Research Article

Human-Computer Interaction System Application in Hotel Management Teaching Practice

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With the increasing demand for the performance and security of communication networks, the fifth-generation mobile technology has developed rapidly and has attracted unprecedented attention. At the same time, this article analyzes the current research status of visual gesture recognition and human-computer interaction based on the Internet of Things. In view of the current shortcomings of gesture recognition, this article proposes a solution that involves using Biaonect somatosensory sensors to recognize gestures and explore human-computer interaction. Then, we analyze how the Kinea somatosensory sensor works to obtain depth images, study the method of obtaining gesture positions and joint points based on the depth information, and combine the depth information and the skin color model to create a three-dimensional image of the gesture simulation. With the rapid development of China's tourism industry, China's hotel industry has entered an era, in which domestic and foreign competitors coexist in the hotel industry. The development of hotels urgently needs high-quality hotel professionals who have received professional training and are familiar with hotel management. In hotel management teaching, human-computer interactive learning can effectively improve learning interest. In this paper, the structure of the human-computer interaction system based on gesture recognition is established, which can effectively improve the recognition accuracy and is of great significance in the hotel management teaching system.

1. Introduction

This article mainly introduces the background of 5G security certification network technology research, outlines the security threats and security requirements of 5G networks, and analyzes the current status of security certification technology research at home and abroad [1]. At the same time, we introduced the main research content of this article and the structure of this article. 5G wireless networks are flexible, open, and highly heterogeneous. It can not only provide traditional voice and data transmission but can also be applied to scenarios such as the Internet of vehicles, smart grids, smart cities, and smart healthcare [2]. Although the 5G network is convenient for people to use, it also faces various security and performance issues, such as protecting user privacy, safe data transmission, restricted access, and limited resources [3]. Since the data sent by the sender contain a large amount of confidential information, when data are lost during data transmission, it will cause immeasurable losses to the user. Therefore, safe data transmission is very important [4]. In recent years, people have put forward higher and higher requirements for the performance and security of communication networks, and the fifth-generation mobile technology is developing rapidly. The 5G network is a new generation communication system designed to meet the mobile communication needs after 2020 [5]. It comes from the 4G network. 5G provides faster connectivity, more bandwidth, better connection services, and better business experience. The 5G network structure is characterized by flexibility, openness, and high heterogeneity [6]. At present, the rapid development of 5G network systems is also conducive to the development of China's hotel tourism industry, which is an emerging industry. In recent years, with China's accession to the WTO, China's tourism industry has
developed rapidly and has entered an era of global competition. With the development of tourism, China’s hotel industry has also become a promising point of economic growth [7]. According to hotel management practice (usually referred to as school education), it is organized and managed by the school according to the rules and objectives of the talent education plan through two methods of on-campus simulation learning and off-campus internship to adapt to the professional development of students, so as to adapt to the professional development of students and the application process of on-site education in practical training [8]. This major has been highly applied, and hands-on learning has become an important means and link for students to combine theory with practical work. Students will hone their professional skills in practical classes and improve their professionalism [9]. Through hands-on learning, the school continuously discusses the impact of educational methods on talent development, improves the quality of teaching, and then improves the practical training of hotel management to improve professional development [10].

2. Related Work

The literature pointed out that as IoT technology has been integrated into people’s lives, more and more IoT terminals need to be connected to the network to meet the diverse needs of users [11, 12]. Today, there are more than 20 billion connected devices worldwide. Ericsson predicts that by 2021, the number of connected devices will grow to nearly 28 billion. In the future, 5G networks will support simultaneous access of a large number of users and devices and provide security guarantees for the realization of the “Internet of Everything”. Therefore, 5G networks must not only continue to face the challenges of mobile Internet services [13] but also improve spectrum efficiency and user data rate, reduce latency and increase mobility, and meet the various needs of IoT services. In the “Internet of Everything” scenario, the 5G security mechanism must not only protect a large number of access devices but also ensure that users will not lose information when the access devices exchange messages with the network [14]. The literature knows from the theory of pedagogy that there are three factors that determine education: one is the teacher, the other is education, and the third is the means of education. Education is the bridge between them [15]. Appropriate educational measures can not only educate educated people so that they can learn and benefit from it, but they can seamlessly and perfectly achieve their educational goals and contribute to society. According to the alternative education model of “study-work-study”, the school avoids the vicious circle of high investment and low efficiency. It can not only use the technical characteristics, atmosphere, and environment of high-end hotels to achieve educational goals but also improve the quality of learning. Internships in international brand hotels not only improved their language skills and professional knowledge but also opened up the world, broadened their horizons, strengthened their self-confidence, and laid a good foundation for their future careers [16].

3. Human-Computer Interaction Systems

3.1. Sensor-Based Human-Computer Interaction System. 5G network is a new generation of communication system designed to meet the needs of mobile communication after 2020. It comes from 4G network. It can be seen from the network structure analysis that the 5G network is mainly composed of two parts: the access network and the core network, as shown in Figure 1.

In a visual gesture interaction system, it is very important to accurately track and recognize gestures. Formulas (1) and (2) show the conversion between YCbCr color space and RGB color space, which proves

\[
\begin{bmatrix}
Y \\
Cb \\
Cr
\end{bmatrix} =
\begin{bmatrix}
0.2290, 0.5870, 0.1140 \\
-0.1687, -0.3313, 0.5000 \\
0.5000, -0.4187, -0.0813
\end{bmatrix}
\begin{bmatrix}
R \\
G \\
B
\end{bmatrix},
\]

(1)

\[
\begin{bmatrix}
R \\
G \\
B
\end{bmatrix} =
\begin{bmatrix}
1, 1.40200, 0 \\
1, -0.34414, -0.71414 \\
1, -1.77200, 0
\end{bmatrix}
\begin{bmatrix}
Y \\
Cb - 128 \\
Cr - 128
\end{bmatrix},
\]

(2)

Use human skin color samples of different races to train the Gaussian model, the average vector \(m = (Cb, Cr)\) in the YCbCr space, such as the following formulas:

\[
Cb = \frac{1}{N} \sum_{i=1}^{N} Cb_i,
\]

(3)

\[
Cr = \frac{1}{N} \sum_{i=1}^{N} Cr_i.
\]

(4)

The covariance matrix \(C\) is shown as the following formula:

\[
C = \begin{bmatrix}
\sigma_{CxCBb} & \sigma_{CxCr} \\
\sigma_{CxCBb} & \sigma_{CxCr}
\end{bmatrix}.
\]

(5)

Using the hue vector value of the input pixel \(x = [Cb, Cr]^T\), the probability that it is the skin color is shown as the following formula:

\[
P\left(\frac{x}{\text{skin}}\right) = \exp\left[-\frac{1}{2}(x - m)^T C^{-1} (x - m)\right].
\]

(6)

When using the Gaussian mixture model to create a skin color model, the formula is as follows:

\[
x = [Cb, Cr]^T,
\]

(7)

\[
x = [Cb, Cr]^T.
\]

(7)

Among them, \(P (j)\) represents the weight of the \(j\)th element, and \(M\) represents the number of elements in the Gaussian distribution, so the \(j\)th Gaussian distribution can be expressed as the following formula:

\[
P\left(\frac{x}{j}\right) = \frac{\exp\left[-(1/2)(x - m)^T C_j^{-1} (x - m)\right]}{2\pi \sqrt{|C_j|}}.
\]

(8)
Among them, $m_j$ and $C_j$, respectively, represent the mean vector and covariance matrix of the $j$th Gaussian distribution, and $P(j)$ satisfies the following formula:

$$\sum_{j=1}^{M} P(j) = 1, \quad 0 \leq P(j) \leq 1. \quad (9)$$

The ellipse limit model is defined as the following formula:

$$\varphi(c) = (c - \varphi)^T \Lambda^{-1} (c - \varphi), \quad (10)$$

where $c$ is the color vector, and the model training process includes two stages: first, exclude more than 5% of low-frequency training color samples to eliminate noise and trivial data. Second, estimate the model parameters ($\Phi$ and $\Lambda$) as the following formula:

$$\varphi = \frac{1}{n} \sum_{i=1}^{n} c_i,$$

$$\Lambda = \frac{1}{N} \sum_{i=1}^{N} f_i \cdot (c_i - \mu)(c_i - \mu)^T. \quad (11)$$

Each Haar-Like element is composed of two or three interconnected “black” and “white” rectangles. The $f(x)$ value of the hairy element is the difference between the sums of pixel values in the black and white rectangles, as shown in the following formula:

$$f(x) = \sum_{\text{black}} \text{pixelvalue} - \sum_{\text{white}} \text{pixelvalue}. \quad (12)$$

The “integrated image” at the pixel position $(x, y)$ contains the sum of the above-mentioned pixel value and the pixel value on the left side of the pixel, that is, as shown in the following formula:

$$P(x, y) = \sum_{x' \leq x, y' \leq y} p(x', y'). \quad (13)$$

According to the definition of “integral image”, the sum of pixel values $BIII$ can be calculated as the following formula:

$$P_{\text{SUM}} = P_1 + P_4 - P_2 - P_3. \quad (14)$$

Among them, there are $P_1 = A, P_2 = A + B, P_3 = A + C, P_4 = A + B + C + D$.

The corresponding weak classifier corresponds to the Haar-like feature $f_j$ is defined as the following formula:

$$h_j(x) = \begin{cases} 1, & p_j f_j < p_j \theta_j \\ 0, & \text{other} \end{cases} \quad (15)$$

They are mainly used in robotics research, interactive games, and other fields. The principle of 3D laser scanning is to use laser beams to obtain PointCloud data from spatial coordinates through rapid scanning technology. This technology can quickly create complex nonstandard scenes. The principle of structured light is to first emit structured light, and then the device directs a controlled light spot, light strip, or smooth surface structure to the target surface to be measured. Then, the camera captures the image and uses the principle of triangulation to calculate the 3D coordinates of the target from the image.

If the target is near the infrared camera, the reflected light spot from the target is captured again. At this time, the light spot should move a distance $d$ in the image plane. According to the type of such triangles, formulas (16) and (17) are applied:

$$\frac{D}{b} = \frac{Z_0 - Z_k}{Z_k}, \quad (16)$$

$$\frac{d}{f} = \frac{D}{Z_k}. \quad (17)$$

The following formula is obtained:

$$Z_k = \frac{Z_0}{1 + (Z_0/fb)d} \quad (18)$$

According to formula (18), the target depth can be calculated from the displacement image, and the parameters $Z_0, f,$ and $b$ are known. In addition, the plane coordinates of each target point can be obtained by replacing the coordinates of the image, such as the following formulas:
\[ X_k = \frac{Z_k}{f} (x_k - x_0 + \delta_x) \quad (19) \]
\[ Y_k = \frac{Z_k}{f} (y_k - y_0 + \delta_y) \quad (20) \]

Among them, \( x_k \) and \( y_k \) are the coordinates of the point image, \( x_0 \) and \( y_0 \) are the original coordinates, which are the lens distortion coefficients.

According to the received information about the depth of a given pixel \( x \), the feature is calculated according to the following formula:
\[ f_\theta(I, x) = d_l \left(x + \frac{u}{d_l(x)}\right) - d_l \left(x + \frac{v}{d_l(x)}\right), \quad (21) \]
where \( d_l(x) \) is the depth of image \( I \) in pixel \( x \), and the parameter \( \theta = (u, v) \) describes the displacement of \( u \) and \( v \).

In the distribution probability \( P(c|I, x) \) after training, the following formula can be obtained:
\[ P(c|I, x) = \frac{1}{T} \sum_{i=1}^{T} P_t(c|I, x). \quad (22) \]

Train each tree on a different set of random synthetic images, the learning algorithm is as follows.

Divide \( \phi \) sample \( Q = \{(I, x)\} \) into two parts, such as the following formulas:
\[ Q_i(\phi) = \{ (I, x) | f_\theta(I, x) < \tau \}, \quad (23) \]
\[ Q_s(\phi) = \frac{Q}{Q_i(\phi)}. \quad (24) \]

The maximum amount of information acquisition can be calculated, namely, the following formulas:
\[ \phi^* = \arg \max_{\phi} G(\phi), \quad (25) \]
\[ G(\phi) = H(Q) - \sum_{\pi \in I(x)} \frac{|Q_i(\phi)|}{Q} H(Q_s(\phi)). \quad (26) \]

If the maximum gain \( G(\phi^*) \) is still very high and the depth of the tree has not reached the maximum, the recursive operation continues on the left \( Q_i(\phi^*) \) and right subset \( Q_s(\phi^*) \) of the sum.

Determine the estimated density of each body part, as shown in the following formula:
\[ f_x(\bar{x}) = \sum_{i=1}^{N} w_i \exp \left( \frac{-\| \bar{x} - \bar{x}_i \|^2}{b_c} \right), \quad (27) \]
where \( \bar{x} \) is the coordinate in the space, \( w_i \) is the number of pixels in the image, \( \bar{x}_i \) is the weight of the pixel, \( d_l(x_i) \) represents the coordinate of the projected pixel \( x_i \) according to the spatial depth, and \( b_c \) represents the width of the formed component.

3.2 Human-Computer Interaction System. Gestures can indicate a person’s intention to operate a robot. Therefore, this article creates a human-computer interaction system structure based on gesture recognition for the platform. As shown in Figure 2, the structure of the human-computer interaction system based on gesture recognition includes two main processes: learning and recognition. Feature extraction module: extract important and unique features of the hand.

4. Construction of Hotel Management Teaching Practice System

4.1 Analysis of the Status Quo of Hotel Management Practice Teaching. According to industry feedback, there are two main drawbacks. First, it cannot ensure the sustainable development of practical skills and student innovation capabilities. Second, there are many traditional practice projects that are usually all-encompassing. Students cannot choose projects that are not beneficial to their personal needs and self-development. Practical training is a relatively independent learning system and does not contribute to the development of students’ comprehensive qualities and skills, so it has not been strengthened or researched. General education colleges and universities have relatively clear educational goals for students who specialize in hotel management, but a common problem is that the practical learning goals of various tourism schools are not accurately set. It is mainly manifested in the following: firstly, there is no independent practical training plan; secondly, the content of practice does not completely correspond to the theoretical teaching, which is not conducive to improving the students’ ability to use knowledge; secondly, the lack of practice, and greatly reduced the impact of the internship, and finally there was no improvement in the actual realization of the dungeon goal.

Most of the reception internships are based on knowledge, almost all of them are completed by one person, and most of them are based on the mastery of operational skills. In the past, practice courses in hotel management have taken cognitive exercises as their main goals. From the actual training of graduates, the lack of training in the field of hospitality and management, and the lack of information content, trying to use them is a shortcoming in current practice. Due to the school environment, the relationship between the actual hotel management classrooms is very weak, and the actual classrooms in the simulated classrooms are seriously lacking in equipment and related audio-visual materials, resulting in unstable learning outcomes.

By creating a talent learning model that combines hands-on learning with work and learning, a unique and dynamic teaching team must be created. In addition to teaching, teachers must be able to work. Teachers of this major should also go to the company to guide interns during the six-month internship provided by the company for students, so that teachers not only gain relevant theoretical knowledge.
but also gain practical experience and continuously improve their level. As the size of the university continues to expand, a large number of young teachers have taken up teaching positions. However, most teachers are scholars and have no practical experience. In hotel management courses, teachers not only master all technical skills but also have appropriate positions to practice, otherwise they will not be able to lead students well. The learning connection between internship and work/study combination not only puts forward new requirements for students but also puts forward new challenges for teachers. On the basis of mastering the practical skills of literacy, teachers should pay attention to the communication and interaction with the hotel in order to respond to the various problems of the practical class students in a timely manner. Teachers are accustomed to the learning environment of the school, and they urgently need to improve their ability to solve the professional and ideological problems of students during the internship.

Most hotel management majors in higher education management majors adopt another mode of talent training. The course stipulates that the proportion of practical training should not be less than 40%, and it focuses on cultivating students' practical skills. Most of the hands-on learning is carried out in off-campus internships in Hong Kong, such as hotels, and only a small part of them are taught on campus. In order to understand the possibilities and methods of strengthening the hotel management professional practice training in higher professional colleges, the author provides a detailed description in Table 1 based on the hotel management professional (two-year) practice training method.

According to market demand, schools and companies will form a professional steering committee to adjust the

<table>
<thead>
<tr>
<th>Order</th>
<th>Time</th>
<th>Detailed arrangement</th>
<th>Plan implementation</th>
<th>Target setting</th>
<th>Internship period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>First semester</td>
<td>Enterprise probation for one week; professional introduction</td>
<td>Participate in major hotels in a certain city to introduce the spirit of enterprise and industry characteristics</td>
<td>Preliminarily set a role to lay a foundation for the theory and form a preliminary understanding of the hotel management major</td>
<td>Short-term internship</td>
</tr>
<tr>
<td>2</td>
<td>Second semester</td>
<td>Four weeks of in-school training</td>
<td>Department leaders, professional teachers, etc., introduce the professional situation</td>
<td>Experience the working status of the hotel; take the vocational skills qualification test</td>
<td>Short-term internship</td>
</tr>
<tr>
<td>3</td>
<td>Third semester</td>
<td>Graduation internship</td>
<td>Submarine training; guest room training; etiquette training; catering training</td>
<td>Experience real work, accumulate experience, and exercise ability; be able to deal with and deal with problems at work alone</td>
<td>Long-term internship</td>
</tr>
<tr>
<td>4</td>
<td>Fourth semester</td>
<td>Internships around companies</td>
<td>The team is led by the internship instructor and enters all hotels for on-the-job internship work; the company will officially take up the job after one week of training, and the training will be led by the &quot;mentor and apprentice&quot; of old employees</td>
<td>Can be fully qualified for the grassroots work and various management tasks of various departments of the hotel</td>
<td>Long-term internship</td>
</tr>
</tbody>
</table>
curriculum system and revise the curriculum in time, taking into account, the changes in professional skills requirements, that is, adjusting the parameters of the curriculum and the content of the curriculum. The application-based curriculum system is used in the main professional courses. On this basis, the subject of the course is determined, the content of the training is selected, training modules are developed, and the skill modules required for professional positions are determined in advance. Create a set of application systems that emphasize hands-on learning, professional knowledge, and professional skills. The course system is shown in Figure 3.

In the practical training system, there is only one theoretical course in each specific academic year, that is, there is no sub-target system for student skills, no specific goals and plans for various skills, no courses for practice, and no ability to improve students’ skills. The specific annual target curriculum also does not include norms for cultivating students’ practical and management skills.

We use questionnaires and interviews to track the internship status of hotel management students, as shown in Table 2:

### 4.2. Construction and Implementation Countermeasures of Hotel Management Practice Teaching System

At present, postgraduate professional education is the most practical level of talent training for hotel management majors, and it is most suitable for industry needs. As far as the type of industry is concerned, the hotel industry is a capital-intensive and labor-intensive industry that requires a large number of highly skilled and high-quality personnel to serve and manage front-line personnel rather than high-precision machines. From the perspective of the education level of talents, the development of society, and their gradual integration into the international level, the demand for talents in the hotel industry is becoming more and more professional and better quality. It was replaced by highly educated employees, especially famous international hotel management groups. The requirements for talents and selection are higher, and the requirements for language skills are higher.

<table>
<thead>
<tr>
<th>Project Evaluation grade</th>
<th>Percentage of people (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internship Satisfaction</td>
<td>2.0</td>
</tr>
<tr>
<td>Basically satisfied</td>
<td>9.1</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>7.0</td>
</tr>
<tr>
<td>Internship treatment</td>
<td>1.6</td>
</tr>
<tr>
<td>Poor</td>
<td>95.9</td>
</tr>
<tr>
<td>General</td>
<td>1.6</td>
</tr>
<tr>
<td>Better</td>
<td>0</td>
</tr>
<tr>
<td>Did the internship achieve the goal</td>
<td>7</td>
</tr>
<tr>
<td>Partially achieved the goal</td>
<td>81</td>
</tr>
<tr>
<td>Cannot achieve the goal</td>
<td>12</td>
</tr>
<tr>
<td>Recognition of the profession after the internship</td>
<td>61</td>
</tr>
<tr>
<td>Know it better</td>
<td>31</td>
</tr>
<tr>
<td>Relatively vague</td>
<td>8</td>
</tr>
<tr>
<td>Cannot understand</td>
<td>27</td>
</tr>
<tr>
<td>Interns’ views on the rationality of the internship plan</td>
<td>38</td>
</tr>
<tr>
<td>Reasonable</td>
<td>38</td>
</tr>
<tr>
<td>Basically reasonable</td>
<td>12</td>
</tr>
<tr>
<td>Unreasonable</td>
<td>30</td>
</tr>
<tr>
<td>Still to be reformed</td>
<td>5</td>
</tr>
</tbody>
</table>

Quality and image are indispensable. Regrettably, the tension between industry development and talent shortage has become more and more obvious. On the one hand, the hotel pursues high-quality talents. On the other hand, some college and university hotel graduates are used as theories to introduce the "two skins" phenomenon. Without contact with practice, they cannot meet the needs of hotels. Moreover, many graduates are unable to meet the professional characteristics of the hotel industry from basic to professional transition, and in vain to upgrade the hospitality industry talent management major. Considering the hotel industry’s thirst for talents, what kind of training model should be adopted to ensure that hotel graduates can not only meet industry requirements but also firmly
establish a position at the forefront of hotel companies and gradually become the backbone of hotel services and management? This is a practical problem that the hands-on learning model is trying to solve. Since 2020, we have been trying to implement the "work-study" training model for the hotel management profession. In the implementation process, we usually divide the learning process of "changing jobs and learning" into three stages, as shown in Figure 4.

Figure 5 shows the process of organizing and coordinating the collaboration between the school and the company in the work-learn-alternate learning model.

5. Conclusion

With the continuous development and innovation of communication technology, 5G is a new generation of mobile communication technology, and its research value is obvious. On the one hand, the deep integration of vertical industries and cellular networks in the 5G era has led to more application scenarios, including simultaneous access to large IoT devices with limited resources, such as unattended sensors, sensors, and connected car components. On the other hand, the security model of the traditional network
architecture is no longer applicable, and the terminal faces greater security challenges. It is expected that the 5G security mechanism will ensure the security of communication in several application scenarios. Privacy and security authentication are the main issues facing 5G networks. This article analyzes the security threats faced by IoT endpoints and 5G networks during the communication process, including eavesdropping, replay attacks, forgery attacks, and DOS attacks, as well as the shortcomings of IoT scenarios (large scale), and defines the security requirements to meet the communication process. What needs to be done. Then, the hair-like function is used to extract the features of the gesture, which provides a good foundation for recognizing the gesture. Under the guidance of system theory, this article is based on the reform of hotel management professional practice teaching, and on the basis of the collected survey data, the current situation and existing problems of the hotel management system are obtained, referring to the professional staff of our hotel industry. On the basis of in-depth reading, the practical education system will be reformed. The purpose is to define and improve the core, content system, management system, and evaluation system needs around the target system.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References