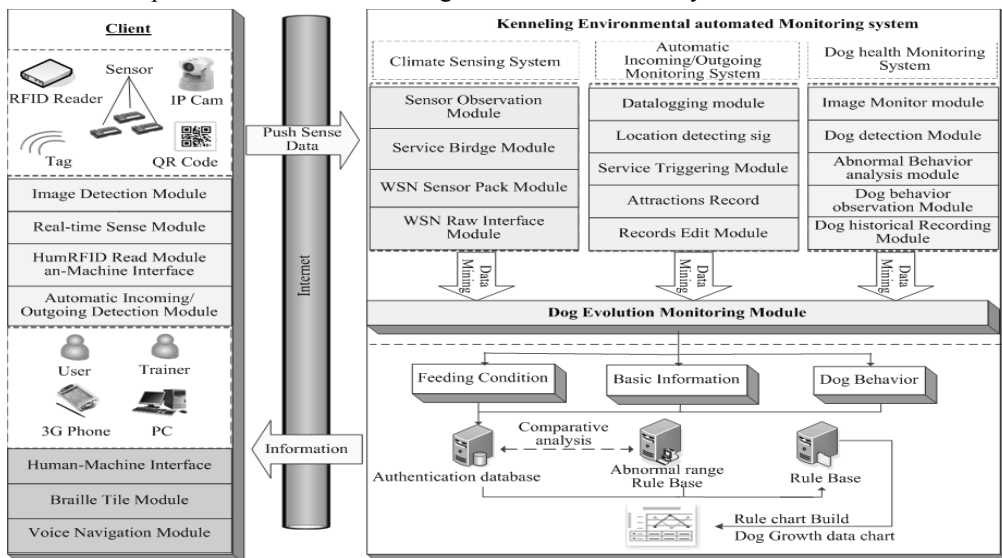


Fig. 1 System concept framework

- Incoming/Outgoing monitoring system: Automated access control of training dog: This system is used to control incoming and outgoing of training dog during the day for training dog tasks. The RFID reader is installed on the kennel door, when training dogs are incoming or outgoing the kennel, the reader automatically detects the signal and identify dogs, using tag which has been worn on the dog body. This system records the automated identifying data, date and time.
- Dog health monitoring system: The professional training program and activities is most significant for all of training dogs. This is designed as the back-end system that the trainers or professional staff has to operate with individual dogs. All diet, behavior, health care activities, medical care, vaccination, canine and caretaker information have been recorded every day. This information system was developed based on web based query system.

4. System Implementation

In this paper presents two automatic monitoring systems and a dog health care system that secures the working training dogs. The automatic monitoring systems were designed for one kennel which the environmental sensing system and incoming/outgoing control. In kennel was constructed the sensing system to capture the real-time temperature, humidity and level of light, and then transmit to the server as the Fig. 2. Figure 2 shows the automated identifying system when the dogs are incoming or outgoing kennel during the day, and then records the identified dog number, date, and time on the server. The end user can access the monitoring systems through the internet web applications by both PC computer and mobile smart phone.

4.1. Kennel environmental sensing system

The real-time environmental sensing system is provided for automated capture of temperature, humidity, and light level using the heterogeneous wireless sensor network technologies. The sensor devices were

constructed in-house, the system capture data when the environment changes, then record to the database and send to caretakers. On the other hand, the system has provided web application for all related workers to manipulate the data via internet or mobile phone. When the weather extreme changes, the caretaker can be taking care all dogs and safe them from inappropriate environment. Therefore, this system is a valuable indicator to secure all dogs from the threat of climate changes. The sensing data are shown in Fig. 3.

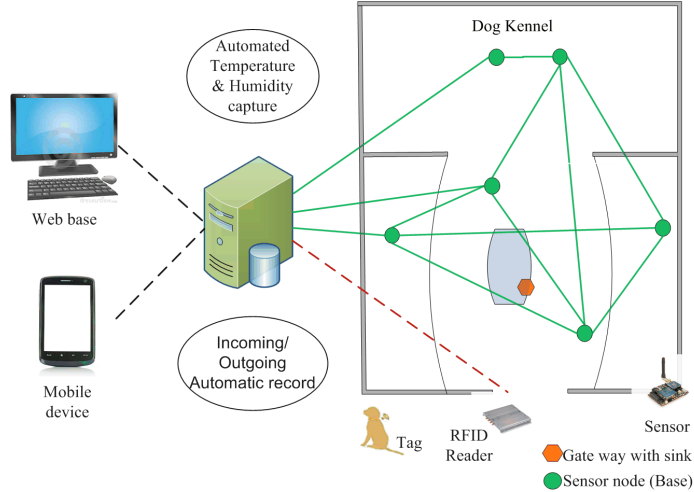


Fig.2 Conceptual system map

Sensor#	Date	Time	° C	Humidity	Light
WSN-DOOR-01	2012-12-01	8:44:25	26.13	8.65	55
WSN-DOOR-02	2012-12-02	8:44:46	27.15	10.63	50
WSN-DOOR-03	2012-12-03	0:07:18	22.2	11.33	55
WSN-DOOR-04	2012-12-04	7:22:14	27.3	14.6	63
WSN-DOOR-05	2012-12-05	7:23:14	25.7	12.9	52

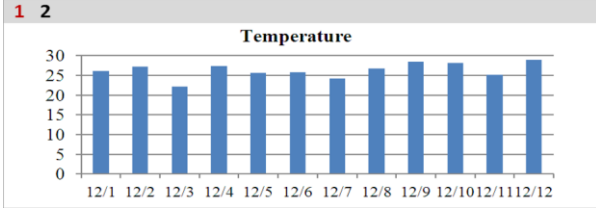


Fig. 3 Retrieval sensing data page

◆ Working dog's access control ◆ Historical data query

Dog's Name :

Date : ~

Dog's name	Outdoor time	Home time	Activity time
Apple	2012/11/18 13:34:22	2012/11/18 14:34:27	01:00:05
Amber	2012/11/18 14:35:25	2012/11/18 15:10:35	00:35:10
Amber	2012/11/19 10:28:34	2012/11/19 10:28:55	00:00:21
Amber	2012/11/19 10:52:24	2012/11/19 10:52:53	00:00:29
Binu	2012/11/18 14:04:15	2012/11/18 14:34:20	00:30:05
Kea	2012/11/18 13:10:20	2012/11/18 13:45:17	00:34:57
Lucky	2012/11/18 12:07:06	2012/11/18 12:40:08	00:33:02

Fig. 4 Incoming/outgoing data in detail

4.2. Incoming/Outgoing monitoring system

The automated access control uses to identify dog applying RFID technology. All dogs wear collars with embedded tag which was back-end operating for dog numbered identity. When dogs are incoming or outgoing kennel, the reader can detect the tag on dog body, and then transmit a set of data to the server. The set of data comprises of a tag, identity number, date, outgoing time and incoming time. This application also analyzes duration time between dogs are staying outside. Figure 4 shows the Incoming/Outgoing monitoring application system and its output.

4.3. Dog health monitoring system

All historical data of dogs were recorded in a the database that are a microchip number, breeding, color, sex, date of birth, the collar label, housing day, type of work, sources of dogs, trainers, photos and so on. In addition, this data is used for dog health tracking and access management which is important for dog training

operating basis. Based on data information from history recording, when a dog causes an abnormal, it will be immediately make diagnoses and treatment.

5. Conclusions

The automatic environmental monitoring system in kennel of working dog training has been implemented with a heterogeneous computer communication system, in order to secure animal health and value added of the successful trained dogs. The nourishment cost can be recovered from the improvised animal health and training management service delivery to dog owners. Moreover, the system should be expanded to the automatic tracking dog in other training areas.

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