Using TAM and Maslow's Needs Theory to Evaluate the Intention of Adoption of Home-Based Intelligent Exercise System: The Example of Golf Croquet

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Article

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Abstract: In 2020 the world experienced the threat of the COVID-19 epidemic, as seniors and chronic disease patients typically try to reduce their exercise and social activities to avoid increasing the risk of infection, which could lead to increased loneliness and even many diseases. This research combining golf croquet games with AIoT companion robots constructs a home-based intelligent exercise system thus uses the Technology Acceptance Model (TAM), deduces users' intention to use this system based on perceived usefulness and perceived ease of use, and adds the needs of love and belonging, esteem, cognitive, aesthetic, and self-actualization in Maslow's needs theory to conduct system needs analysis. The analysis results show that participants have a high level of acceptance of this system, believing that it is easy to learn and operate, can increase interaction with others, also found that this system can improve self-confirmation, satisfying the third for knowledge, feeling happy, and self-actualization needs are easier to fulfill. In the future, we shall collect and record the seniors in the process of use, so as to find out their health problems as soon as possible, expand their daily life through this exercise, and achieve the goal of happy living and health care.

Keywords: Technology Acceptance Model; Maslow's hierarchy of needs; golf croquet; mobile applications; companion robot; AIoT; senior

1. Introduction

The course of a person's life is no more than the stages of birth, aging, disease, and death. Human life is a process of gradually withering and aging after the test of years. The experiences that can be shared together are those in life, family, and society [1,2]. During their growth in life, most of people experiences a diverse and colorful world, followed by an elderly lifestyle, which is also the final stage before human death. However, before the final stage of life, how to adjust one's physical and mental health and to arrange leisurely life are goals in old age now or in the future. If senior can actively participate in leisure activities that are beneficial to their body and mind and recognize the significance and importance of leisure to quality of life, then they can successfully move towards aging and reduce their social burden [3,4].

With the growth of the economy and the progress of science and technology and medical treatment, human life expectancy is continuing to grow, and the global aging population has also increased year by year, which has become a topic of close attention by many countries [5–7]. With the change in society and the change in the concept of procreation in Taiwan, the growth of its population has slowed down, and the national fertility rate has decreased year by year. In addition, the

prevalence of late marriage and the increase in average life expectancy have significantly changed the age structure of Taiwan's population [8]. The social problems of aging are not only the needs of the elderly's welfare, but also economic, medical, and family issues. The secondary issues relate to elderly's life, leisure and entertainment, well-being, and psychological and social adaptation, which are issues that the government and society should pay attention to and properly plan for [9–11].

Under the premise of strong and rich countries, the greatest risk for senior is not entirely health problems, but also isolation and loneliness [12–14]. For senior, regular exercise is the most effective way to reduce organ degradation and improve physical aging. By participating in leisure sports or activities that they are interested in and obtaining happiness from them, people can achieve physical and mental satisfaction and avoid isolation and loneliness [15,16]. Among them, croquet is a low-intensity sport and is a lei-sure activity with both fitness and social functions. Senior have plenty of time to participate in croquet, which has a great effect on physical and mental health [17]. In addition to gaining recognition among peers, they can temporarily get rid of unhappiness and become happy from sports, and depression and anxiety can be effectively relieved. Past studies [18–22] also showed that if you want to improve the quality of life of senior, then you can use home-based robots to achieve the goal and also effectively reduce the burden of caregivers.

With continuous progress and development of science and technology, smartphones have entered society family and played an important role in most people's lives. According to Dennison et al. [23], mobile phones have become an important way to spread healthy behaviors. The development of internet mobile technology has promoted the rapid rise of fitness apps, which are third-party application(s) of smartphones or wearable devices that can help users record fitness data, guide sports learning and lead healthy lifestyles [24]. Thus, more and more scholars are continuously investing in research related to fitness or sports applications [25–28]. To explore a sports system suitable for senior to use at home, this study takes golf croquet as an example and proposes the revised Hierarchy of Needs Theory (HNT) and Technology Acceptance Model (TAM) to confirm senior's demand for a healthy home exercise system.

HNT proposed by Maslow [29] is a well-known incentive theory. Its main connotation is that there are high and low levels of demand, and individuals will first try to meet the needs of the lower levels. From the bottom, when people's needs of one level are met, they will pursue another higher level [30]. TAM was proposed by Davis et al. [31] and provides a theoretical basis for understanding the impact of external factors on the beliefs, attitudes, and intentions of users' internal factors and then on the use of technology. From the perspective of science and technology, with the maturity of the Internet of Things (IoT) technology and the rapid development of artificial intelligence (AI), the use of AIoT emerging technology to improve the quality of life of senior has attracted greater attention [32–34]. The integration between IoT and mobile phone devices can effectively solve the difficulties of limited storage space and insufficient computing processing capacity of devices at low power consumption, strengthen the development of the entire IoT technology, and achieve effective management in terms of reliability, computing performance, security, and confidentiality [35–37].

To enable senior to use it at home, it is necessary to improve the limitations of the open and flat field and the assistance of many staff members in the game of golf croquet. This research is based on the new patent "An auto-scoring system for golf strike-back ball" published by Chen et al. [38] (Republic of China Patent No. TWM602930) to optimize the game of golf croquet. It uses IoT technology combined with ultrasonic sensors and Zenbo robots to calculate scores and display rankings. Finally, through the investigation of the golf croquet home action system in this study, the testers' acceptance of the functional orientation and demand design of the system will be further explored. In the future, relevant information during the use process can be collected and recorded, can detect the health problems of the users early, and can promote this research to penetrate into the daily life of seniors.

2. Literature Reviews and Research Hypotheses

2.1. The Needs and Characteristics of Senior

Population aging is a global problem, and Tai-wan is no exception. Due to the substantial improvement in living standards and the continuous progress of medical technology and science and technology, people's awareness of health and wellness is also gradually rising. According to data from the survey report of the elderly by the Ministry of Health and Welfare of Taiwan [39], about 71% of the senior feel that their health and physical and mental functions are at the middle level - that is, most senior are still in a relatively healthy state. Therefore, when senior have relatively more time at their disposal, the arrangement of daily life is not only to replace the work style before retirement, but also an important key to maintaining quality of life. In other words, the arrangement of various leisure and health activities is more important for the senior, and this changing trend is also of wide concern by many circles [40,41].

According to data of the survey report of senior by the Ministry of Health and Welfare of Taiwan [39], about 76% of Taiwan's 55-year-old citizens believed that their health and physical and mental health are in ordinary or even good condition. The statistical data also show that "health care group activities" have the highest participation rate, and "leisure and entertainment group activities" are also those they often participate in, regardless of whether the elderly population is aged 55 to 64, or aged 65 or older. This shows that Taiwan's senior has strong demand for leisure and healthcare activities. On the other hand, the pro-portion of senior over 65 who need nursing, maintenance, or care services is only 17%. Although the physiological function of elderly people will inevitably decline, their psychological pursuit of respect, attention, and companionship will not disappear with age, but will continue to increase [42]. With the progress of medical treatment and technology, the maintenance of the physiological functions of elderly people is also improving. It is expected that the number of elderly people over 80 years old in Taiwan's elderly population will continue to increase.

2.2. Recreational Sport and Golf Croquet

Leisure comes from the Latin "Licere", which means free time or free activities after getting rid of productive labor [43]. Leisure sports refer to those in which participants freely choose to engage for their own fun during leisure time. Such sports include physical exercise and recreational sports [44,45]. Leisure sports emphasize personal will and self-development, pursuing health and physical development in sports, and achieving the purpose of relaxation. More importantly, one can obtain internal satisfaction from sports [46].

With the transformation of society, machines are replacing human beings in various things, the number of working hours of human beings has gradually decreased, and the amount of free time has increased. Therefore, how to arrange appropriate rest and life outside work has increasingly attracted the attention of the public. After entering the elderly age, individuals mainly participate in physical leisure activities (such as aerobics or walking), intellectual leisure activities (such as chess), religious leisure activities (such as charitable activities), and social activities (such as volunteering). If we can increase the number of lei-sure, recreational, educational, and sports courses and provide some opportunities to participate in voluntary services for the senior, then this will fill their spare time and give them the opportunity to participate in society. The most important thing is to help them establish a correct self-awareness so that they will not think that they have lost their usefulness in society [47].

Activity or exercise is a health guide designed for the human body. If an individual does not engage in a certain degree of activity or exercise, then muscle strength will gradually decline with age and the aging phenomenon, resulting in a de-cline in activity, which will increase the possibility of accidents in senior and relatively increase the risk of chronic diseases [48]. Croquet is very suitable for senior to participate in and reduce various chronic diseases [17,49]. For them, participation in croquet can fill interpersonal relationships and interactions after retirement. It is a low-intensity sport, has fitness and social functions, and is quite suitable for the elderly to engage in s. By participating in croquet, senior can gain the recognition of their peers and temporarily get rid of unhappiness from the game of croquet. Depression and anxiety can be effectively relieved [47,50].

The origin of croquet is from France. It is a recreational activity that can be participated in by many people, and it can help with mind power [51]. However, it is also subject to some restrictions, including limitation of the size of the field. Golf croquet originated in Japan and drew lessons from

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the traditional British croquet sport that originated in the 14th century. At that time, it provided children with a way of entertainment, but it was not accepted by them; instead, it was loved by senior. It is an indoor sport suitable for senior [52,53]. Golf croquet combines fun and brainstorming. It integrates the training of feet, hands, and concentration into an activity so that participants can also stand up and walk happily and naturally. Golf croquet requires more attention and better control, and the rich colors on the scoring carpet to improve the willingness to participate, the score matrix in Figure 1 is 13 grids indicating different scores. If the ball falls with the same number of balls as the selected ball number, the score will be doubled, scores can also be negative. The arrangement of competition activities can make everyone more aware of the importance of cooperation and can fully open the door to group activities to laugh and enjoy time with others.

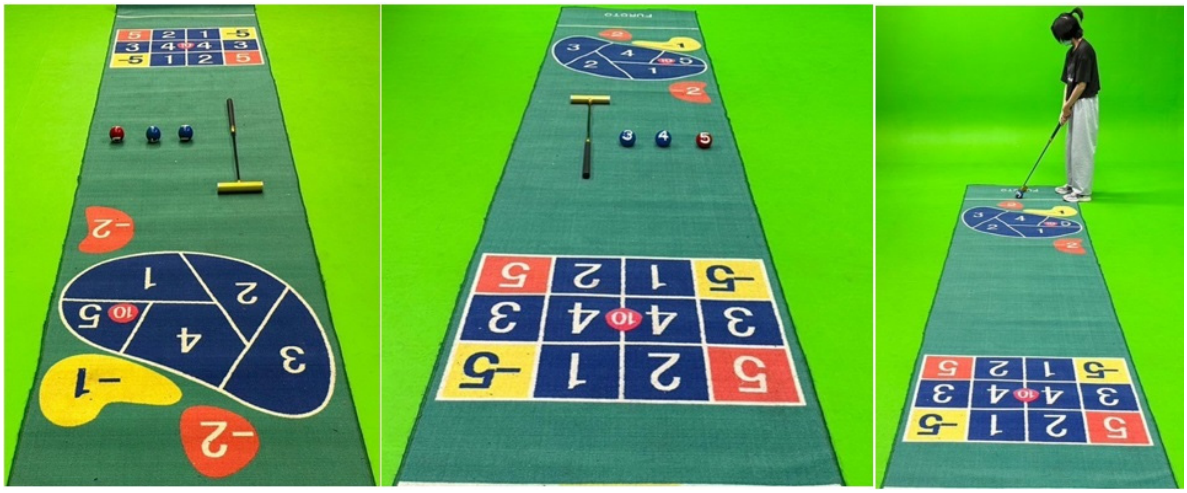

Figure 1. Schematic diagram of golf croquet.

2.3. Internet of Things and Companion Robot

Taiwan's society is facing the phenomenon of aging and fewer children, causing a hidden worry about the country's sustainable development. How to guarantee the quality of life of senior and reduce the burden of young people are important issues for society.

From the perspective of science and technology, the maturity of IoT technology, and the rapid development of AI, the use of AIoT emerging technology combines AI and IoT to improve the quality of life of senior and has attracted greater attention [37,54,55]. The IoT means that every electronics device can be connected to the Internet through the network infrastructure [56]; The device has a variety of sensors, which can collect and integrate information anytime and anywhere to assist people's lives [57,58]. In recent years, IoT has been used more and more widely, covering a variety of different application fields. Among them, Qian et al. [59] used Ambient Assisted Living (AAL) and Healthcare Monitor (HM) in combination with AI and the IoT to systematically help senior live a more relaxed and better life in terms of methodology and application scenarios. Abdi et al. [60] found that some emerging technologies (such as AIoT) may solve the elderly's basic self-care and medical care needs, but there is still a gap in their potential use in some nursing fields. Research results can provide industry with some clear challenges and obstacles to improving the adoption of emerging technologies by the elderly, such as robots and virtual/augmented reality (AR/VR).

With the progress of science and technology, people expect robots to be closer to human life and provide more diversified services. Various service robots have begun to flourish, trying to integrate into human life with different roles. In the care of the elderly, the development of many machine pets and machine dolls, which can interact with the elderly, really helps ease the psychological loneliness of the elderly and feel the value of being needed again [61]. Companion robots have evolved from mental commitment robots to therapeutic robots, which can provide psychological and spiritual

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healing effects for the elderly, relieve their stress and loneliness, provide psychological healing functions for patients with dementia, and improve their mental health and quality of life [62].

The rise of AI in recent years, especially natural language processing technology, has gradually matured and become widespread. Voice assistants combined with IoT technology have already entered many homes. Users can use their voice to perform functional tasks or information queries through a voice assistant and even apply it to the biomedical field, including disease diagnosis and life assistance [63]. Many research and development projects also try to combine robots and natural language processing to develop robots that can talk naturally. For example, Zenbo (as shown in Figure 2), a robot developed by ASUS, is a companion robot that combines the cloud natural language processing engine. Our work uses Asus Zenbo to connect our app. Zenbo Software Development Kit and additional tools can accelerate our development of apps and capabilities for Zenbo.

Figure 2. Zenbo robot.

Because Zenbo has a variety of functions, it can cover the basic needs of senior in daily life and company [64]. Compared with general robots, Zenbo's price is more reasonable, which increases the popularity of it for general families or nursing institutions. Therefore, this study uses Zenbo as an auxiliary research tool to deeply explore the application of companion robots and demand analysis of an elderly family home motion system.

2.4. Mobile Application and Scoring system

The vigorous development of smartphones and wireless networks allows users to easily access the information they want and need through mobile technology anytime and anywhere. It has created diversified mobile application systems, changed the way people communicate, and improved social interactions. Therefore, more middle-aged and senior are using mobile phones to take photos, upload and share, or use social software to communicate with friends and relatives. They are enjoying the convenience brought by information technology.

According to Ofcom [65] report on adults' multimedia use and attitudes, 28% of the elderly aged 75 or above overused tablet computers in 2018, or an increase of 15% over 2015. In 2020, 77% of the elderly over 65 used the Internet at home. According to the same survey results, the Internet use rate of the age group 65 to 74 increased from 52% in 2011 to 83% in 2019 It meaning that the senior are narrowing the generation gap in technology use, and they are not only using their computers. but also expanding to mobile phones and tablets [66].

AT Kearney [67] pointed out in the "Demand and Impact of the Elderly Consumers" report for the middle-aged and the elderly that the elderly have high acceptance of mobile technology, 69% of the senior use the Internet and mobile phones at the same time, and mobile technology has brought changes and influence to the lives of the senior. A report on the use of smartphones published by InsightXplorer [68] explains the use of applications and browsers/web pages on smartphones. Regardless of the content type, the overall use rate of apps is higher than that of browsers/web pages,

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and the availability of local services and specific information is higher than that of browsers. Therefore, under such consideration, people can effectively and immediately manage their own health conditions and make health management plans by using mobile apps.

Most of the intelligent sports systems are mainly targeted at young people, and the category is also biased towards running or cycling records and fitness teaching. This may motivate us to try to mimic the observed activity patterns, resulting in more or fewer sports activities depending on the sports behavior of our peers. Products similar to this research include the golf practice system, which focuses on the evaluation of swing strength and golf trajectory [69,70]. Clubs on Strava [71] is the largest online social network, it connects millions of runners, cyclists, hikers, walkers and other active people. Franken et al. [72] find Clubs on Strava influenced each other's running behavior. A sports partner's excellent results will motivate him to keep exercising [71]. There are few indoor sports intelligence systems for multi-person interactive seniors, so it is very important to discuss multi-person online sports systems suitable for seniors.

Based on the above, we find that using mobile apps to promote health management products is very effective. Through the development of a prototype of a home-based intelligent exercise system, this research can attract Taiwanese to pay attention to their own health, immediately know the health management suggestions, and can use this app to achieve the purpose of health maintenance. In order to adapt to the sports system used by the senior at home, this study takes golf croquet as an example to improve the croquet field and rule restrictions, based on the research result "Auto scoring system for golf strike back ball" published by Chen et al. [38], and applies for a new patent (No. : TWM602930), this system uses a sensing plate and image recognition device (as shown in Figure 3) to determine the path and final stop position of the croquet after hitting, as the basis for the score of golf croquet. The score is recorded and displayed in the App software, the "Smart Golf Croquet System" App in Figure 4 includes five functions: Login, select ball, Swing ball, Score, and Leader board, also can automatically sort the score and list the ranking, so as to reduce the number of judges, scorers, and other staff, and the smaller venue can also be used. This system improves the original restrictions and also records the muscle groups and fitness conditions used by users in the process of use, because the app software of this system contains an image recognition function module and storage area that can identify and store at least three hitting paths. Thus, the base point of hitting can be set in advance with assistive devices. Rehabilitation therapists suggest that three hitting points be determined for the fixed muscles. The hitting path, the position of the ball, and scoring are recorded at the same time, and so specific muscle rehabilitation or fitness status can be evaluated.

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Figure 3. Ultrasonic sensors plate and image recognition device.

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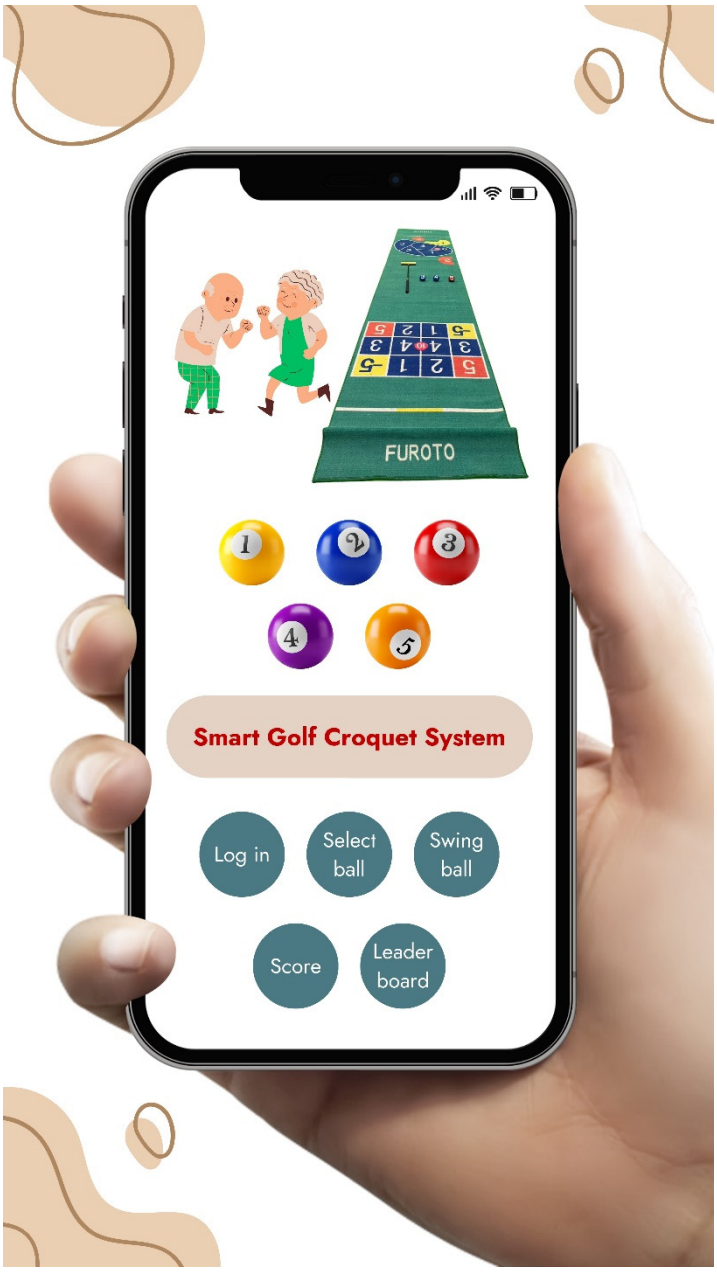

Figure 4. An App for Auto scoring system for golf strike back ball.

Generally, when playing traditional golf croquet, there will often be an embarrassing situation where the ball is pressing on the line or on many points. At this time, you will be confused about the score. Our work changed it to an intelligent scoring method, using image recognition to detect the actual score of the ball, sending it back to the background to calculate the score, and then making a sound to inform the score and convenient to help users easily know the score overview. The intelligent scoring system mainly uses the camera that shoots the scoreboard, the back-end differential image recognition, and finally read out the score. In smart golf croquet, there are four main items: smart scoring system, smart club, robot, and app. The intelligent scoring system mainly uses the camera that shoots the scoreboard, then the differential image recognition at the back end, and finally read the score out loud. In the part of the smart club, will install a shock, pressure and Accelerometer sensor on the smart club, and an Arduino to process the data. The part of the robot will have an intelligent voice and camera system. Usually, the elders are not ideal for using electronic products and can be operated this system only by speaking. Furthermore, the app screen can be directly displayed on the robot's screen. The last part of the App is to integrate the data of previous

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scoring and clubs for display. Next, the multiplayer connection is the most important part, so that players can play together online without being disturbed by space factors.

2.5. Technology Acceptance Models and Hierarchy of Needs Theory

TAM published by Davis et al. [31] is based on the theory of rational behavior. Davis believed that the individual's attitude will affect his/her willingness to use something and then affect his/her actual behavior. They proposed that "perceived usefulness" and "perceived ease of use" are the key factors that affect his/her acceptance or not and added external variables, including system design characteristics, user characteristics, use environment, task characteristics, degree of involvement, etc., to explore their relevance with a user's cognition and behavioral intention. In other words, because of the influence of some external factors, users realize whether the new technology is useful and easy to use, and only after they have a positive attitude towards the internal psychology will they have the intention to use, and then the actual use behavior will occur.

The TAM dimensions defined by Davis et al. [31] are as follows. (1) Perceived usefulness: external variables and perceived ease of use will affect perceived usefulness, and improvement of the ease of using the system will also promote work efficiency, and perceived usefulness will affect people's attitude and intention to use new technology systems. (2) Perceived ease of use: perceived ease of use will affect perceived useful-ness and use attitude, because users need to be able to use it to produce performance. The easier the technology system is to use, the better the work efficiency will be, and the time to complete the task will be shortened. (3) Intention to use: perceived ease of use and attitude to use will affect people's intention to use the technology system. We expect that the technology system can improve work performance and feel about the sys-tem and promote users to actually use the product.

Research on the acceptability of interpreting information systems based on TAM has obtained numerous empirical evidence [73,74], which has been fully affirmed in terms of both interpretation ability and theoretical applicability. Although TAM was originally only used in information-related fields, many studies have applied it to information services and innovation and technology products [75,76], proved its effectiveness, and verified the relation-ships among users' perceived usefulness, perceived ease of use, use attitude, intention to use, user behavior, and other aspects of information technology. Therefore, this study proposes the following research hypotheses.

H1: *Mobile phone experience has a positive and significant impact on perceived usefulness.*

H2: *Education level has a positive and significant impact on perceived usefulness.*

H6: *Perceived usefulness has a positive and significant impact on intention to use.*

H7: *Perceived ease of use has a positive and significant impact on intention to use.*

Maslow's hierarchy of needs theory [29] is the most widely used theory in the study of organizational incentives, including the following requirements: (1) Physiological needs: the basic needs for human survival, including food (hunger, thirst), clothing, housing, transportation, education, and happiness; (2) Safety needs: including physical and psychological safety and stability, avoiding physical injury or mental injury; (3) Social needs: various interpersonal relationships for personal needs, such as friendship, love, companionship, and sense of belonging; (4) Self-esteem needs: personal needs related to self-esteem, such as the pursuit of social status, social respect and recognition, and trust; (5) Cognitive needs: seeking knowledge, and the curiosity of individuals to explore specific problems and knowledge and then learn; (6) Aesthetic needs: seeking beauty, including the appreciation of external beauty and the internal desire to achieve perfection in the things within; (7) Self-fulfillment needs: the highest level of demand in this theory refers to the individual's ability to maximize, realize his ideal and ambition, and become his desired person; (8) Spiritual needs: it is a need to transcend oneself and integrate nature and man, including altruism, compassion, and other goodness implied in human nature.

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Maslow's hierarchy of needs theory is not only a prominent science in psychology, but also an important exposition of humanistic psychology and is widely used in other fields. Ryan et al. [77] proposed a framework for community stability and sustainability in COVID-19. Their study pointed to the need for policymakers to understand the associated risks, and how Maslow's hierarchy of needs and social determinants of health can guide policy across society. Aligning decision-making with societal needs will help ensure that the needs of all segments of society are met while managing a crisis. Altymurat et al. [78] discussed the application of Maslow's hierarchy of needs principles in organizations, showing that companies will function optimally when the requirements for confidentiality, convenience, and certainty are met, thereby enabling the satisfaction of the process of user knowledge requirements to go smoothly. Hale et al. [79] proposed Maslow's hierarchy of human needs (physiological, safety, love/belonging, esteem, and self-actualization) as a potential framework for addressing wellness programs. Their findings revealed that widespread burnout in graduate medical education exists and has detrimental effects on career satisfaction, personal well-being, and patient outcomes. Therefore, this study proposes the following research hypotheses.

H3: *Education level has a positive and significant impact on social needs.*

H4: *Education level has a positive and significant impact on esteem needs.*

H5: *Education level has a positive and significant impact on self-actualization needs.*

H8: *Social needs have a positive and significant impact on intention to use.*

H9: *Esteem needs have a positive and significant impact on intention to use.*

H10: *Cognitive needs have a positive and significant impact on intention to use.*

H11: *Aesthetic needs have a positive and significant impact on intention to use.*

H12: *Self-actualization needs have a positive and significant impact on intention to use.*

To sum up the above, this study is based on perceived usefulness and perceived ease of use in TAM to explore the relationships among users' cognition, attitude, intention, and use of technology systems. Next, we further explore the needs of the senior, propose to add Maslow's needs theory to improve the technology acceptance model, and confirm the relationships among social needs, self-esteem needs, cognitive needs, aesthetic needs, and self-actualization needs in Maslow's needs theory, as well as perceived usefulness, perceived ease of use, and intention to use of TAM.

3. Research Method and Design

This study proposes to add Maslow's hierarchy of needs theory to improve TAM and explores the needs of senior for healthy sports mobile phone apps. The relationship between TAM of the perceived usefulness, the perceived ease of use, and in Maslow's needs theory of social needs, esteem needs, cognitive needs, aesthetic needs, and self-actualization needs. In the control variables, the relationship between mobile phone use experience and perceived usefulness; The relationship between education level and perceived usefulness, social needs, esteem needs, and self-actualization needs. This study establishes hypotheses by exploring the relationship between these variables and the home-based intelligent exercise system of golf croquet and carries out experimental analysis by questionnaire. The research structure is shown in Figure 5.

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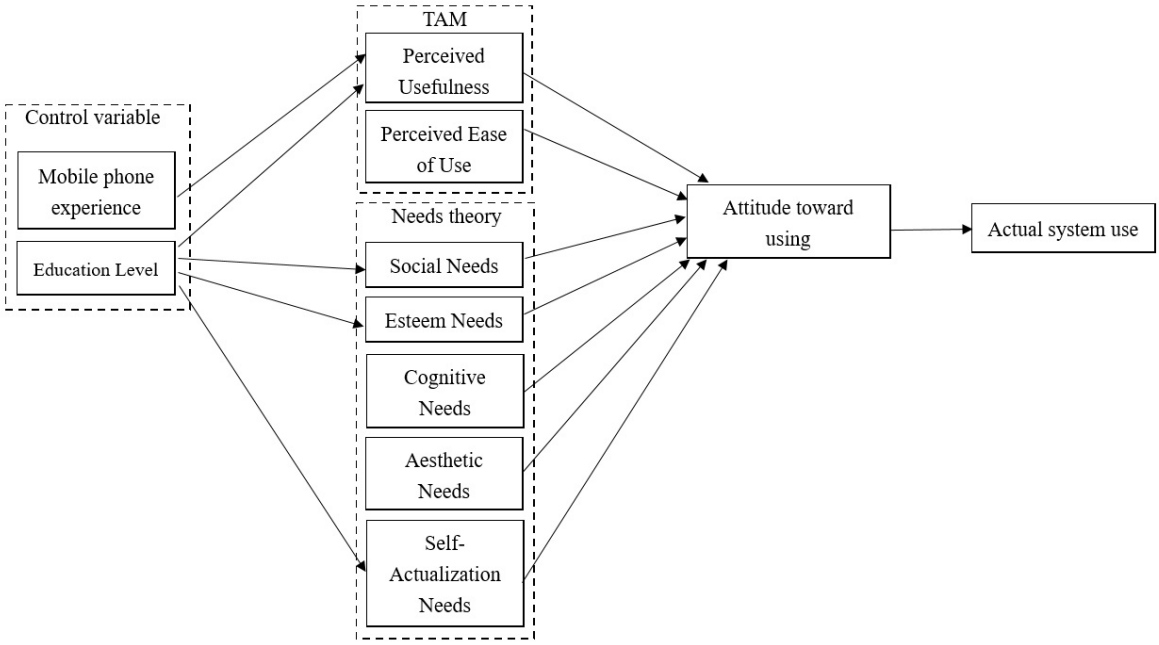

Figure 5. Conceptual framework.

According to the previous literature, perceived usefulness, perceived ease of use, and intention to use TAM are sorted out into 7 criteria and implications and 16 items. The criteria and their implications are: (1) Relieve loneliness: Can effectively alleviate loneliness; (2) Stay healthy: Can maintain physical and mental health; (3) Convenience: Very convenient to use; (4) Easy to operate: Operation steps are simple; (5) Easy to learn: Does not take much time to learn; (6) Self-intention to use: Facilitate users to refer to the product and use it in practice; (7) Recommend and share: Recommend and share the product with others.

The five items in Maslow's hierarchy of needs theory are sorted out into 15 criteria and implications and 15 items. The criteria and their implications are: (1) Sense of identity: Can identify with each other; (2) Maintain good relationship: Can maintain good relationship with others and maintain emotions ; (3) Embrace other people: Able to accept others and live in harmony; (4) Sense of glory: Can pro-duce a sense of pride; (5) Earn recognition: Be able to gain the affirmation of others; (6) Respected by others: Be respected by others; (7) Full of confidence: Can make oneself full of confidence; (8) Curious and seek knowledge: Be curious about new sports equipment and want to know; (9) Learning their skills: Easy to learn and want to learn skills in use; (10) Hone their skills: Want to use more to improve skills; (11) System functions: Functional design meets the requirements; (12) Font display: The font and screen display are clear and easy to recognize; (13) Exert personal potential: Be able to fully exert their potential without being disturbed by emotion or environment; (14) Competition with myself: Actively face challenges and do not give up easily; (15) Peak experience: Experience a high degree of self-realization, and can feel happy, excited, and touching in a short period of time, even selfless feelings.

All items were measured using the Likert five-point scale, which was divided into five options according to the degree of agreement: very disagree (1 point), disagree (2 points), ordinary (3 points), agree (4 points), and very agree (5 points), as shown in Table 1. This study places the selected questionnaire items in Appendix A.

Table 1. Literature compilation of dimension.

Dimension	Criteria	Implication	References
Perceived Usefulness (PU)	Relieve loneliness	Can effectively alleviate loneliness.	[31,49]

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	Stay healthy	Can maintain **physical** and mental health.	
Perceived Ease of Use (PE)	Convenience	Very convenient to use.	
	Easy to operate	Operation steps are simple.	
	Easy to learn	Does not take much time to learn.	
Intention to Use (IU)	Self-intention to use	Facilitate users to refer to the product and use it in practice.	[107–109]
	Recommend and share	Recommend and share the product with others.	
Social Needs (SN)	Sense of identity	Can identify with each other.	
	Maintain good relationship	Can maintain good relationship with others and maintain emotions.	
	Embrace other people	Able to accept others and live in harmony.	
Esteem Needs (EN)	Sense of glory	Can produce a sense of pride.	
	Earn recognition	Be able to gain the affirmation of others.	
	Respected by others	Be respected by others.	
	Full of confidence	Can make oneself full of confidence.	
Cognitive Needs (CN)	Curious and seek knowledge	Be curious about new sports equipment and want to know.	[110,111]
	Learning their skills	Easy to learn and want to learn skills in use.	
	Hone their skills	Want to use more to improve skills.	
Aesthetic Needs (AN)	System functions	Functional design meets the requirements.	
	Font display	The font and screen display are clear and easy to recognize.	
Self-Actualization Needs (SA)	Exert personal potential	Be able to fully exert their potential without being disturbed by emotion or environment.	
	Competition with myself	Actively face challenges and do not give up easily.	
	Peak experience	Experience a high degree of self-realization, and can feel happy, excited, and touching in a short period of time, even selfless feelings	

Through literature review, a total of 31 questions were collected from a questionnaire consisting of 7 criteria for TAM and 15 criteria for Maslow's hierarchy of needs theory. Firstly, a sample structure analysis was conducted on the collected questionnaire, and narrative statistics were analyzed and explained for each aspect. Secondly, confirmatory factor analysis (CFA) was conducted to con-firm the results after clustering. CFA is a statistical method used in social sciences to evaluate the degree

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of fit between theoretical models and real-life collected datasets. It is often used as a construct validity test scale or measurement tool; In other words, its purpose is to test the relationship between observed indicators and potential variables (factors) in the model [80]. Next, regression analysis was conducted to validate the proposed hypothesis. Regression analysis is the most basic and important statistical analysis technique and hypothesis validation method in social science research methods, used to display the relationship between two or more variables [81,82]. Finally, an analysis of variance was conducted on the dimensions proposed in this study based on education level and mobile phone usage experience. Analysis of variance can help identify whether differences between data groups are statistically significant. Its principle is to analyze the level of differences within each group by selecting samples from each group [83].

4. Data Collection and Analysis of Results

4.1. Sample description

The subjects of this study are an elderly care center in northern Taiwan. The main subjects are seniors over 65 years old and their accompanying caregivers. A random sampling method is adopted. The number of questionnaires is 320. The questionnaires are completely recovered, and so the effective recovery rate is 100%. Our work adopts a physical questionnaire. Before filling out the questionnaire, the senior individual and their companion or caregivers will be gathered in a conference room and explained orally the rules and disadvantages of traditional golf croquet. Then, the improvement methods proposed in this study will be introduced. At the same time, recorded explanations and introduction videos will also be played to make the participants more aware of the overall testing procedure. After completing the explanation, move to a spacious indoor space to experience the golf croquet home-based intelligent exercise system. Finally, gradually fill out the questionnaire content based on the experience results. For those who do not understand the questionnaire content, we will provide assistance and explain the content of their questions.

The basic data of the collected questionnaire samples are as follows: 82.2% of the respondents are male, 78.4% of the respondents have a high school education, and 80.6% have more than five years of experience in using smartphones. Among the subjects, 31 had chronic diseases, with cardiovascular diseases accounting for the majority (52%), followed by diabetes (26%), and 61% had chronic diseases for more than five years. Those who participated in sports three times a week accounted for 49.7% of the sample, followed by more than five times at 26.3%. A duration of each exercise o less than 30 minutes, accounts for the majority (74.4%), followed by 1 hour (19.4%). The majority (37.2%) of them have continued to exercise for more than five years. The basic in-formation of the questionnaire is shown in Table 2.

Table 2. Basic information of respondents.

Item	Information	Quantity	Percent
Gender	Male	263	82.2
	Female	57	17.8
Education level (EL)	Elementary school	3	0.9
	Junior high school	20	6.3
	High school	251	78.4
	University or above	46	14.4
Mobile phone experience (ME)	None	4	1.3
	Less than 1 year	0	0
	1~3 year(s)	9	2.8
	3~5 years	49	15.3
	5 years or above	258	80.6
Chronic disease	None	289	90.3

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	Yes (including cardiovascular disease, diabetes, rehabilitation treatment, hypertension, cholesterol, and others)	31	9.7
Seniority of chronic disease	None	289	90.3
	Less than 1 year	3	0.9
	1~3 year(s)	8	2.5
	3~5 years	1	0.3
	5 years or above	19	5.9
Exercise times / week	0	15	4.7
	1	11	3.4
	2	39	12.2
	3	159	49.7
	4	12	3.8
	5 or above	84	26.3
Exercise duration / time	Less than 30 minutes	238	74.4
	1 hour	62	19.4
	1~2 hour(s)	15	4.7
	2~3 hours	4	1.3
	3 hours or above	1	0.3
Seniority of sport	Less than half year	25	7.8
	Less than year	32	10.0
	1~3 year(s)	62	19.4
	3~5 years	82	25.6
	5 years or above	119	37.2

According to the statistical results in Table 3, the average number of questions on perceived usefulness, perceived ease of use, intention to use, social needs, self-esteem needs, cognitive needs, aesthetic needs, and self-actualization needs of the respondents ranged from 3.97 to 4.13. This represents the respondents' positive attitude towards the home action system of golf croquet.

Table 3. Descriptive statistics of question.

Dimension	Criterion	Question No.	Mean	SD
Perceived Usefulness (PU)	Relieve loneliness	PU1	4.10	0.494
		PU2	4.00	3.92
	Staying healthy	PU3	3.97	0.461
		PU4	4.09	0.401
		PU5	4.04	0.402
Perceived Ease of Use (PE)	Convenience	PE1	4.20	0.461
		PE2	4.19	0.446
	Easy to operate	PE3	4.11	0.411
		PE4	4.13	0.424
	Easy to learn	PE5	4.11	0.431
		PE6	4.10	0.410
Intention to Use (IU)	Self-intention to use	IU1	4.05	0.456
		IU2	4.03	0.429
		IU3	4.10	0.447

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	Recommend and share	IU4	4.01	0.407
		IU5	4.01	0.375
Social Needs (SN)	Sense of identity	SN1	3.99	0.392
	Staying good relationship	SN2	4.07	0.424
	Embrace other people	SN3	3.99	0.363
Esteem Needs (EN)	Sense of glory	EN1	3.95	0.401
	Earning recognition	EN2	3.97	0.375
	Respected by others	EN3	3.97	0.414
	Full of confidence	EN4	4.02	0.461
Cognitive Needs (CN)	Curious and seek knowledge	CN1	4.03	0.410
	Learning its skills	CN2	4.00	0.423
	Hone its skills	CN3	4.02	0.419
Aesthetic Needs (AN)	System functions	AN1	4.03	0.429
	Font display	AN2	4.03	0.399
Self-Actualization Needs (SA)	Exert personal potential	SA1	3.99	0.434
	Competition with myself	SA2	3.98	0.415
	Peak experience	SA3	4.00	0.419

4.2. Factor analysis, reliability and validity analysis

In order to further understand the degree of consent of the subjects to each dimension, this study carried out factor analysis respectively for TAM's perceived usefulness, perceived ease of use, and intention to use and Maslow's social needs, self-esteem needs, cognitive needs, aesthetic needs, and self-actualization needs. It extracted common factors with a characteristic value greater than 1 [84], using principal component analysis and maximum variation pivot method. Questions with an absolute value of factor load greater than 0.5 are reserved and properly classified. In terms of scale reliability, according to Guilford [85], Cronbach's α greater than 0.7 means high reliability, and that less than 0.35 is of low reliability, which should be rejected [86]. The construction validity of this study is based on the Item-Total Correlation method of Kerlinger [87] - that is, assuming that the total score is valid, the size of the correlation coefficient between individual items and the total score is the measure of construct validity.

The results in Table 4 show that the KMO value of each facet is between 0.500 and 0.851, Bartlett's ball test is significantly in line with the requirements, and the values of each facet are quite good. The results of Table 5 show that the factor load of each item is between 0.502 and 0.877, which is more than 0.5. The characteristic value of each facet is between 1.746 and 4.711, the cumulative explanatory variance is between 57.773 and 87.302, and the Item-Total Correlation value of each item is greater than 0.5, indicating considerable constructive validity and content validity. Cronbach's α values are all greater than 0.6, indicating good internal reliability. There is thus real correlation between the measurement items, and the content of the questionnaire is highly consistent.

Table 4. KMO measure of sampling.

Testing / Dimension	KMO	Bartlett's Test of Sphericity		
		χ^2	df	P
PU	0.812	511.938	10	0.000***
PE	0.851	2158.924	15	0.000***
IU	0.847	1029.735	10	0.000***
SN	0.722	527.225	3	0.000***
EN	0.789	1006.788	6	0.000***
CN	0.761	714.099	3	0.000***

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AN	0.500	258.196	1	0.000***
SA	0.729	567.436	3	0.000***

*** $P < 0.001$.

Table 5. Analysis of factor, reliability, item-total correlation.

Question No.	Eigenvalue	Cumulative Percentage	Factor Loading	Cronbach's α	Item-Total Correlation
PU1	2.889	57.773	0.622	0.814	0.770
PU2			0.660		0.758
PU3			0.556		0.783
PU4			0.548		0.782
PU5			0.502		0.793
PE1	4.711	78.512	0.730	0.945	0.939
PE2			0.777		0.934
PE3			0.777		0.935
PE4			0.797		0.933
PE5			0.828		0.931
PE6			0.803		0.933
IU1	3.611	72.214	0.692	0.902	0.885
IU2			0.638		0.894
IU3			0.761		0.871
IU4			0.792		0.869
IU5			0.728		0.881
SN1	2.413	80.425	0.841	0.874	0.788
SN2			0.735		0.883
SN3			0.836		0.797
EN1	3.230	80.742	0.755	0.917	0.907
EN2			0.871		0.873
EN3			0.840		0.879
EN4			0.764		0.909
CN1	2.595	86.512	0.852	0.922	0.898
CN2			0.877		0.877
CN3			0.866		0.866
AN1	1.746	87.302	0.873	0.853	0.880
AN2			0.873		0.862
SA1	2.643	82.09	0.867	0.891	0.801
SA2			0.787		0.874
SA3			0.809		0.856

4.3. Hypothesis testing

Table 6 shows that, for the prediction of the intention of use, each dimension uses SPSS software to carry out regression analysis. According to the research framework (Figure 5), it is assumed that the variable of path direction is the dependent variable, and the variable of path starting is the independent variable or predictive variable. According to analysis of the relationship between perceived usefulness and intention to use, the empirical results show that hypothesis H6 is supporting, indicating that perceived usefulness has a positive and significant impact ($P < 0.001$) on intention to use. According to analysis of the relationship between perceived usefulness and intention to use, the empirical results show that hypothesis H7 is supported. This indicates that perceived usefulness has a positive and significant impact ($P < 0.001$) on intention to use. According to analysis of the relationship between social needs and intention to use, the empirical results show that

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hypothesis H8 is supported. This indicates that social needs have a positive and significant impact ($P < 0.001$) on intention to use. According to analysis of the relationship between esteem needs and intention to use, the empirical results show that hypothesis H9 is supported. It indicates that esteem needs have a positive and significant impact ($P < 0.001$) on intention to use. According to analysis of the relationship between cognitive needs and intention to use, the empirical results show that hypothesis H10 is supported. This indicates that cognitive needs have a positive and significant impact ($P < 0.001$) on intention to use. According to analysis of the relationship between aesthetic needs and intention to use, the empirical results show that hypothesis H11 is supported. This indicates that aesthetic needs have a positive and significant impact ($P < 0.001$) on intention to use. According to analysis of the relationship between the need for self-actualization and the intention to use, the empirical results show that hypothesis H12 is supported. This indicates that the need for self-actualization has a positive and significant impact ($P < 0.001$) on the intention to use.

Table 6. Analysis of Regression.

Dimension	β	T	P	R^2	$Adj - R^2$
PU	0.700	17.464	0.000***	0.490	0.488
PE	0.615	13.909	0.000***	0.378	0.376
SN	0.793	23.174	0.000***	0.628	0.627
EN	0.779	22.139	0.000***	0.607	0.605
CN	0.770	21.545	0.000***	0.593	0.592
AN	0.798	17.854	0.000***	0.501	0.499
SA	0.742	19.738	0.000***	0.551	0.549

*** $P < 0.001$.

Table 7 shows the difference between education level and mobile phone experience in terms of perceived usefulness, social needs, esteem needs, and self-actualization needs when analyzed using SPSS software. According to the research framework (Figure 5), the variable of path direction is assumed to be the dependent variable, and the variable of path starting is assumed to be a factor.

Table 7. Analysis of Variance, ANOVA.

Between-Group	SS	MS	F	P
ME - PU	4.131	1.377	1.382	0.248
EL - PU	0.726	0.242	0.240	0.868
EL - SN	6.992	2.331	5.900	0.071
EL - EN	16.921	5.640	4.015	0.001**
EL - SA	11.713	3.904	4.015	0.008**

SS: Sum of squares of deviation from mean. MS: Mean-Square. ** $P < 0.01$.

According to analysis of the relationship between mobile phone experience and perceived usefulness, the actual results of the study show that hypothesis H1 is not supported. This indicates that the positive impact of mobile phone experience on perceived usefulness is not significant. According to analysis of the relationship between education level and perceived usefulness, the actual results of the study show that hypothesis H2 is not supported. It means that the positive impact of education level on perceived usefulness is not significant. According to analysis of the relation-ship between education level and social needs, the actual results of the study show that hypothesis H3 is not supported. It indicates that the positive impact of education level on social needs is not significant.

According to analysis of the relationship be-tween education level and esteem needs, the actual results of the study show that hypothesis H4 is supported. This indicates that education level has a positive and significant impact ($P < 0.01$) on esteem needs. According to analysis of the relation-ship between education level and self-actualization needs, the actual results of the study show that

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hypothesis H5 is supported. This means that education level has a positive and significant impact on ($P < 0.01$) self-actualization needs.

4.4. Discussion

Based on the TAM and HNT model, this study constructs a demand model to confirm the needs of senior for a healthy home-based intelligent exercise system. After analyzing the empirical data of 320 senior using regression and difference analysis methods, this study finds that perceived usefulness (PU), perceived ease of use (PE), social needs (SN), esteem needs (EN), cognitive needs (CN), aesthetic needs (AN), and self-actualization needs (SA) positively affect the willingness of the subjects to use the home-based intelligent exercise system of golf croquet. Based on the comprehensive analysis results, the following important findings are summarized.

The subjects mostly agree with the ease of use of the home-based intelligent exercise system of golf croquet.

This study presents that the subjects are highly receptive to the home-based intelligent exercise system of golf croquet, especially in terms of perceived ease of use. The average number of each item was the highest, indicating that they believed that the system is convenient to use, and that they could operate the system skillfully without the help of others.

Aspects that affect intention to use

Perceived usefulness (PU): This study notes that when a user believes that a system can increase his work performance or be of practical benefit to him, the higher his willingness to use the system will be. On the contrary, the lower the system helps him, the lower is his willingness to use. The subjects recognize that the home-based intelligent exercise system of golf croquet is helpful to improve their quality of life. This will make the sub-jects more likely to use this system. In other words, this method has a positive effect on the limbs and waist, can strengthen muscles, and achieve exercise effects. The research findings are of great significance to the acceptance of the initial subjects. Some previous studies have put forward a relatively pessimistic view of the ability to predict user behavior based on subjective measurement [88,89]. The results of this study show that the subjects can have a good impression of cognition when they actually communicate with each other in a group interactive way. Therefore, it is more critical to ensure that the prototype of the design is fully implemented, because at the initial stage the testers expect to provide valuable insights on the acceptability of the subsequently revised software/hardware products [90].

Perceived ease of use (PE): This study finds that when a user believes that a system is easy to learn, easy to use, and can operate skillfully, the user's willingness to use the system will be higher. On the contrary, the more complex and difficult the operation process of the system is to learn, the lower is the willingness to use it. The subjects think that the home-based intelligent exercise sys-tem of golf croquet is very convenient to use, without any assistance from others, and can be easily used skillfully, which will make the sub-jects likely to use the system. In other words, this study combines robot and IoT devices, which tends to be easier to use. From the perspective of knowledge and learning [91], cognitive ease of use is based on procedural knowledge. Anderson [92] suggested that procedural learning only occurs when per-forming skills, such as learning while doing. This is one of the reasons why procedural learning is more gradual than declarative learning. Therefore, it reflects the ease of use related to the use of technology, which requires personal experience.

Social needs (SN): This study presents that when a user believes that a system can increase interaction with others, his willingness to use the system will be higher; otherwise, the willingness to use the system will be lower. The subjects believe that the home-based intelligent exercise sys-tem of golf croquet can increase the interaction between them and their families, interact with each other, and accept others, which will make the subjects likely to use the system. In other words, in the mode of multi-person interaction, social relations can be enhanced. Fang [93] explored the role of interaction strategies in consumer decision-making. That study pointed out that among the diverse online communication mechanisms, some customers are hesitant to do online shopping given that IoT cannot provide the opportunity to inspect products before purchasing, thus increasing online interactivity of the website and the addition of product information to supplement online decision-making, which increase purchase and usage intentions. Yim et al. [94] stated that AR positively affects

media and purchase intentions by generating greater novelty, immersion, interactivity, and usefulness compared to web-based product presentations.

Esteem needs (EN): This study finds that if a system allows the user to gain confidence and self-affirmation in the process of using the system, then his willingness to use the system will be higher; otherwise, the willingness to use the system will be lower. The subjects believe that using the golf croquet home-based intelligent exercise system can make them feel proud, positive, confident, and respected, which will make the subjects likely to use the system. The scoring system of golf croquet designed in this study, its ranking function can boost morale and make people feel honored. Liao et al. [95] took the self-affirmation theory in order to examine the influence of real-world need satisfaction on online players' loyalty. Their research results showed that users' achievements and relationships in the real world can enhance their satisfaction with real-world needs, thereby enhancing the self-worth and loyalty of game players and further maintaining or enhancing the willingness to use.

Cognitive needs (CN): This study notes that when users think that a system can arouse their curiosity, satisfy their thirst for knowledge during use, or want to enhance their use skills, then their perception of the system will increase, and the higher the willingness to use will be. On the contrary, if the system cannot arouse the user's curiosity, the lower the willingness to use will be. The subjects think that the home-based intelligent exercise system of golf croquet can make people feel curious and want to try to use it and that learning the use skills of this system is suffice for cognitive needs. They will want to hone and enhance their proficiency, and so it will make the subject likely to use this system. In other words, with the application of emerging technologies such as AIoT and App, it can stimulate users' cognitive curiosity. The concept of curiosity is derived from flow theory. When people are in a state of immersion, they may be willing to interact with their environment [96]. Yoon et al. [97] investigated the influence of hedonic and utilitarian shopping values on continuous aspects that affect the intention to use online cross-border shopping. Their research results showed that hedonic value affects the continuous intention to use online shopping through the mediation of curiosity and self-efficacy.

Aesthetic needs (AN): This study presents that when the user thinks that a system is more recognizable in appearance, screen, and function, the higher his willingness to use the system will be. The subject believes that the golf croquet home-based intelligent exercise system can be clearly identified and easy to use on the font display, and the functional design is not too complex, which will make the subject likely to use this system. The scoring system of golf croquet designed in this study has an elegant user interface design, which can increase the overall aesthetic feeling and thus increase the willingness to use it. Tsai et al. [98] investigated how user interface design affects the intention and attitude of the elderly to use social networking sites. Their results showed that user interface design and perceived ease of use are positively related to perceived usefulness, and an appropriate interface design will further affect adoption intention.

Self-actualization needs (SA): This study finds that if a system can make users feel a sense of achievement, excitement, and happiness in the process, then the more willing they will be to use the system. Each time the subject uses the golf croquet home-based intelligent exercise system, it is like a new challenge, which makes people want to obtain higher scores. The user process can fully exert a user's potential, gain a sense of achievement, and feel excited and happy, which makes the subject likely to use this system. In other words, learning to use mobile phone applications can achieve self-growth for users, and they are never too old to learn. Zhang and Dang [99] found in a survey of the basic factors of students' perceived sense of achievement, pleasure, and willingness to learn web development that the characteristics of teachers and teaching methods can significantly affect their perceived sense of achievement, pleasure, and then their intention to learn web development.

Dimensions affected by different levels of education

This study finds that people with different levels of education will have different views on esteem needs and self-actualization needs. The subjects with different education levels have significantly different views on the use of the home-based intelligent exercise system of golf croquet to gain pride, affirmation, confidence, and respect. And the subjects with different education levels

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have significantly different views on using the home-based intelligent exercise system of golf croquet to make people want to achieve higher scores and can fully exert their potential, have a sense of achievement, and feel excited and happy during the use process. Maslow [29] referred to so-called self-actualized people, who are satisfied with life, can play their potential and have creativity, and can have a loving and accepting attitude towards themselves and others. So-called esteem needs refer to all the needs to acquire and maintain personal esteem, including the respect of others and self-respect. Solomon et al. [100] pointed out in a study on the level of education and job satisfaction that it is theoretically inferred that education level involves a significant trade-off relationship. Because of the need for self-actualization, well-educated people will enjoy more resources from the job (including income, job autonomy, and diversity). Yu and Chang [101] explored the needs of the elderly according to the type of community. They found that senior with high education levels have better self-confidence and value of themselves, and their level of respect and self-actualization needs

5. Conclusions

Due to economic development and the improvement of national living standards in recent year, people's leisure and sports time has in-creased, their concept of physical activities has become stronger and stronger, and the time and money spent on sports have also increased (Malm et al. [102]). However, the aging trend of the global population highlights the planning direction of the future leisure sports of the senior. How to choose or participate in leisure sports is thus worthy of concern and discussion. Generally speaking, old people often pursue the best quality of life, but not everyone can get or improve to a high-quality enjoyment of life when they are old. Therefore, in the future, everyone should pay attention to the planning of lifestyle in old age. The indispensable factors are life satisfaction, self-esteem, general health and function, and social status [103,104], which can also bring proper esteem and responsibility during one's own later years.

This study was conceived at the early stage of the COVID-19 epidemic. At that time, in order to solve the seniors' problem who living in elderly care centers in northern Taiwan for a long time, the lack of exercise or good social activities led to organ degradation or increased isolation and loneliness. Therefore, this research puts forward the concept of a home-based intelligent exercise sys-tem (including an intelligent scoring system, modified golf croquet, robot, and mobile phone applications), and applies for patents of the Republic of China at the same time of design. In order to understand the acceptance and demand level of seniors in this home-based intelligent exercise system, this study conducted a demand analysis using a TAM combined with Maslow's needs theory, so that the original leisure sports items belonging to the team and individuals can achieve the effect of daily sports, and the senior also gain psychological attribution.

The results of this study show that the subjects have high acceptance of the home-based intelligent exercise system of golf croquet, especially in terms of perceived ease of use. This shows that they think the system is convenient to use and can operate the system skillfully without assistance from others. It is also a leisure activity with fitness and social functions, which is quite suitable for senior. By participating in croquet, they can gain recognition of their peers and also temporarily put aside any unhappiness, depression, and anxiety, thus effectively finding a form of relief. These results are particularly interesting, as Chinese society has traditionally chosen to avoid unfamiliar information technology due to self-learning resistance or face-saving issues. Therefore, it is important to confirm the acceptance level of convenience brought by emerging technologies among Chinese people. Thus, these findings uniquely contribute to the intelligent exercise system literature. In recent years, sports record apps and fitness teaching apps have both attracted researchers' attention [105,106].

Current sports and fitness apps have many problems, such as serious product homogeneity, low user viscosity, and lack of scientific innovation. However, with continuous improvement of the professional and technical level by fitness app makers, future fitness apps should be more convenient to meet the needs of users. In addition, through optimization and improvement of user experiences through IoT, VR, or other information technologies, apps will become more personalized for users and take into account scientific data collection and security service provision. With the cooperation

and assistance of various aspects, it is believed that sports apps can add a healthy, safe, and happy lifestyle for older generations.

6. Limitations

As with other works, this study also has certain limitations. We did strive to be objective in data collection, dimension, or criteria establishment, but due to the influence of external factors, there are still some unavoidable drawbacks. For example, subjective well-being is an individual's evaluation of the subjective perception of certain things. The subjective well-being of elderly people participating in golf croquet may have other factors that affect their subjective perception and feelings. In the future, other variables such as personality traits of the elderly people themselves, life satisfaction, or other factors that may affect them can be added for further research and comparison. Affected by the COVID-19 epidemic, more competition activity data could not be collected due to the inability to hold more competitions, leading to the improvement of the overall design will be slightly inadequate; It is also impossible to explain the equipment and functions of this study face-to-face with the respondents, and the interaction can only maintain a relative distance, and the entire process of the activity can be introduced through a video. Most of the questionnaire content in this study may be difficult or unclear for the seniors to understand. In addition, most of the seniors use Taiwanese and do not know Mandarin well, which makes communication difficult, leading to potential misunderstandings.

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Appendix A

Dimension	Criterion	Item	Questionnaire
Perceived Usefulness (PU)	Relieve loneliness	PU1	I think using the home-based exercise system of golf croquet can help me not feel lonely.
		PU2	I think that using the home-based exercise system of golf croquet can increase my interaction with others.
	Staying healthy	PU3	I think using the home-based exercise system of golf croquet can effectively achieve the effect of daily exercise.
		PU4	I think using the home-based exercise system of golf croquet can make me think about how to get

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			higher scores and train brain activity.
		PU5	I think using the home-based exercise system of golf croquet can help me to properly exercise my muscles and joints and relieve the discomfort caused by chronic diseases.
Perceived Ease of Use (PE)	Convenience	PE1	I think the home-based exercise system of golf croquet does not need a large venue, which makes it very convenient for me to use.
		PE2	I think the home-based exercise system of golf croquet can be used without the help of many people, which makes it very convenient for me to use.
	Easy to operate	PE3	I think it is easy for me to understand the content and function of the home-based exercise system of golf croquet.
		PE4	I think the home-based exercise system of golf croquet can make it easy for me to use it alone.
	Easy to learn	PE5	I think the home-based exercise system of golf croquet can make me learn to operate easily.
		PE6	I think the home-based exercise system of golf croquet can make me easily and skilfully operate it.
Intention to Use (IU)	Self-intention to use	IU1	I would like to use the home-based exercise system of golf croquet.
		IU2	I am willing to use the home-based exercise system of golf croquet for my relatives and friends.
		IU3	If relatives and friends recommend to me the home-based exercise system of golf croquet, I will want to use it.
	Recommend and share	IU4	I will invite relatives and friends to use the home-based exercise system of golf croquet.
		IU5	I will share the home-based exercise system of golf croquet with my relatives and friends to use it.
Social Needs (SN)	Sense of identity	SN1	I think that the home-based exercise system of golf croquet can help me gain your recognition and interact with each other.
	Staying good relationship	SN2	I think the home-based exercise system of golf croquet can make

			me enjoy and interact with my family.
	Embrace other people	SN3	I think the process of using the home-based exercise system of golf croquet can let me accept others and win the trust of my friends.
Esteem Needs (EN)	Sense of glory	EN1	I think that using the home-based exercise system of golf croquet gives me a sense of honor.
	Earning recognition	EN2	I think the home-based exercise system of golf croquet can make me feel certain.
	Respected by others	EN3	I think using the home-based exercise system of golf croquet can make me feel respected.
	Full of confidence	EN4	I think using the home-based exercise system of golf croquet can make me full of confidence.
Cognitive Needs (CN)	Curious and seek knowledge	CN1	I think the home-based exercise system of golf croquet can make me feel novel and want to use it.
	Learning their skills	CN2	I think learning the skills of using the home-based exercise system of golf croquet can satisfy my thirst for knowledge.
	Hone their skills	CN3	I think continuous use of the home-based exercise system of golf croquet can help me increase my skills.
Aesthetic Needs (AN)	System functions	AN1	I think the function design of the home-based exercise system of golf croquet can make me willing to use it.
	Font display	AN2	I think the home-based exercise system of golf croquet can let me use the font and screen display.
Self-Actualization Needs (SA)	Exert personal potential	SA1	I think using the home-based exercise system of golf croquet can let me fully exert my potential and have a sense of achievement.
	Competition with myself	SA2	I think every time I use the home-based exercise system of golf croquet, it is like a new challenge, which can make me want to get higher scores.
	Peak experience	SA3	I think using the home-based exercise system of golf croquet can make me feel excited and happy.

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