ISSN 2706-655X Vol.4, Issue 6: 9-14, DOI: 10.25236/IJFET.2022.040602

Intelligent Body Measurement System (IBMS) in Colleges and Universities Based on Internet of Things(IOT) Technology

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Abstract: *Nowadays, teenagers' physical quality is getting worse and worse. Therefore, the Party Central Committee has established the educational policy of "health first" as the guiding ideology. In order to fully implement the party's education policy, a wave of sports towards stadiums or playgrounds has swept across the country. However, schools lack effective management means and methods for large-scale sunshine sports. Therefore, many colleges and universities have put forward tough measures for students' middle and long-distance running in sunshine sports, requiring each student to complete a certain number of kilometers of long-distance running distance every semester, record students' long-distance running with manual recording method, and finally count it into students' total score as a course. This scheme provides a good entry point for the development of sunshine sports, but the disadvantages of manual recording method also appear: a large number of students, a large number of long-distance runs, a large amount of data, inconvenient statistics, and recording with notes, low efficiency, heavy workload of statisticians, and error prone. Therefore, this paper puts forward the design of College intelligent physical testing system based on IOT technology, and develops the college intelligent physical testing system. This paper discusses the design objectives and principles of the ibms and the overall design idea of the system software, and takes a university as an example to test the packet loss rate of the intelligent test system under the IOT technology and the body temperature index under different distances. The experimental results show that the packet loss rate is very low and almost negligible, and in terms of communication distance, there is no packet loss within 500m; The website is stable, the information is uploaded in time, the calculation accuracy is high, and the students' feedback is good; When the distance is 1m, the body temperature is 36.6℃, when the distance is 12M, the body temperature is 36.5℃, and the error is small. The system has good flexibility. The hardware test shows that the hardware equipment selection of this system is perfect, the function is perfect, and the stability and flexibility are very high.*

Keywords: *Internet of Things Technology, Universities, Intelligent Body Measurement System, Body Measurement System Design*

1. Introduction

The intelligent sports measurement system in Colleges and universities uses sensor technology to perceive the sports behavior of athletes, transmits the sensing information to the processor through the sensor, and combines with powerful algorithms such as IOT technology to process and analyze the sports process, so as to make sports management and service more intelligent and smarter. The essence is to use IOT technology to combine IOT and sports, and provide better training plans for athletes more intelligently and scientifically, so as to improve China's ability in sports management and sports competitiveness. This is a modern project.

Many scholars at home and abroad have studied the design of ibms in Colleges and Universities Based on IOT technology. Keremk üü K introduces a teaching method of IOT system course, which will encourage students to learn how to develop and complete IOT applications in real time at a reasonable cost, and strengthen the teaching of IOT course by using widely available open source software and cloud platform. The proposed course is taught in the undergraduate Department of computer engineering at the University of kokali and the University of Sakarya in Turkey. The results show that the designed method can have a constructive impact on the process of computer engineering education by timely and actively helping to train new IOT engineers [1]. Harris MS reports using cluster analysis to examine data from the integrated higher education data system and create a typology of six types of institutions in four-year higher education institutions in the United States. Based on the

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research on institutional diversity and organization theory, the discovery provides a typology that can provide information for researchers and practitioners when they compare different systems. Strengthening the understanding of the similarities and differences between colleges and universities can not only clarify the characteristics and characteristics of American higher education, but also guide administrative decision-making [2].

Based on the traditional physical fitness testing technology, this paper introduces the intelligent technology of the IOT, adopts the advanced wireless communication technology, realizes the ad hoc wireless communication platform covering the whole campus, independently designs the high reliability communication protocol, and realizes tens of thousands of data sending and receiving without packet loss within the coverage range. The terminal online intelligent detection technology is adopted to realize the real-time fault alarm and analysis of online equipment. During the operation of the system, the big data intelligent background analysis platform is adopted to realize the real-time online intelligent analysis and real-time release of large-scale sports test data. It can automatically calculate students' long-distance running distance, speed and other information. The design of one primary and one secondary data base station is adopted. Normally, the primary base station is responsible for regulating the operation of the system, and the secondary base station is used as the receiving data for backup; When the primary base station has a problem, the auxiliary base station intelligently detects the problem of the primary base station. At this time, the auxiliary base station becomes the primary base station instead, and the system stability is very good [3-4].

2. Design of ibms in Colleges and Universities Based on IOT Technology

2.1 Intelligent Body Measurement System in Colleges and Universities Based on Internet of Things Technology

Smart sports can overcome the high-temperature and dry climate in the Middle East. Using sensors and intelligent air-conditioning system, the sensor detects the temperature and humidity in the venue, and the intelligent air-conditioning regulates the environment in the venue, so as to make the temperature and humidity in the venue appropriate, so as to improve the comfort of the audience, and make the sports mobilization better adapt to the competition.

The working principle of Internet of things technology is to install smart chips or sensors on real-life items, and then use RFID technology and ZigBee technology to make items deliver the information we need to people or other items. However, it is not easy to make a real work. The electronic tag uses the wireless sensor network to transfer the collected or stored information to the central information system through the sensor devices such as stress, smoke, temperature and humidity, infrared and inclination, and then realizes the identification of items through the computer network to achieve the accurate management of items [8]. RFID technology is not only the core technology of the Internet of things, but also the basis of the Internet of things. In addition, computer network, database, wireless sensor network and other technologies are also components of the Internet of things. With these advanced technologies, powerful functions such as monitoring, monitoring and numerical control can be realized [5].

Sensor technology: sensors are generated by digitizing and concreting information that people cannot clearly perceive, such as temperature, speed, humidity, gravitational acceleration, electromagnetic radiation and PM2 5 value, etc. Sensor can be regarded as the expansion of human senses. It is a very important device in unknown fields or fields that are not suitable for human exploration. At the same time, it plays the role of connecting the outside world and the processor in automatic control. The sensor collects signals from the external input through the sensitive element, and converts the signals into another output form (electrical signal) that is easy to be identified, recorded and analyzed through the conversion element and conversion circuit, and then various processors can process it [6].

2.2 Type Selection and Distribution of Body Side System Sensors

The selection and distribution of sensors is the first and most basic step in building an intelligent body measurement system, because whether the selection and distribution of sensors are reasonable is directly related to whether the health state can be accurately monitored. The selection of sensors mainly includes the selection of stress sensors, tilt sensors, temperature and humidity sensors and smoke sensors. Through the reasonable selection and distribution of four types of sensors, the test of building

ISSN 2706-655X Vol.4, Issue 6: 9-14, DOI: 10.25236/IJFET.2022.040602

stress, inclination, temperature and humidity, smoke concentration and other parameters is completed. These four types of sensors constitute the sensor system. In intelligent body measurement system, sensor selection is particularly important. In the selection, we should consider not only the attributes of the sensor itself, but also the requirements of the parts to be tested, but also the influence of the external environment[7-8].

The digital circuit part of the chip mainly includes the following parts:

ATR response unit: it is mainly used to respond when the IC card is within the action range of the card reader and the card reader sends a request command; Anti collision unit: when multiple cards respond to the command sent by the card reader, it is used to complete bit frame anti-collision and assist in the process of card selection; Select application unit: after completing the above steps, the selected card sends the capacity stored in sector 0 of the card to the card reader; Authentication and access control unit: after the card reader and the card are selected, the card reader, the card reader and the password on the card are mutually confirmed, and the next operation is allowed after confirmation; Control and arithmetic operation unit: this unit is the core control part of the whole card. It coordinates and controls other units in the card, and performs operation processing and verification correctness processing on the data; RAM / ROM unit: RAM realizes the temporary storage of operation data, and the program instructions are solidified in ROM, which will be selected and called when the card is running; E2PROM: an important memory in the card, which contains the unique serial number, capacity information, key, manufacturer information, user data, etc; The interfaces between the cache and the host include USART, SPI and I2C. These three main interfaces are described below:

The function of serial interface between MCU and peripheral equipment is to exchange information in the form of serial bus. SPI has three registers: SPCR (control register), SPSR (status register) and SPDR (data register). Peripheral devices include flash, ram, LCD display driver, MCU, etc. SPI interface mainly has four lines, MoSi, SCK, miso and NSS. Mfrc522 communicates with the host MCU as a slave, MoSi and miso as input and output serial data, SCK is the clock line, and NSS is the chip selection (SPI transmission enable) line.

UART interface: UART interface is used to control the communication between PC system and serial equipment. It receives parallel data from inside the system or serial data stream from outside, and converts it into serial data stream output or bytes for internal devices of the system. It is frequently used for full duplex asynchronous communication. In mfrc522, the baud rate of UART can be set through the internal register and can be used by users in a wide range.

I2C interface: I2C bus interface includes SDA (serial data line) and SCL (serial clock line), which are used to send and receive data between CPU and controlled IC, IC and IC. I2C bus is a simple, efficient, low-cost but high-quality serial bus, which is suitable for the field of electronic medium and low-speed devices. In the process of data transmission, I2C bus has three signals [9] of start, end and response, which respectively control the start, end and response of data. Like UART, I2C bus transmits data in serial mode. SDA is allowed to change in level only when SCL is low level.

2.3 Overall Design of System Software

(1) Overall design of host computer software

The function of the upper computer software is to process the data transmitted from the data base station through the network port, enable the data receiving program, sort out each piece of data, add a time stamp after each piece of data, and save it in the file of the PC hard disk.

(2) Overall design of lower computer software

If the lower computer software and communication modules send or receive data at the same time, there will be serious data collision. Polling communication is adopted, so that only one wireless module is in working state at the same time [10-11].

(3) Overall design of bit computer software

The function of the upper computer software is to process the data transmitted from the data base station through the network port, enable the data receiving program, sort out each piece of data, add a time stamp after each piece of data, and save it in the file of the PC hard disk.

The goal of the host computer software design of this system is to design a web site, which is connected with the background database, and the website provides the query of administrators, students

ISSN 2706-655X Vol.4, Issue 6: 9-14, DOI: 10.25236/IJFET.2022.040602

and teachers. In addition, the school administrator has full authority to import and export the information of the whole school, such as the list of teachers and students' long-distance running, and the administrator has the function of modifying the list of students' long-distance running, and the administrator has full authority to export the information of students' long-distance running. In addition, the administrator has the ability to query and export the information of students' long-distance running by the school administrator; Student login: students can log in to the system with their student ID as their account, view their own long-distance running records, their basic information and class teachers, and provide the function of password modification; Teacher login: the teacher can use the job number as the account to log in to the system, view and export the long-distance running summary of the students in the class, and realize the function of modifying the password for the students in the class [12].

3. GEP Positioning Optimization Model

First, an initial feasible individual H1 satisfying the constraint conditions is automatically generated, and the initial individual H2 is randomly generated according to formula (1).

$$H2 = H_{\min} + R2(H_{\max} - H_{\min}) \tag{1}$$

Where R2 = (R2A, r2b, r2c) t, Hmax = (Amax, Bmax, Cmax) t, hmix = (amix, bmix, cmix) t. If H2 meets the constraints, continue to generate a new individual H3; If H1 is not approached by equation (2):

$$H2 = H1 + \eta(H2 - H1) \tag{2}$$

Where: η contraction coefficient, $\eta \in$ [0,1], the initial value of η is 0.5. If H2 shrinks once according to formula (2) and still does not meet the conditions, then halve the contraction coefficient and further approach H1 until H2 meets the conditions. After H2 is generated, use the above method to iteratively generate a new individual H3 until the initial feasible individual reaches the initial population size. The formula is as follows (3) (4)

$$\begin{cases} p1 = 1/(\sqrt{ai(hi) - Gaj)^2 + (bi(hi) - Gbj)^2 + (ci(hi) - Gci)^2} - di)^2 \\ p2 = 1/(\sqrt{ai(hi) - eaj)^2 + (bi(hi)ebj)^2 + (ci(hi) - ecj)^2} - di)^2 \end{cases} \tag{3}$$

$$P\mathrm{i} = \sum \theta 1 p1 + \theta 2 p2 \tag{4}$$

Where, θ1 represents the weighted value corresponding to the location relationship of the anchor node, and θ2represents the weighted value corresponding to the location relationship of the general node. When the anchor nodes are sufficient, the θ2value is 0; In case of insufficient, set θ2 to 1 / 2 of θ1to reduce the impact of initial position error accumulation on positioning accuracy.

4. Experimental Test and Analysis of ibms In Colleges and Universities

According to the hardware design, draw the PCB board, the bottom and top PCB of the data acquisition terminal. After the data acquisition terminal and data base station are ready, start to deploy the whole system in University A: install two data base stations in the network management center, one as the main data base station and the other as the standby data base station. Eight data acquisition terminals are divided into two groups and arranged around the data base station. The four points are: the second teaching building, the ninth teaching building, the student activity center and the gymnasium. The distance between each point is different, and the longest distance is 600m. one is the worst environment test, each data acquisition terminal is pasted with Campus All-in-one Card for about one hour, and the other is the normal test mode: students run normally for a long time according to the specified time, and use the background software to calculate the packet loss rate. The final test results are shown in Table 1 and figure 1

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Table 1: Packet loss test results

	D	E	F	G	A	B	C
Number of swipe cards	2926	2436	2648	2776	2246	3386	3467
Number of lost packets	7	1	11	0	9	0	12

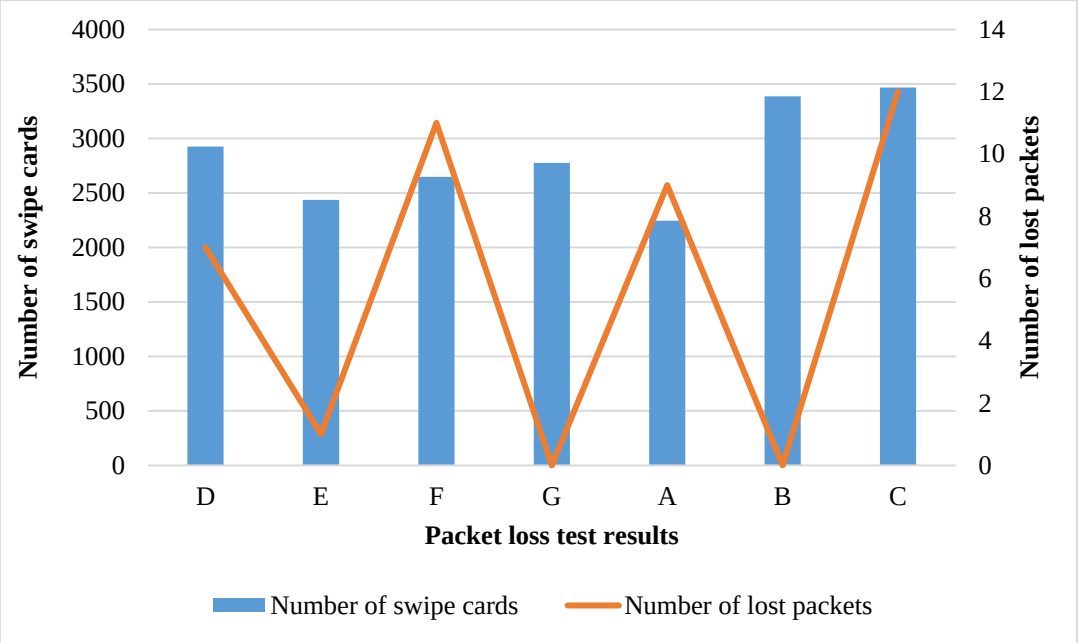

Figure 1: Packet loss test results

According to the test data, the packet loss rate is very low and almost negligible, and in terms of communication distance, there is no packet loss within 500m; In terms of upper computer, the whole system has been running for more than 3 months without collapse, and the web page is stable, the information is uploaded in time, the calculation accuracy is high, and the students' feedback is good.

Next, the body temperature indicators at different distances are tested through the ibms. The test results are shown in Figure 2

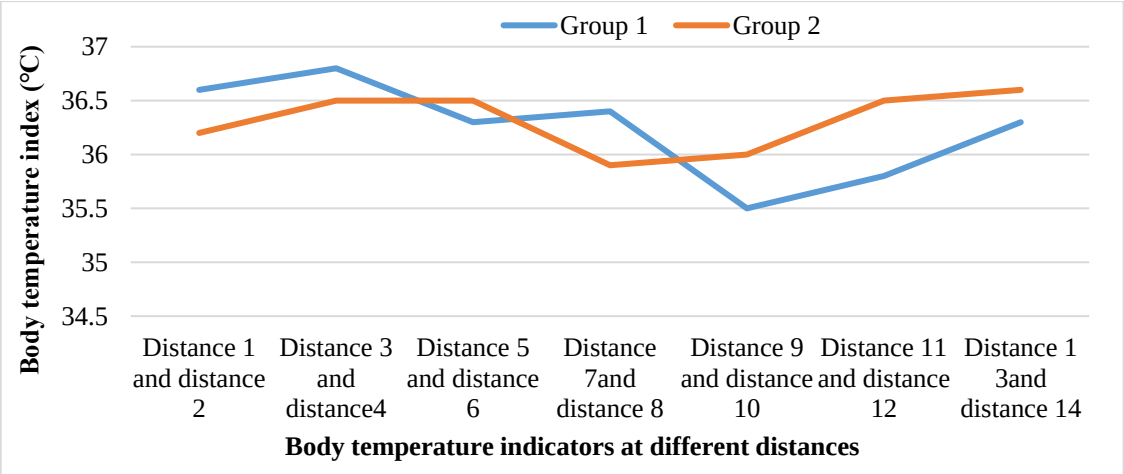

Figure 2: Body temperature indicators at different distances

It can be seen from the data in the table that when the location is far away, there will be occasional packet loss and no data can be received, but in most cases, there is no problem in data transmission and reception. In terms of intelligence, when the received physiological parameters exceed a reasonable range, a warning will be given. When the test distance is within a reasonable range, the body temperature can be accurately measured. When the distance is 1m, the body temperature is 36.6℃, when the distance is 12M, the body temperature is 36.5℃, and the error is small. It shows that the system has good flexibility. The test results are recorded by recording, analyzing and archiving, which is convenient for the performance evaluation of the whole system in the future. Through the hardware

ISSN 2706-655X Vol.4, Issue 6: 9-14, DOI: 10.25236/IJFET.2022.040602

test, it can be seen that the hardware equipment selection of this system is perfect, the function is perfect, and the installation is convenient and fast.

5. Conclusions

Although this paper proves the advantages of high stability and performance of the ibms under the IOT technology through experiments, there are still some deficiencies based on the system design and performance. In the future, we should make improvements in the following aspects: hardware design. Firstly, we should modify the defective parts of the hardware PCB design. Secondly, we should punch as many holes as possible when designing the PCB to enhance the heat dissipation of the hardware version, and we need to lay copper on a large area; Hardware intelligence. When the system is running, there is not much communication between the data acquisition terminal and the data base station except receiving and transmitting data. When the polling signal reaches the data acquisition terminal, if no data is sent, the data base station cannot judge whether it is because there is no data or because there is a problem with the data acquisition terminal; Data packet loss rate. Although the data packet loss of the system is not serious, if a longer communication distance is required in the future application process, the packet loss will increase a lot. Therefore, the system should improve the previously designed packet loss retransmission mechanism to ensure that the system receives and sends data more completely.

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