Tailoring Care Robotics through Utilitarian and Emotional Needs: Transitioning to Premium Paid Services in South Korea

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Abstract

The increasing demand for senior care in South Korea, driven by an aging population and expanding welfare policies, has led to a rise in free welfare services. This study, part of a government-led initiative, seeks to develop premium, paid care robot services aimed at advancing the care robotics industry. In addition, it focuses on reducing caregiver burnout and workload by addressing both utilitarian and emotional needs. Through the identification of personalized emotional needs derived from ten happiness factors, the study aims to deliver data-driven, tailored services that enhance care recipients' willingness to pay (WTP). The ultimate objective is to transition from free public services to paid premium options that provide both functional and emotional support, thereby fostering the growth of South Korea's care robotics market.

Keywords: Care Robotics, Utilitarian Needs, Emotional Needs, Happiness Factors, Willingness to Pay.

South Korea is facing a rapid increase in its aging population, projected to reach 20.6% of citizens aged 65 or older by 2025 [1]. This demographic shift has led to a surge in demand for senior care services. However, with the world's lowest birthrate of 0.72 births per woman, the nation's working-age population is rapidly declining [2], exacerbating the shortage of caregivers [3]. Additionally, poor working conditions and low wages in caregiving have further strained the system [4].

Given these challenges, the South Korean government is engaging in multi-ministry collaborative projects for the R&D and demonstration of smart care robot technologies. Efforts are being made to develop core technologies and move towards commercialization, but distribution remains limited. Certification standards for new care robots are not fully established, and the focus remains on technological advancements, indicating the need for further support in commercialization [5].

Moreover, welfare policies have increased reliance on free services, and as care robots become more prevalent, the associated costs will limit government-led supply. To address this, the government has initiated a five-year project to

boost consumers' willingness to pay and enhance the competitiveness of care robot industry.

This study outlines the five-year project and introduces strategies for practical implementation. Ultimately, the goal is to identify emotional needs using 10 happy factors to increase willingness to pay and develop premium services, transitioning from free public services to paid options.

CURRENT GOV'T PROJECTS FOCUS ON CARE ROBOT

A. Government Initiatives

The South Korean government has initiated a comprehensive five-year project focused on the R&D and demonstration of smart care robot technologies. This multi-ministry collaborative project includes the development of three types of care robots (excretion assistance, transfer assistance, and pressure ulcer prevention), a mobile daily support robot that understands human behavior, and a simplified boarding robot system to aid the elderly, disabled, and patients in standing, repositioning, and indoor mobility.

In 2023, the Ministry of Health and Welfare allocated approximately 1.13 billion USD for healthcare R&D, representing about 5% of the total government R&D budget of 23.62 billion USD. To address increasing demand due to aging and low birth rates, the ministry launched the "User-Centered Care Robot and Service Demonstration R&D" project, investing 3 million USD in the first year[6].

B. Project Goals and Directions

The project focuses on the development of core technologies for care robots, establishing certification standards, and prioritizing commercialization. This includes developing classification systems for care robots and devising public support plans, conducting policy research for safety, performance, and reliability, and encouraging the business model of care services for sustainable industrialization. Furthermore, the project aims to create an industrial ecosystem for sustainable industrialization by promoting the business model of care services, redesigning care tasks and processes to support the use of care robots, and addressing the challenges posed by low birth rates and an aging population [6].

This study aims to develop service models and evaluation frameworks to promote the commercialization of care services, with a focus on deriving emotional needs and increasing the willingness to pay for premium services.

DEVELOPMENT OF FUNCTIONAL AND EMOTIONAL CARE ROBOT SERVICES

The project titled "Development and Demonstration of Integrated Care Robot Control System and Care Data Service (HK23C0054)" focuses on several critical objectives. Firstly, it aims to develop Artificial Intelligence (AI)-based care robot systems designed to support various care tasks, enhancing the efficiency and effectiveness of caregiving. Furthermore, the project seeks to integrate sensor data from diverse care robots into a comprehensive monitoring and control system, ensuring seamless operation and real-time data analysis [7].

Another key goal is the development of robust systems to support caregivers' tasks, which includes creating adaptive and responsive solutions that cater to the specific needs of care recipients. The project also emphasizes the importance of developing and field-testing functional and emotional services for both care recipients and caregivers, utilizing methodologies to derive Utilitarian Needs (functional needs) and Emotional Needs (eudaimonic needs). By addressing these needs, the project aims to enhance the overall quality of care through practical application and validation. Finally, the project introduces innovative approaches to develop premium services tailored to individual requirements [7].

Moreover, this paper outlines the methods for deriving the functional and emotional needs of caregivers and discusses the benefits and service development directions based on these needs.

A. Utilitarian Needs

Senior care services are primarily centered around providing functional support. The basic senior care services for seniors living alone aim to offer preventive services by dispatching life guidance officers to visit them. These services include safety checks, which are conducted through direct visits at least once a week and indirect checks via phone calls at least twice a week to assess the health status, environmental changes, and needs of the recipients. Additionally, life education is provided, with educational sessions on dementia prevention and weather alert measures conducted at least once a quarter for groups of five or more seniors living alone [8]. Despite its current limitations, the service linkage component involves identifying the needs of the recipients through information gathering and direct visits, developing individualized service plans, and actively discovering and linking resources from public and private institutions.

In the first year of this study, the status and requirements for developing care data utilization services were identified through secondary data analysis. For direct services targeting seniors living alone, previous research highlighted concerns about care gaps due to difficulties in real-time monitoring for those at high risk of solitary death [9]. There is also a lack of data to assess the physical, mental health, and environment of care recipients. Caregivers often lack confidence in their expertise, with approximately 31% of caregivers not considering themselves as experts in senior care [10]. This underscores the need for 24-hour monitoring, objective and personalized data-based service connections, opportunities for caregivers to improve their expertise through training and manual creation, and programs to encourage and support them.

Regarding daily tasks, caregivers and institutional managers experience high fatigue due to excessive workloads, limited authority, and significant responsibilities. High turnover rates due to low compensation relative to workload also diminish the continuity and professionalism of services [11] [12]. Additionally, there is a recognition of the need for an efficient electronic work system due to excessive non-care tasks and inefficient work systems. The most challenging aspects for caregivers include emotional labor and excessive workloads, which necessitate the implementation of efficient electronic work systems and solutions to address emotional labor burnout [13].

Alongside the secondary data analysis, several expert interviews were conducted with representatives from the Central Support Center for Seniors Living Alone and the Gangnam District Senior Integrated Support Center, who use smart care devices extensively. The interviews were conducted over a period of three months, from September to November 2023, involving ten experts in total. These interviews took place at their respective centers, providing valuable insights into the practical challenges and requirements of smart care services.

Their feedback includes:

- There are currently 681 customized senior care service centers in South Korea, with initiatives such as the "Happy GPS System for Smart Care Services," and ICT-based care scenarios are being developed and demonstrated.
- However, the lack of a standardized integrated control system hinders the continuous and standardized distribution of services.
- The limitations of smart care services focusing on care recipients are evident, necessitating a system to support caregivers.
- Although there are movements towards developing premium and paid services, the range of services and service manuals is still insufficient.

In conclusion, the secondary data and expert interviews indicate that the following care robot systems and services to support caregivers should be prioritized:

- Minimizing care gaps and providing customized services through real-time biometric, environmental, and emotional data-based

services for care recipients, thereby enhancing caregivers' job efficacy.

- Developing care task recording systems, such as digitizing care recipient records, to ensure standardized service provision despite frequent caregiver turnover and improve caregivers' work efficiency.
- Additionally, to facilitate smooth operations and efficient data-based service provision, it is necessary to establish systems to manage caregivers' attendance and performance, as well as identify and support their needs to provide better work environments.

B. Emotional Needs

Emotions are considered essential, driving individuals to choose between different options [14]. Emotional needs significantly influence consumer behavior, generating demand to fulfill wants. Previous studies have assessed ideal emotional states by asking participants to indicate the extent to which they desire to experience or avoid specific positive and negative emotions [15]. Based on the study by Lau, White, and Schnall, British participants showed a higher willingness to pay to experience positive emotions than to avoid negative ones, while Hong Kong Chinese participants were more willing to pay to avoid negative emotions [16]. As non-market goods, emotional experiences can be quantified using the willingness-to-pay (WTP) approach, which offers advantages for evaluating both emotional experiences and regular expenditures [16]. Therefore, identifying the emotional needs of both caregivers and care recipients is paramount for developing high-value care services and products.

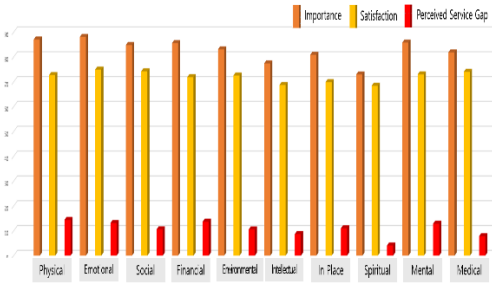
Recognizing emotional needs is also essential for addressing caregiver emotional labor burnout and promoting the well-being of care recipients [10]. The emotional difficulties and burnout caused by emotional labor among care service workers directly impact on the perceived quality of service for care recipients. Therefore, it is crucial to establish systems that address the emotional labor challenges faced by caregivers [13]. As the intensity of labor increases, efforts should not only identify needs but also implement compensation systems and other measures to reduce burnout among care service workers.

In this study, the 10 Happy Factors were used to derive individual needs considering personal growth, self-realization, and achieving long-term happiness [17]- [21]. According to reports issued by Korean government agencies, the 10 Happy Factors encompass physical, emotional, social, environmental, intellectual, financial, occupational, mental, spiritual, and medical aspects.

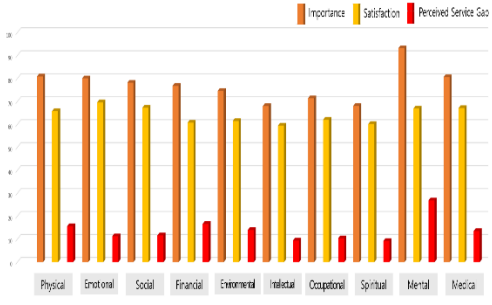
From November 13 to 23, 2023, two types of pre-tests were conducted with staff members at the Gangnam District Senior Integrated Support Center. The first pre-test focused on the happiness of the caregivers themselves, yielding 67 valid responses out of 73 participants. The second pre-test asked caregivers to indicate the expected happiness of care recipients and the realistic extent of services they could provide, with 65 valid responses out of 68 participants. It was to identify gaps between the perceived importance of services for care recipients and the caregivers' capacity to deliver them effectively.

In each pre-test, respondents were asked to: (1) describe the concept of happiness subjectively in words or sentences, (2) rate the importance and expectations for their happiness in each of the 10 areas on a 7-point scale, and (3) directly score their subjective satisfaction degree in each area out of 100 points. This aimed to identify the gap between the perceived importance and satisfaction in each area that enhances and enriches their lives.

As the graph shows, the results were as follows: First, regarding the happiness of caregivers themselves, overall satisfaction was lower than importance, with significant gaps in the physical, emotional, financial, and mental areas.



Second, the pre-test on the expected happiness of care recipients and the realistic extent of provided services revealed the most pronounced service gap in the 'mental' area, along with deficiencies in economic and physical services. These insights can guide the development of customized services that increase caregivers' willingness to pay and improve overall service quality.



INTEGRATION AND IMPLEMENTATION

This section explains the methods developed and anticipated for the development of care robot services during the second year of a five-year project. The project focuses on creating real-time data systems to support caregivers, developing recording systems to efficiently manage caregiving tasks, and researching data-driven personalized service development and evaluation models. Most importantly, this study aims to develop high-value-added personalized services that satisfy both Utilitarian Needs and Emotional Needs based on care robot technology. To concretize the relatively vague Emotional Needs, the study employs the 10 Happy Factors to identify perceived service gaps.

A. Real-Time Data Services

To minimize care gaps and enhance operational efficiency, a system was implemented using Android Watches to collect real-time biometric and activity data from care recipients, especially the elderly living alone, and monitor risks. For instance, elderly individuals are currently visited once a week and called once a week by life supporters. By having care recipients wear wearable watches, real-time monitoring is possible for life supporters and administrators. This system reduces care gaps and provides personalized services tailored to individual needs, thereby improving the quality of care. The system's usability is being tested through a pilot project involving 15 caregivers and 30 elderly individuals at the Gangnam-gu Integrated Support Center for the Elderly in Seoul, South Korea. This continuous monitoring system ensures timely interventions for care recipients, enhancing their overall well-being. Furthermore, data-driven insights help predict potential health issues, significantly reducing the burden on healthcare systems through preventive measures.

B. Care Task Recording Systems

A care task recording system has been developed to ensure standardized service provision despite high caregiver turnover rates. Handwritten visit notes by caregivers are now transferred to tablets for digitalization and database management. By increasing work efficiency, caregivers can focus more on primary tasks, and the quality of care can be enhanced through real-time monitoring data. Digital records provide comprehensive information on each care recipient, including biometric signals and daily routines, accessible and updatable by both administrators and caregivers, ensuring continuity of care. Additionally, digitized records facilitate better communication and coordination among care service providers, making integrated care services easier to deliver.

Caregivers use a tablet-based app for home visits or phone consultations with elderly individuals living alone. The app allows access to personal information and weekly or monthly schedules of all the elderly individuals under their care. During visits or consultations, they can check case management items and input additional information as needed. All data is automatically transmitted to a central system for classification and analysis, streamlining the previous manual entry process.

Care institution administrators utilize this data via a web interface to monitor and analyze care activities, manage risks, and respond to emergencies. The system tracks when caregivers visit elderly homes, the duration of their visits, and the details of their consultations. This comprehensive recording system enhances accountability and provides a robust mechanism for ensuring high-quality care.

The digitized system also supports better workload management by providing real-time updates and alerts, aiding in task prioritization and efficient resource allocation. This reduces the administrative burden on caregivers, allowing them to focus more on direct care activities. The integration of real-time data supports predictive analytics, enabling proactive interventions based on early identification of potential issues.

By promoting seamless communication between caregivers and administrators, the digital recording system fosters a cohesive and responsive care environment. This enhances the overall efficiency of care delivery and improves the experience and satisfaction of both caregivers and care recipients. The implementation of digital tools in care task recording represents a significant advancement towards modernizing the caregiving process, ensuring it meets the evolving needs of the aging population.

C. Support Systems for Caregivers

Addressing caregivers' physical, emotional, financial, and mental needs is crucial for reducing burnout. The pretest results highlighted significant gaps in these areas, emphasizing the need for comprehensive support systems. To support eudaimonic well-being, it's essential to develop incentive programs that improve job satisfaction and overall happiness for caregivers, who often experience high stress and turnover rates.

Physical Needs: Implementing programs to reduce physical fatigue, such as adequate break times, ergonomic tools, and rotational tasks, can help alleviate the physical burden on caregivers.

Financial Needs: Offering financial incentives, such as performance bonuses, salary increases, and financial planning services, can enhance caregivers' financial stability and motivation.

Emotional and Mental Needs: Emotional support systems may include counseling services, stress management programs, and peer support networks. Accumulating individual data and providing data-driven resources can help manage caregivers' eudaimonic well-being. Recognizing and rewarding caregivers' efforts with incentives and career development opportunities can further boost morale and motivation.

D. Support Systems for Care Recipients

This section focuses on the needs of care recipients as perceived by caregivers. It highlights the importance of understanding and addressing the emotional needs of care recipients to provide comprehensive support.

The pretest results indicate that caregivers perceive significant gaps in the mental needs of care recipients. This suggests the necessity of developing programs, schedules, and methods to fulfill these mental needs. By comparing the importance of each emotional need for care recipients and the current level of service provided, the study identifies areas requiring improvement.

Gap Analysis for Care Recipients' Needs: Surveys can be conducted to assess the importance and satisfaction levels of various emotional needs from the perspective of care recipients. By identifying these gaps, care providers can develop targeted content and

programs to address unmet needs, thereby enhancing the overall well-being of care recipients.

Implementation of Mental Health Programs: Caregivers can plan and execute programs that focus on mental health, such as cognitive stimulation activities, social interaction opportunities, and therapeutic interventions. Providing time and resources for these programs is crucial to ensure they are effective and sustainable.

By addressing both caregivers' and care recipients' needs comprehensively, the care system can enhance the quality of life for all involved parties. This holistic approach not only improves service delivery but also fosters a more supportive and resilient care environment.

E. Classification of Services

Services can be categorized into three main types based on the 10 Happy Factors: Prevention of Unhappiness, Homeostasis, and Happy Up Services. Each category addresses different aspects of well-being and provides a structured approach to meeting the diverse needs of care recipients.

- Prevention of Unhappiness includes services aimed at alleviating or eliminating negative conditions that cause distress or discomfort. These services encompass pain management programs, medical treatments for chronic diseases, emergency response systems for acute health crises, and mental health services to address anxiety or depression. The government plays a crucial role in minimizing these areas by providing essential healthcare services and support systems to ensure all citizens have access to necessary treatments and interventions.
- Homeostasis focuses on maintaining a stable and balanced state of health and well-being. These services ensure individuals can sustain their current health status and quality of life through regular health check-ups, medication management, nutritional counseling, and fitness programs. Psychological support is also provided to help individuals cope with daily stress and maintain mental balance. Individuals are encouraged to maintain homeostasis with minimal effort by adopting healthy lifestyles, participating in regular health monitoring, and utilizing available support services to manage their health proactively.
- Happy Up Services aim to enhance and elevate the quality of life beyond mere maintenance. These services promote happiness, fulfillment, and personal growth through anti-aging treatments, wellness retreats, cognitive enhancement programs, and activities that encourage social interaction and engagement. Services that cater to hedonic satisfaction, such as leisure activities, hobbies, and cultural experiences, are included in this category. Individuals can opt to pay for these premium services to achieve a higher level of happiness and well-being, as they significantly contribute to one's quality of life and overall satisfaction.

Although this study did not conduct pretests with this classification, it highlights a valuable direction for future research. In the next phase of scale development, services will be categorized into these three types, and surveys will be conducted accordingly. This approach can clearly delineate the areas the government should provide for free (Prevention of Unhappiness), the areas where individuals strive to maintain their health (Homeostasis), and the areas where individuals will pay for enhanced well-being (Happy Up Services). Incorporating this classification in future studies will provide a more nuanced understanding of care needs and preferences, helping to tailor services more effectively. By identifying specific gaps within each category, service providers can develop targeted programs that address unmet needs and enhance overall care quality.

This structured approach to service classification not only aids in understanding and addressing the diverse needs of care recipients but also supports the development of a more sustainable and high-value-added care industry. By balancing essential services with premium offerings, both the government and individuals

can contribute to a holistic care ecosystem that promotes overall well-being and happiness.

F. Evaluating and Enhancing Support Systems

To ensure the effectiveness and sustainability of the developed support systems for both caregivers and care recipients, continuous evaluation and enhancement are essential. Regular feedback loops should be established to collect insights from caregivers and care recipients about the effectiveness of the implemented programs. These insights can guide iterative improvements and adaptations to meet the evolving needs of the care ecosystem. Utilizing advanced data analytics and machine learning algorithms can help identify patterns and predict future needs, enabling proactive adjustments to support systems. By continuously refining these systems, the care industry can maintain high standards of service quality and enhance the overall well-being of all stakeholders.

The evaluation system integrates Utilitarian Needs and Emotional Needs to develop a comprehensive scale for care robot services. By comparing the perceived service gap before and after implementing care robot services, this system can serve as a key indicator of effectiveness. If the gap does not decrease, it identifies specific areas where further requirements must be addressed. This approach transforms subjective and abstract states of satisfaction or dissatisfaction into concrete data-driven solutions that can either enhance premium services or reduce dissatisfaction. By providing precise strategies to address identified gaps, the system supports the development of targeted interventions to improve care quality and increase the willingness to pay for premium services.

G. Year Two Project Basis

This study is based on the pretest results conducted during the second year of a five-year project. Over the next three years, the project aims to develop scales for identifying emotional needs and integrate functional needs to derive comprehensive care robot service requirements. This will serve as a foundation for developing new paid services and future service evaluation models. The pretest results provide valuable insights into caregivers' emotional needs, aiding the design of care services that address both practical and psychological aspects. Leveraging these findings, the project aims to develop a robust framework for the commercialization and evaluation of premium care services.

CONCLUSION

In conclusion, this study highlights the critical importance of addressing both utilitarian and emotional needs to advance the care robotics market in South Korea. Key findings demonstrate that fulfilling these needs is to significantly increase the willingness to pay for premium care robot services.

Advanced care services have the potential to transform the senior care industry by reducing caregiver burnout and delivering high-quality care. The integration of real-time data services, digital record-keeping, and emotional support systems creates a comprehensive care environment that meets the diverse needs of the aging population.

Future research should focus on new technologies to further enhance care services and expand the study to other demographics and regions. Utilizing perceived gap analysis based on the 10 Happy Factors can serve as a methodology to derive emotional needs. Additionally, surveys can be conducted to compare the importance of each happiness factor for caregivers and care recipients, identifying areas where service provision is lacking. For instance, caregivers' perceptions of care recipients' happiness can be compared to the actual services provided, identifying gaps that need to be addressed. Similarly, surveys of care recipients can assess the importance and satisfaction in each area, highlighting service gaps. These insights can guide the development of content and programs to fill these gaps,

ultimately enhancing the willingness to pay for tailored services.

The classification of services into Prevention of Unhappiness, Homeostasis, and Happy Up Services provides a structured approach to address different needs. This classification can clearly delineate the areas that the government should provide for free and the areas where individuals will pay for premium services.

By employing the happiness index to identify emotional needs, this research provides a robust methodology for improving care services across various settings. Longitudinal studies should be conducted to evaluate the long-term impact of integrated care robot services on caregiver well-being and care recipient satisfaction. Continuously refining and expanding care models will help the industry stay ahead of emerging challenges, contributing to a resilient and adaptive care ecosystem.

Overall, developing high-value care services tailored to individual emotional needs can foster a competitive and high-value-added industry, ensuring sustainable growth and better care outcomes. This research lays the groundwork for future innovations in care robotics, aiming to create a more effective and compassionate care environment for the elderly.

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