Acceptability of an AI-Powered Wearable Ring Sensor for Upper Body Mobility in Individuals with Cognitive Impairment: A Pilot Study

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***Abstract*—Dementia affects cognitive function and daily functioning, with an increasing global prevalence. This pilot study assesses the feasibility, usability, and acceptance of a wearable ring powered by Artificial Intelligence (AI) to monitor upper body movements in individuals with dementia. After wearing the device for one full day, all participants adhered to the device. Quantitative results revealed moderate usability and acceptance. Qualitative themes included high comfort, low perceived significance, and minimal impact on daily activities. This study demonstrates the feasibility of an AI-powered wearable device in dementia care. Future large-scale studies should incorporate individuals with different levels of cognitive disability to assess the adaptability of wearable technology to their needs.**

Keywords--Wearable Devices; Artificial Intelligence; Dementia; Feasibility; Aging; Movement Monitoring.

I. INTRODUCTION

Dementia impacts memory, cognition, behavior, and daily tasks, affecting 36.5 million people globally [1][2]. People with dementia and cognitive disabilities have historically been excluded from research, especially in gerontology, reflecting broader ableism that marginalizes those with dementia [3]. Over the past decade, there has been a growing shift toward addressing these biases, emphasizing the importance of inclusive health technology research to ensure equitable access, use, and benefits from technological advancements [4][5]. This shift is crucial in advancing technologies like wearable devices, which can enhance dementia care [6]. Kinematic technologies—such as accelerometers, Global Positioning System (GPS) trackers, and motion detection tools—offer cost-effective, minimally invasive ways to assess disease burden and deliver personalized care [6]. Wearable devices provide continuous physiological monitoring in real-world settings, offering insights beyond traditional in-clinic assessments. These technologies support rehabilitation, measure mobility, and improve daily functioning in aging populations [7]. However, the current use of wearable devices in dementia patients is primarily utilized for measurement of the sleep wake cycle [5]. Artificial intelligence (AI) enhances dementia management through AI-powered wearables and telepresence systems, providing cognitive support, and social engagement [8]. These innovations reduce the caregiver burden, improve patient well-being, and enable real-time, personalized health monitoring [8][9]. Expanding on these advancements, AI-integrated wearable devices, such as a ring sensor for shoulder movement monitoring, present a promising tool for supporting individuals with dementia [9]. This study aims to assess the feasibility, usability, and acceptance of a wearable ring powered with AI designed to track upper body movements in individuals with dementia. The rest of the paper is structured as follows. In Section II, we present the methods pertaining to quantitative and qualitative data collection. In Section III,

we outline feasibility, acceptability and usability results of the pilot study. Finally, Section IV addresses the conclusions and future work directions.

II. METHODS

This pilot study employed a mixed methods design to assess the feasibility, acceptability, and usability of wearable sensor technology for older adults with dementia. Quantitative methods were used to evaluate feasibility and usability, followed by a qualitative phase using a focus group to explore participant experiences. Participants were recruited from a long-term care home using convenience sampling. Eligibility criteria required participants to be aged 65 or older, residing in the facility, and capable of providing informed consent. Exclusion criteria included significant mobility restrictions or medical conditions affecting sensor use, such as severe arthritis, hand tremors, or Raynaud's disease. The intervention involved participants wearing a ring-based wearable sensor to continuously monitor upper-body movements. Participants wore the device for one day, from 8:30 AM to 3:30 PM (Figure 1). A trained staff member ensured proper device usage and data integrity. The XO TECHNOLOGY© ring, linked to the XO HEALTH© app on Android and iOS tablets, collected and analyzed movement data using AI algorithms [10].

Figure 1. Wearable ring devices by XO technology.

Metrics included shoulder flexion, extension, abduction, adduction, and rotational movements. The AI-driven platform identified anomalies and provided insights to support early detection of movement limitations. Quantitative data collection assessed feasibility through adherence tracking and usability via the Technology Acceptance Questionnaire (TAQ) and User Acceptance Questionnaire (UAQ) [11][12]. One week post-intervention, a structured focus group was conducted to explore participant perceptions of comfort, ease of use, and impact on daily activities.

III. RESULTS

The final sample included five participants with moderate dementia (Table 1). Cognitive status scores on the Mini-Mental State Examination ranged from 5 to 30, with a mean score of 20.90 (SD ±8.84). The feasibility of the device was demonstrated, as all residents used it correctly, and no residents requested to remove the ring. However, an issue arose when the ring sensor size was too large for one participant. Questionnaire results indicate moderate usability and acceptance, with mean scores of 52.20 (SD ±38.40) on the TAQ and 87.80 (SD ±66.20) on the UAQ. Qualitative analysis identified three key themes: High Ring Comfortability, with participants finding the ring comfortable due to its design; Low Ring Significance, as many felt the ring had little noticeable impact or benefit; and Low Ring Impact, as it did not interfere with daily activities like exercising or showering. The wearable ring is designed to monitor upper body movement in individuals with dementia, providing data on their physical activity, mobility patterns, and potential early frailty indicators.

TABLE 1: CHARACTERISTICS OF STUDY PARTICIPANTS

Category	**Dementia** (n=5)
Gender	
Female	4 (80.0%)
Male	1 (20.0%)
Duration (in seconds)	1703.00 ± 348.00
Ethnicity	
White	5 (100.0%)
Other	0 (0.0%)
Highest Level of Education	
High School or Equivalent	4 (80.0%)
Other	1 (20.0%)
Engaged in Recreational Activities Involving Shoulder Exercises Today?	
No	0 (0.0%)
Yes	5 (100.0%)
Expressed Shoulder Pain Today?	
No	4 (80.0%)
Yes	1 (20.0%)
Expressed Discomfort with the Device?	
No	4 (80.0%)
Yes	1 (20.0%)
Age (Mean ± SD)	78.60 ± 81.60

Movement monitoring can help assess motor function, detect changes that may signal increased fall risk, and support personalized interventions. Establishing the acceptability of this technology is a crucial step toward its integration into dementia care, ensuring its feasibility for real-world application. This study is not without limitation. Exclusionary criteria were made to ensure accuracy and reliability of data collection; however, this may not fully represent the experience of individuals with more advanced physical impairments. This limits the generalizability of the results to a broader population of people with dementia.

IV. CONCLUSION AND FUTURE WORK

This study shows the feasibility and potential of AI-powered wearable ring technology for individuals with dementia. Participants wore the device consistently, with minimal discomfort, demonstrating its acceptability and practicality. The design features prioritize ease of use, adaptability, and low intrusiveness, which enhanced its usability. Future large-scale studies should include individuals with varying levels of cognitive disability to evaluate how wearable technology can be adapted to meet their needs. This would expand the generalizability of findings and better address the diverse experiences of people living with dementia. Finally, future research should explore the use of the ring device in other conditions outside of dementia to further examine generalizability of the ring device.

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