

Role of Artificial Intelligence in Assisted Living Centers for the Elderly

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Abstract

This research paper is about the contribution of artificial intelligence in enhancing the quality of life offered in assisted living centers along with overcoming the issues faced by the elderly people in such a setup. As per statistics, the number of seniors over the age of sixty-five has reached one billion. This figure is expected to be doubled by 2050. The number of older adults worldwide is increasing faster than any age group. Without restructuring the approach of providing such services, it might not be possible to deliver quality care to people. Big data and artificial intelligence technology are going to play an extremely important role in the near future in the field of senior care.[1] An assisted living facility is a day care or residential housing facility for those people who need regular supervised medical care. It also provides an opportunity to socialize with the peer group. These centers basically provide residential, socializing and primary healthcare facilities. The people depending on such centers include retired people, people on medication or whose children are in working class group. People are either living alone or with the working children who are left in the care of maids but the quality of their life are growing worse and they are becoming the victims of depression, loneliness and anxiety. Moreover, the working children are always on a quick run in case anything may happen to their elderly at home.

Artificial intelligence refers to machines that are programmed to simulate the way that humans think, learn and work. These systems collect data over time and analyze it to deliver accurate information. This can save a lot of time of the service providers and enable them to spend more time with the patients to enhance their quality of life.

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I. INTRODUCTION

Several factors are driving the demand for retirement housing in India. One of the most significant changes in our world today is the shift in population demographics. The people of the world are getting older. In 2000, there were 600 million people aged sixty and over, there will be 1.2 billion by 2025 and two billion by 2050.^[2] In 2050, the number of older persons in the world will exceed the number of young for the first time in history. The country's overall population is growing at 1.8% annually but the rate of senior

Citizens are increasing at a much faster rate, i.e. 3.8% per year. In recent years, the number of people aged sixty-five or over has risen by 2% a year and the fastest growing age group is people over 80.^[3]

People are living longer today for several reasons including advances in medical science technology, health care, nutrition and sanitation. An important consequence of this progress is that those aged eighty or older are the fastest growing age group in the world. Although this larger older population is in better health than even before, they have some modified abilities. Sensory, cognitive and

physical health, mobility and dexterity changes are prevalent among older persons, and raise many questions about the ways one thinks about human-environment interaction.

Assisted living communities face a number of challenges like client accidents (like falls), high client to employee ratio, high employee turnover, family distrust, increasing regulations, increasing workload and outdated technology. When some member of the family is in the assisted living facility, it is both financial as well as emotional stress on families. The “sandwich” generation is responsible for caring for their ageing parents and supporting their children. It can multiply the efforts of a lean staff while maintaining a high quality of patient care and save caregivers from executing mundane tasks like scheduling and billing by deploying automation processes so that caregivers can spend more quality time with patients and bring positive health outcomes. In terms of elderly care, it can envision a better way to passively monitor residents using technologies like wearable sensors, Ultra-Wideband (UWB) radar, and machine vision to train artificial intelligence engines. It can help to absorb and track a person’s behavior, and then, predict health issues before they become medical emergencies.

As the saying goes, “Prevention is better than cure”, similarly, identifying potential hazards and preventing issues before they occur reduces injury, reduces healthcare costs and decreases staff overload.

Alternating Requirements adding to the Sentimental Values of the Elderly

After reading various reports, articles and research papers on the elderly the following points can be summarised. ^{[4][5]}The elderly face a number of challenges in their survivals as a result of increased likelihood of having Physical, Sensory and Cognitive Deficits in their lives.

- Migration of young couples from Delhi to abroad in search of better employment opportunities to fend for themselves.
- Elders who have been in control of the household for a long time are unwilling to give up the responsibility of their children.
- Youngsters on their part are sometimes resentful of the attitude of their parents.
- Many youngsters have moved to places far away from their native homes and in the recent past to many countries abroad. So even if they want to they cannot accommodate their parents in their own homes.
- Elders are sometimes too incapacitated or unwell to look after themselves or get medical care especially in an emergency.

A few design principles that are proposed keeping in mind the needs of the elderly are follows. These points also form an alternating base for experimenting with the concept of artificial intelligence to be included in the already existing as well as upcoming assisted living centres.

Principles of Universal Design

1. Equitable Use- Housing is usable by anyone, and does not disadvantage, stigmatize, or privilege any group of users. No-step entries are an example of equitable features that allows all people to enter the dwelling in the same way.
2. Flexibility in Use- Living environments accommodate not only a wide variety of individual choices, but also adapt to user`s varying functional abilities. For example, placing kitchen counters at various heights permits people who are of tall or short status or those who are in seated positions to prepare food in a comfortable manner.
3. Easy and intuitive – All aspects of the domestic surroundings are straightforward to grasp, no

matter the inhabitant's experience, knowledge, language skills or concentration level. Bathroom faucets that create operation apparent which clearly indicate temperature levels are an example of a universally designed solution. Light switches that are consistently located in relation to room entrances and that contain uniform "on/off" indicates help people to intuit lighting operation.

4. **Perceptible Information-** The housing communicates all necessary information effectively to all users regardless of ambient conditions or the user's varying cognitive or sensory abilities. Both auditory and visual warnings on appliance buzzers and security alarms alert people to important information, and circumvent negative situations that might occur because of low vision, hearing limitations, environmental noise, and dark or clouded spaces.

5. **Tolerance for Error-** The design of residences minimizes hazards and adverse consequences of accidental or unintended actions by all users. Built-in-shower seats are an example of a universally designed feature which can prevent slips and falls while bathing. Niches for keys and other items near every entrance door help users to remember where they locate items that are often misplaced.

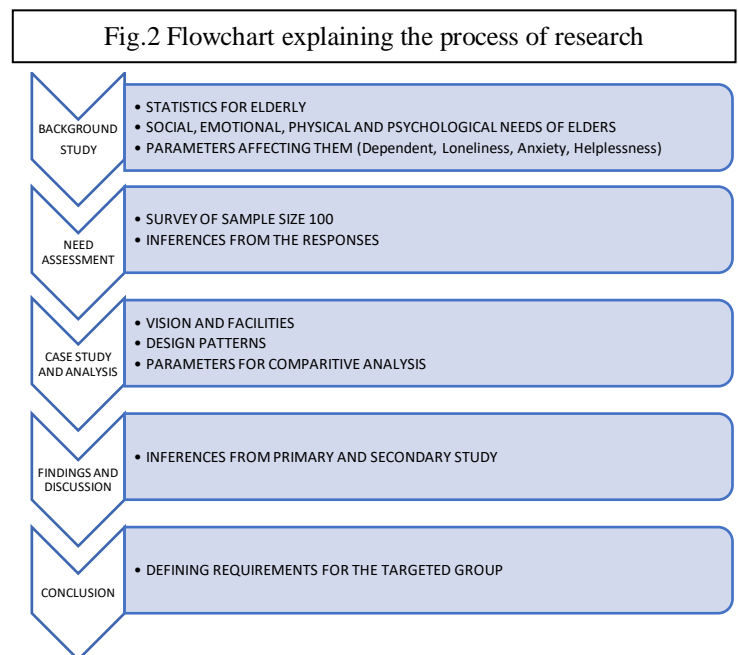
6. **Low Physical Effort-** Everyone can use the dwellings efficiently, comfortably and with minimal fatigue. Locating all basic living requirements on one entrance grade level reduces effort for those with mobility difficulties.

7. **Size and Space for Approach and Use-** Housing provides appropriate size and spaces for approach, reach. Manipulation and use regardless of the user's body size, posture or functional abilities. For example, wide doorways and passageways provide a clear path of travel throughout the dwelling for all inhabitants. Reachable cabinets give users access to all stored items. ^[6]

II. METHODOLOGY

Initially, research papers, Indian and foreign studies were done through secondary resources, i.e., books, journals, conference papers. A need assessment study along with the primary and secondary case studies was done. An online survey was conducted and discussions were done in various assisted living centers like Panchvati Homes, Tughlaqabad, Ashiana Care Homes (Bhiwadi), Epoch Assisted Living (Gurgaon) and Golden Estate, Faridabad. After interaction with people and taking the valuable inputs of the people, the study was taken forward.

Loop holes were found from the previous studies that have already been done for assisted living centers and similar set ups. The proposals are made to improve upon the functioning of assisted living centers.



II. NEED ASSESSMENT SURVEY

After understanding the needs and requirements, they are now translated to an innovation stage for achieving best out of the blend of artificial intelligence in the concept of assisted living. The need assessment was done by doing a primary survey in a sample size of hundred. A multiple

choice-based questionnaire was floated among more than a hundred people of Delhi – NCR who are between thirty to fifty years of age as their parents come in the old aged group.

Questionnaire for establishing need for assisted living centres

A multiple-choice questionnaire which was circulated had general questions to know about the age and background of the person, his/her parents and family. The specific questions included the details about the physical health and medical conditions of their parents so as to know the degree of assistance (fully/partially) required for them. Mobility issues were also enquired about. After knowing about the condition of their parents, an attempt was done to know who is there to look after them at home all day. In case of any emergency, who is there to provide proper medical assistance to them and take them to the hospital, if required. Further questions were asked to know if such sudden circumstances created stress and affected the concentration and productivity of people working as they are constantly worried about their parents who are ill alone at home. Along with the questionnaire, a basic idea was given to them about the assisted living centers so as to know their preference if they would want to send their parents into daycare or residential abode so as to give them an environment where they are constantly under medical supervision, socializing with the peer group and involved in the recreational activities.

Focussed Group Discussions with Old Aged People

A group of elderly were gathered to have a common discussion for understanding more about their needs (physical, social, emotional). Elderly who live with their children who are there at home 24X7 don't have many problems as someone is always there to assist them. But the elderly who live with their children who are working do not

feel secured as they are always dependent either on their maids, servants or caretakers for assistance. In the case of any emergency, a panic situation is created at home and since, there is no maid trained for providing first aid or primary healthcare treatment. As a result, their children have to rush from their workplaces and thus, the medical support gets delayed by a few hours. Also, sometimes, the maids and servants are busy in doing the work that they are not able to hear when an elderly call for assistance.

When discussed about their routine, it was identified that their children don't have much time to sit with them and interact so those who have friends, they go daily to park, temple or community areas to keep themselves busy. The ones who are not able to go out, they spend time by reading books, newspapers, watching television, or pursuing their hobbies like knitting. Some of them have also joined some NGOs to utilize their time productively.

But deep inside, loneliness haunts them and they want to run away from it. When the concept of assisted living facility was explained to them, then, almost 75% of them agreed to use either the day care or residential facility as this would give them an opportunity to grow as individuals, interact with people from various backgrounds, gain knowledge, learn new things and utilize their time in a more productive manner rather than spending time alone at home in a more vulnerable situation.

Observations, Findings and Discussion

The surveyed sample space of 100 includes the people in the age group between thirty to fifty years of age whose parents are in the old age. They would be able to connect to the concept of assisted living centers as they see their parents struggling for the survival (whether it is in terms of medical assistance, mobility, daily chores etc). Here are a few observations from the survey held. Majority of the elderly population lie in the

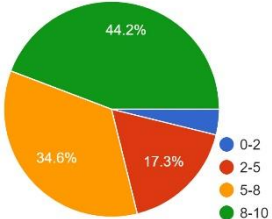
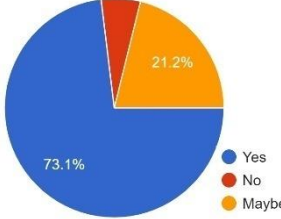
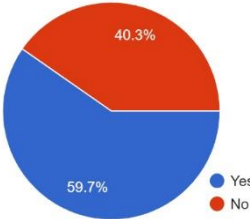
retired age group or are in the non-working class (67.7 %) which states that they are mostly at home for the entire day. Their mobility has recessed and has limited to going to nearby places like park, temple or sometimes market. This is the time when their health actually starts declining and they become dependent on others for some or the other reason. As per the survey done, their children are not always able to fulfil the emotional needs of their parents as they are out throughout the day at their workplaces and they are not able to spend quality time with their parents. As a result, they are there at home with either maids, servants

(21.2%) or grandchildren (25%) or all alone (28.8%). When they are alone at home, the chances of accidents increase. Even if they are capable of handling daily chores on their own, they might need some emergency medical assistance. After understanding the concept and need of assisted living center, 55.8% of the people agreed to leave their parents in either day care or assisted living residential abode rather than leaving them in a more vulnerable situation at home all alone.

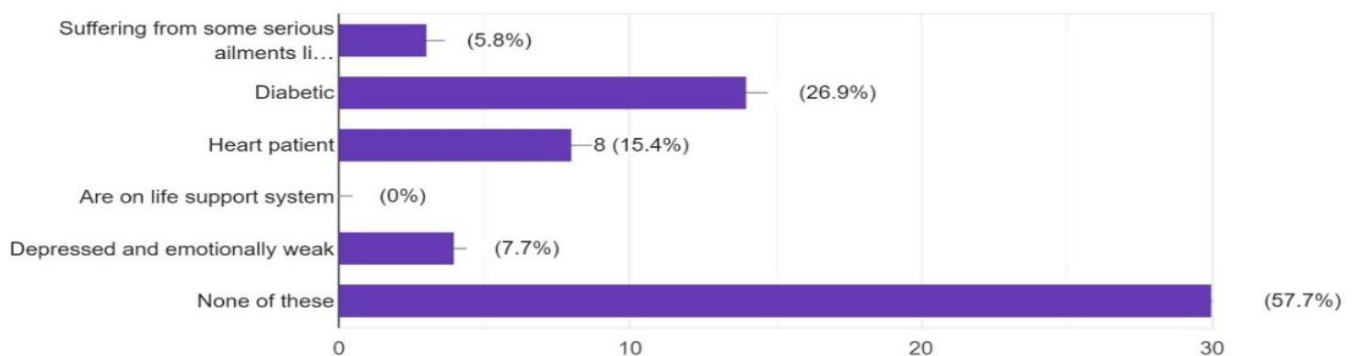
The graphical analysis of the survey is as follows:

Which group do you belong to?	In which age group your parents belong to?	In which working group your parents belong to?
63.5% belong to the working class (full time) and 28.8 % belong to the working class (part time).	The age group of parents on which the study is focussed is above 50 years.	Majority (40.4%) of the parents are retired and 38.5 % belong to working full time and 17.3% belong to the non-working group.

Do they need assistance for daily chores?	Do they need regular medical assistance?	Who is there to look after your parents when you are at your workplace?	Do you feel that you are able to fulfil their emotional needs?
51.9% people need assistance for their daily chores.	55.8% people need regular medical assistance.	The elders are left behind with their maid/servant or children. Still 28.8% remain alone.	Most of the people agree that they are sometimes(61.5%) able to fulfil the emotional needs of their parents.

<p>How much does your stress level when you know that you can get an emergency call from home (regarding your parents)?</p>	<p>Does this stress affects your concentration and productivity at work?</p>	<p>Would you want to leave your parents in assisted living (which has a trained nurse in your personal home-like environment as there might be cases of medical emergency)?</p>
		
<p>44.2% people agree that their stress level increases between 8-10 (on the scale of 0-10) when they get an emergency call.</p>	<p>73.1% people agree that their increased stress level affect their productivity and concentration at work.</p>	<p>Afetr understanding the concept of assisted living centers, 59.7% people agree to leave their parents in such centers rather leaving them alone at home.</p>

In which category do they fall?



III. FINDING GAP AREAS IN THE FUNCTIONALITY OF ASSISTED LIVING FACILITIES

After understanding the gaps in the functionality of an assisted living center, the main problem is lack of human resource and this gap can only be fulfilled by utilizing the available advancements in technology which can replace the monotonous job of admin work so that the caretakers can spend more time with the old residents and render more quality care.

Assisted living communities face a number of challenges like :

- Client accidents (like falls)
- High client to employee ratio
- High employee turnover
- Family distrust
- Increasing regulations
- Increasing workload
- Outdated technology

When some member of the family is in the assisted living facility, it is both financial as well as emotional stress on families. The “sandwich” generation is responsible for caring for their

ageing parents and supporting their children. It can multiply the efforts of a lean staff while maintaining a high quality of patient care and save caregivers from executing mundane tasks like scheduling and billing by deploying automation processes so that caregivers can spend more quality time with patients and bring positive health outcomes. In terms of elderly care, it can envision a better way to passively monitor residents using technologies like wearable sensors, Ultra-Wideband (UWB) radar, and machine vision to train AI engines. It can help to absorb and track a person's behaviour, and then, predict health issues before they become medical emergencies. As the saying goes, "Prevention is better than cure", similarly, identifying potential hazards and preventing issues before they occur reduces injury, reduces healthcare costs and decreases staff overload.

IV. PROPOSALS FOR AMALGAMATION OF ARTIFICIAL INTELLIGENCE IN ASSISTED LIVING

There are many prototypes which can be adopted in such centers to assess the efficiency and performance in different setups using artificial intelligence. The applications of artificial intelligence can also help an employer's retention and quality with voice activated devices and smartphones apps that can be used by the staff to receive guidance, automatically log mileage, capture notes, send messages to families, talk to physicians and more.

Employee turnover can also be improved using artificial intelligence via using a voice activated wearable device which can be operated from a phone or tablet as staff retention is one of the biggest challenges faced today.

Automatic Log: Automatic data collection and analysis by sensors will eliminate a significant amount of paperwork and also save a lot of time of the staff which they can utilize in

communicating, providing better care and helping them socialize with their peer group by organizing activities, events or trips.

Capture Notes and Receive Guidance: Record the activity behavioral patterns in real time for performance of people in such centers to make accurate performance graphs and give proper medication as per requirement. Real time monitoring also enables to take guidance from the professions all over the globe.

Passive Health Monitoring: It is one way by which the health of patients can be monitored more accurately using artificial intelligence like sensors recording body temperature, fall indicators, heartbeat, motion, respiratory rate etc. depending upon the need of the patient. The information registered can then be processed using software to interpret patterns and predict potential medical crises, including heart disease, infections and stroke.

Preventing Falls: According to CDC data, older people are treated in the emergency room for fall-related injuries every eleven seconds. Falls can also be prevented in a similar manner by monitoring the patterns of a person in terms of balance, gait, stride, length and walk speed. This information database of every person can be used to alert the family members, care takers and healthcare professionals to reduce fall risks.

Updating family members via messages or real time video sharing of the patients about their daily activity and improvement so that they can be at a higher mental peace level for their loved ones, can also be assured of the proper care that is being received at the assisted living facility and also allowing the staff members to provide personalized care for the residents.

Increased staff efficiency and improved retention: Systems and devices using the concept of artificial intelligence can help scheduling the monthly calendars and notifying residents about upcoming

events, meals and appointments in an easier and efficient manner. Digital assistants can also be used in such an environment with voice recognition capabilities which would allow staff to dictate notes, send messages to family members as well as healthcare professionals.

V. PROPOSED PROTOTYPE INTERFACE TO INCREASE EFFICIENCY

After getting to know about the prototypes incorporating artificial intelligence that can be used in an assisted living facility set up, it can be clearly stated that this would be beneficial on both the hands, for the residents as well as for the employers. This can save a lot of time of the staff and also enable the residents to enjoy a more quality care.

Here is a suggestive prototype which can be developed and used in various assisted living facilities to reduce the problem of lack of human resource and thus managing the admin work in a more organised and effective manner with the help of an app or software. This would be covering a wide range of activities like maintaining a database record of all employees as well as patients. For employees, it would have their personal details, job profile, payroll records, training and development, awards and achievements. For the patients, it would have their personal details, medical history, daily schedules, messages and mail alerts, day to day progress reports and real time video.

This would enable the employees and the caregivers to spend less time on paper work as this could all be managed with the help of this developed software or app in a very efficient manner. They can utilize and spend their time with the patients and render more quality care to them. This would be accessible by the patients, their family as well as their doctors who can see if the care is being given in the desirable manner. It would also give relief to the family members of

those patients as they would be able to see their parents whenever they wish to and would also be getting time to time alerts to keep a check on whether they have taken medicines properly or not. This would in turn be beneficial for the working children who would be able to concentrate more on their work rather than worrying about their parents who used to be there alone at home in a more vulnerable environment.

This is the interface of Android App Development as well as Website which would help the staff of the assisted living centers to maintain records in an accurate and efficient manner. This would also have a real time tracking system as provided in apps like Healthify, FitBit etc. For example, a patient who has a lot of fluctuation in Blood Pressure, his/her BP can be regularly monitored so the graph can be monitored regularly and proper medication can be given to him/her and any major terrible situation can be avoided.

This would also help the children of the elderly to keep a regular check to see whether their parents are being rendered timely care and assistance as and when required. An automatic update system would also inform about their health progress and day to day health checkup reports to their family members. Their children can work in a peaceful environment without taking any stress about their parents' care as they know that they are in safe hands.

The following interface can be run and tested in collaboration of any of the centers in Delhi so as to identify the bugs (if there are any), and this can be further rectified and implemented in the existing and new upcoming such centers to improve the efficiency and enhancing the quality care.



Fig.4 Proposed Prototype for Interface

VI. RESULTS

After getting to know about the prototypes incorporating artificial intelligence that can be used in an assisted living facility set up, it can be clearly stated that this would be beneficial on both the hands, for the residents as well as for the employers. This can save a lot of time of the staff and also enable the residents to enjoy a more quality care.

VII. DISCUSSION

With the advanced medical care, it can be seen as per the demographics and mortality rate study, India has a growing ageing population in past three decades and hence, there would be an increased demand for the assisted living industry to meet the requirements. The critical aspect of this would be ensuring the same or rather enhanced quality to the residents so that they feel like coming happily into the personalized home care environments or else, there would be no significant difference left out in nursing homes, old age centres and assisted living centres. The quality of life for employees is as important as it for senior residents. If technology can help improve inefficient processes and support in their day to day tasks, job, they will feel empowered and it can result in high job satisfaction. It can change the ways in which an assisted living

facility operate. The biggest advantage of artificial intelligence is that it is not a stand-alone technology rather can complement to the existing technologies to make it more impactful.

VIII. CONCLUSION

The concept of using artificial intelligence in assisted living centers in numerous techniques can actually help in reducing accidents and rendering quality services to them. Using artificial intelligence to improve the quality of life of the residents at the assisted living facilities can enable their family members to lead a more peaceful life as they would not be in the state of panic in case of some or the medical emergency of their loved ones. This concept can actually contribute to various factors in near future and could be further taken up for the research by innovating more concepts which could be beneficial for the service providers as well as the takers.

If the technological advancements can help in the improvement of their day to day tasks, then, the staff would feel empowered and this would in turn result in high job satisfaction. It can change the ways in which an assisted living facility operate. The biggest advantage of artificial intelligence is that it is not a stand-alone technology rather can complement to the existing technologies to make it more impactful.

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