HYBRID USABILITY APPROACH IN DEVELOPING ASSITIVE TOOLS FOR DEMENTIA PATIENTS

MASTER OF SCIENCES IN INFORMATION TECHNOLOGY

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HYBRID USABILITY APPROACH IN DEVELOPING ASSITIVE TOOLS FOR DEMENTIA PATIENTS

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Submitted By
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THE SUPERIOR COLLEGE LAHORE, PAKISTAN
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I certify that:

(a) The above-named student has completed the cited thesis under my guidance and supervision.

(b) I am satisfied with the quality of the student's research work, and

(c) I consider it worthy of submission for external evaluation.

_____

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DECLARATION OF AUTHORSHIP

I, hereby, declare the work being presented in this thesis titled **"Hybrid Usability Approach in Developing Assistive Technologies for Dementia Patients"** submitted to The Superior College Lahore in partial fulfillment for the award of the degree of Master in Sciences in Information Technology is a presentation of my original research work. Wherever contributions of others are involved, every effort is made to indicate this clearly, with due reference to the literature, and acknowledgment of collaborative research and discussions. I also declare that this work is the result of my investigation and research, except were identified by references and free from plagiarism of the work of others.

Lahore, June, 2021 Signature: _____

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Sincerely thanks,

Fahad Ali

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ABSTRACT

The technology of the assistive tools like wireless body area network, medical bracelet is used in health and non-medical bodies. In Medical sciences it has been used to track as well as navigate patient health in hospitals and homes Remote control of medical devices. The purpose of the research is to find the best elements in developing an assistive tool for dementia patients "ATDP" also try to enhance the efficiency of dementia patient toward wellbeing. Because they got a lot of problems like thinking, remembering and reasoning, so "ATDP" has been collaborated with "ATDP" to collect accurate and efficient data in the form of bio-signal sensing in the hospital as well outside the premises for helping patients.

Body sensors will collect medical data from patients and report it directly to hospital servers with the help of the internet. An "ATDP" offers many applications in the fields of remote health control for dementia patients. The research will be significant for mankind because this is going to help the patient to continue his routine life. He does not have to remain in bed but can walkabout. Moreover, data gained over a longer time in the patient's natural environment provides more valuable knowledge, allowing for a more detailed and often even quicker diagnosis. The goal of this approach is to reduce the risk of the fight against the disease. Different protocols are used in data transferring of a patient to servers and sensors to wearable devices [1].

The methodology we are using is simple, collect data against the currently running apps for helping patients and the features they got in a positive perspective as well as the feature they lack and need to be added, then quantifying and instrumenting this data with Likert Scale putting in SPSS to get analysis. We are Using ANOVA by demographics of patients and topologies, Regression both SLR and MLR. This research carrying Limitations as well our research will have limitations of the Hospitals Using "ATDP" Technology. This research will open a pathway for future Research to work on Health Car integrated with SDWAN which should be the next level of such research i.e., "ATDP". We are Using some new terms for prototyping to define the best model by validation and assessment of existing and hybrid model that contains all attributes inclusive of "ATDP". The assessment tools used for evaluating the suggested model of the prototype would be Regression, which only used in few of the Universities in Pakistan mostly Used in Top Ranked USA and Australian Universities.

Key Words: ***Dementia, WBAN INTEGRATED "ATDP", Protocols, ATDP, GPS/GPRS, Wireless Bracelet***

1.Introduction

In the disease of dementia patient loses his mental skills, thought, recalling, and reasoning with the everyday life and activities of an individual. So, there is a severe need of such application that has a storage function for helping them for remembering things, like paths to their home, indicators utilizing the GPS integrated into the application [2]. Using Google navigation integrated with our app and attribute storage of things to do are the most important factors that need to cater.

Health is the primary factor in the life of a human being. According to the study, in the world around 17.5M people deaths has been recorded each year from heart disease. 246M people found to be suffering from diabetes. The number of patients will be increased up to 380M in 2025 due to insufficient health. It is possible to mitigate the assault of other diseases such as kidney disorders, anxiety disorder, by providing health care. According to another study by the United Secretariat's Department of Economic and Social Affairs, people over 65 years of age will make up around 15% of the world's population after 10 years. [3]

There is also a need for low-cost health monitoring devices for the future for older individuals facing medical health problems. The wireless Body Area Network has recently been implemented to track the health of an individual by taking this into account. Zimmerman first suggested this definition in 1996 that WBAN integrated “ATDP” wireless bracelet at patient’s hands consist of sensor nodes linked to the patient for tracking.

Cloud computing is a game-changing method for capturing, retrieving, studying, and storing confidential data was creating a mobile health tracking system [4], that is 20 times faster and uses ten times less resources than a conventional one. These are some of the projects in this area, but the key issue is the routing protocols used in the body region's network.

We will find the best route to the destination, i.e., the shortest path, according to the routing protocol. “ATDP” with the bracelet is a unique network designed to control the disease in the human body like blood pressure, temperature and ECG. Signs can be tracked by using various sensors mounted on the fabric or even under the skin.

Because of this technology, the patient is tested all the time and he can get a report from the hospital anytime he wishes, if there is a problem that continues, then doctors can even remind the patient

for his checkup in time. It will therefore give us greater flexibility in the direction of health monitoring activities, and it is sufficiently efficient to track vigorously and at the same time provide an error-free environment. The key use of “ATDP”. [5]

Below is the architecture of the application that needs to be integrated for the patients of dementia. One End Hospital or Advisor or HDC- “Hosted Data Center” carrying information of patients for assisting him.

1.1 ATDP-Ends

Blue Tooth wearable devices were being developed in the health sciences to help patients. At “ATDP” in the research we are going to evaluate web responsive applications already developed to capture in web with mobile devices. These were found to be at the patient’s side where ATDP” has been used. [5]

1.2 Operation Center or Assistive End

As it is clear by heading that this is the point from where patients have been helped out that could via help line of hospital or could be operation center helping dementia patients to remember things as well as paths. Because there are some tools has been integrated in the application to improve the patients of dementia which would be controlled by the hospital operation center connected with the application [6].

1.3 Navigators

It is made up of sensor nodes like digital clock that are mounted all over the human body. Such nodes have identified data obtained from sensors in the form of signals and then sent it to the base station. As a consequence, this look is a little more complex. Low battery sensor nodes and modules are attached to access points to prevent energy problems.

1.4 Connectivity

Interconnecting hospital or HDC other networks are the main purposes of this classified cognitively. Therefore, data was forwarded to the sink by the base station. Data can be transferred from sensor to network via this gateway.

1.4 Information Layer

The main purpose of the information layer is to keep patient data secure by transmitting it over the internet to another venue. It's a one-of-a-kind Programmed.

1.5 Protocols for "ATDP"

Few Strategies and protocols that are most widely used in helping patients for making it efficient in use. WBAN, Wearables and Web-Responsive Strategies that are most widely used in assisting dementia Patients worldwide [7]. This has been carrying some kind of monitoring to detect cognition in in elders.

1.6 Problem Statement

In the "ATDP" handling is one of the most important factors. Routing protocols, algorithms and other features used in the application for both user end and assistive end are a major issue in the wireless body area network. We are going to identify the main issue that has not been addressed still. There are a lot of WBAN and Wireless Bracelet services used for such purposes.

But they have not collaborated yet in a single app. Research is going to evaluate existing infrastructure and going to suggest Hybrid Approach for that. This is for measurement of daily mild dementia patients.

1.7 Research Uniqueness

There were a lot of technologies used for helping dementia patients but a need for hybrid technology is required for them that contains all these at once for helping on-ground reality with live essence of technologies.

1-Wireless Body Area Network with Hosted Data Centers

2-Medical Bracelets or Blue Tooth Devices integrated for patients.

3-ATDP-Connecting above technologies via Web-Based Multi responsive Platform.

4-Assessment in collaboration of Delphi and ISO-based Techniques then validation

1.8 Algorithm:

Take Reading from Patient and process signals at the wrist of the patient according to the condition of the patient in using the case of heart pulse rate signals will be generated. This signal will be of two types according to medical standards Systolic (Low B.P) and Diastolic (High. B.P). This signal will be generated by the Hospital Data Center. HDC will generate a signal to the doctor after

reading this he will advise how this case should be treated and the signal will be sent to Hospital. Fixed Devices in the healthcare center will further send this signal to the patient if the doctor's advice of treatment is according to the medical standards encoded in the AP (Access Point) in the Hospital.

1.9 UCD: (User Center Design)

Below is the algorithm which is based on user centered design on which basis we are going to develop our UCD application using below algorithm in Instrumental Activities of Daily Living in Dementia Patients [8]. There will be another SPSS analysis where we are going to use this application run in the real time scenarios and then feedback of the people using this application will be mined in SPSS to generate some results.

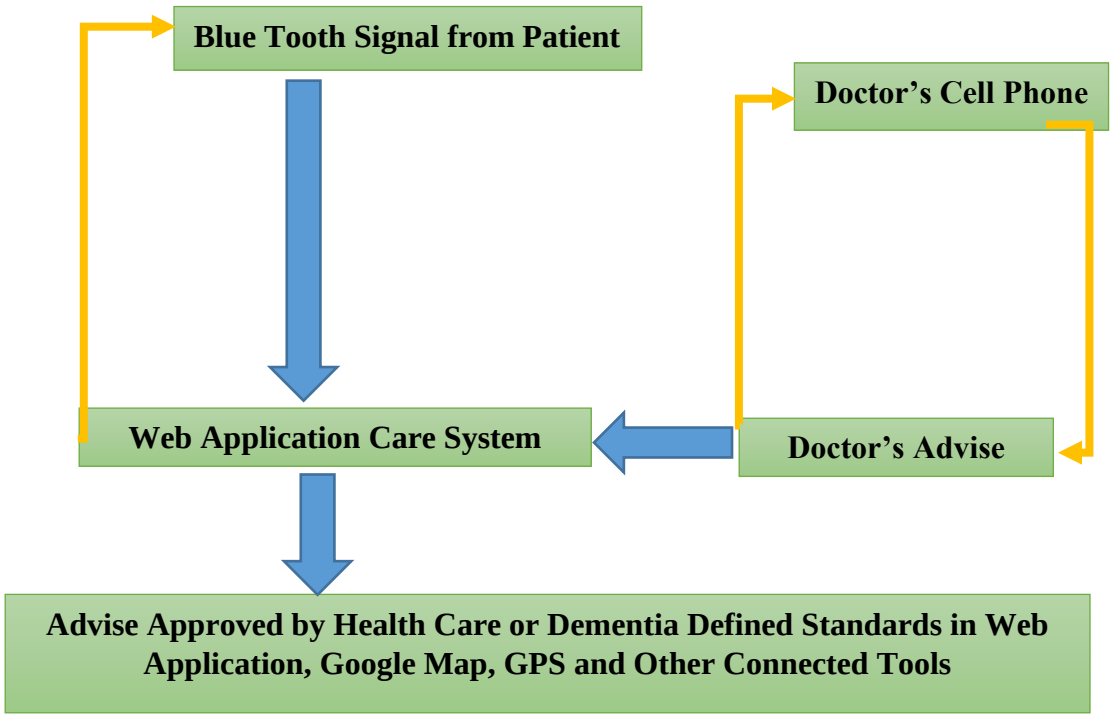


Fig.1: User Centred Design for ATDP

As per above algorithm when dementia patient has been feeling anxiety or forgotten about their path to home or having a headache or any impulse related to their disease there will be an automatic signal generated from the blue tooth of the patient to the web application. But if it is a non-medical issue then dementia patient will himself generate a signal [9]. Which has been later on go the medical association defined data centre for approval as well as finding a relevant doctor or medical advice. If issue needs doctor, he will address the issue sent to data centre or directly to the patient. If the issue is non-medical like patient forgotten path, then Bluetooth device detector will indicate wrong direction via Bluetooth device.

1.10 Objectives

The main intents of this work are as follows:

- ✓ To discover various usability models used for ATDP.
- ✓ To provide a hybrid ideal model for determination of rating for various applications based on different Models used for dementia patients.
- ✓ To develop an ideal usability model structural applications (according to different models) through regression analysis.

1.11 Research Significance

This Research will identify all the problems faced by dementia patients and the health sciences which are still unsolved or difficult to solve. This research will be significant to provide a solution to the existing issues not only this we shall propose another model after comparing with the existing model. It will be beneficial to identify that if the existing model is ideal or there should be a new model which could operate better. This research will open new horizon toward medical sciences because it will provide the best ideal model compared with existing models.

1.12 Scaling "ATDP"

The quantitative process evaluated the data obtained for ATDP. Second, four hundred data were moved from questionnaires to the tool used for evaluating suggested or existing technologies. Also, some Statistical tools to check data utilized for developing an application. It was imported in daily computer software programmer. The conventional procedure of defining the numbers like % and frequency (f) has been used to interpret the data to get a result. In chapter four measurable data will be analyzed then evaluations-based interpretation will be submitted.

1.13 Suggesting Multi-Platform Hybrid Application (Distance>20m)-Adding New Feature

Multiplatform Hybrid System could be added as a suggestion depends on the limitation where application has been subjected to use. Features could be used or not as discussed depend on our jurisdiction that the connection should lost after more than 20m. The Bracelet which has been registered against the MAC address (It's like Hardware address) has been transmitted to GSM-BTS tower (Base transmission Tower). Every area contains 3 BSCs (data handing over towers) at 6 Km each and after 20Km BSC transfer data to MSC (Main Switching Center of Hospital). 4G Based GSM switching help people to get connected with HDC Wi-Fi [10].

1.14 Login Process

It has been suggested or proposed to develop a secure login process depends in development of our application. When the doctor or the health care institute start registration process a code received at mobile during registering Gmail. In which cell phone's MAC address will be registered against the Bluetooth and adding a new patient in Hospital same process in logout.

1.15 Model Prediction

The methodology and procedures used for the analysis of the predictors rated according to the usability of RPs will be described in this chapter. Projections are based on the Hybrid model, with a ranking distinction made with the Hybrid model. For the valuation and authentication of the ultimate framework of applications, we are using KMO and Bartlett, Regression, Reliability as well as Eigen Values for evaluation of our results techniques. These techniques can be used in Health Care [11].

1.16 Model Assessment

Model assessment has been made with the help of MLR (Multiple Linear Regression. The Values of Cronbach Alpha>0.5 has been showing that data is reliable. Now model summary has been generated where value of R-Square is going to predict about good fitness of the model [12].

1.17 Validation Process

A non-exhaustive model validation technique is values of data sphericity validation. This approach makes use of the independent data-set output of the projected model. Where, depending on data

size, that has been split into an equal number of folds. Then calibration and validation provide an incentive fork-cross-verification to verify records points. [12]

1.18 Limitations

Our research has some limitations and the results are valid according to these limitations only. There are some limitations that we implemented in our research as well. The most important factor that is from the demographic point of view is that all the respondents are patients using “ATDP” technology. Research is taken in the form of medical concerns like Doctors and Patients using or implementing “ATDP”. This means that the results may differ for other medical institute or hospitals as well as patients in the purviews.

2.Literature Review

In the Literature Review researcher is going to evaluate the previous researches regarding this topic. It is to highlight the biased and unbiased researches following the selected research lines. Few of the researches have been given in the direction that to which extent technology is helping people encountered dementia.

In 60-70 percent of cases, Alzheimer's disease (AD) progresses to dementia [13]. This affliction refers to a number of symptoms that can include the absence of thought about memory and inconvenience, losing words and stammering, or delaying discourse while speaking. It is a reformist neurological disorder which begins gradually over the long term and declines by and wide. Manifestations of this problem indicate that late occasions are difficult to check (momentary cognitive decline). It is a radical problem that affects the brain. This means that, over the long term, more parts of the mind are damaged. As of now, about 6 percent of people who are 65 years of age and more experienced are affected and, sadly, no final patch has been issued to date.

[14] explored the invention of radio recurrence distinguishing evidence (RFID) to the creation of a working well-being monitoring tool in the home and outside areas. The gadget would naturally remind guardians at some stage an older person reaches a dangerous spot or wanders excessively far for dementia patients. Clinical analysis showed that the indoor patient makes some reaction memories of 0.5 s when detecting 40 labels, while the open air one makes some memories of about 5 seconds when detected, while the external person who peruses makes some memories of around five seconds because of the need to conserve electricity.

Furthermore, we found that patients with strong portability who were touchy were less friendly and removed their own labels once in a while. Guardians should offer complex care and play it safe in order to defend the form of patient.

[15] declared the portable tele clinical screen (AMON) of cutting-edge treatment and caution, a wearable clinical observation and a ready-to-use system for high-risk cardiovascular/respiratory patients are seen. For the gadget, ceaseless assortment and assessment of various vital signs, canny multipara meter health related crisis conclusion and a phone connection to a clinical emphasis are recalled. Without interfering with the patients' daily lives and without reducing their mobility, ceaseless long-haul checking could be handled by joining the entire gadget into an unpretentious, wrist-worn nook and using powerful low-power plan techniques.

During the initial more than two years of this EU IST funded project, the AMON consortium developed, introduced and tried the referenced wrist-worn framework, a correspondence link and a full clinical focus programming package. The efficacy of the procedure was accepted by a clinical review involving a group of 33 subjects. The paper plots the essential standards behind the AMON structure and offers representations of the individual subsystems and structures as well as the outcomes of clinical approval.

[16] Describes an android platform that increases care efficiency for patients with dementia. This programed, iWander, runs with GPS and communication capabilities on many Android-based devices. It allows caregivers to remotely track their patients. Using Bayesian network techniques that estimate the likelihood of wandering activity, the information uncollected from the system is assessed. Upon assessment, multiple action courses can be taken on the basis of the severity, complex settings and likelihood of the situation. These activities include supplying the patient with audio prompts, providing instructions to access them at home, and sending alerts containing the patient's position to the caregiver [17].

Radio recurrence distinguishing proof (RFID, (13) and PDA invention have been used in this study to establish a dual indoor protection and open-air portable consideration system designed to prevent dementia patients from approaching dangerous patients, despite the creation of a dementia screening framework that can be used by professional associations or linked to dementia survey and re-examination

[18] stated that an accurate clinical organization of dementia in more seasoned subjects has not recently been achieved, regardless of the use of such methods as psychometric testing, action placement, and various varieties of simpler psychometric assessments. The Clinical Dementia Rating, a worldwide rating device, was created for an imminent investigation of mellow decrepit dementia type Alzheimer's. This leads to unwavering continuity, validity, and correlational evidence. The CDR was found to distinguish unambiguously among more experienced subjects with a wide range of psychological capabilities, from healthy to truly handicap.

According to [19], an area-based tracker frameworks can keep dementia patients safe, but for energizing or washing, standard GPS trackers or gadgets reliant on cell phones should be removed. For one year, it is conceivable to use a waterproof Bluetooth Low Energy (BLE) tag with a CR2302 battery, so it can be worn quite well. By integrating BLE innovation, mobile phones and cloud

administrations provided by Google, we can build a fair area and global positioning system at negligible cost.

To find patients with dementia using ease of portable identification, we are setting up a high-level, easy to-use, orderly quick admonition system. Using installed wristbands close to managing communication marks, individuals who discover individuals wearing the wristband will send their GPS place to choose the best solution using the highlights of the proposed system. Such highlights are remembered for reminding comparable assistance location staff, neighborhood police stations, and families.

The progressive approach for distinguishing missing dementia patients will be enormously improved by this. A proposed pilot is currently being presented in two urban areas in Taiwan and will be reached in order to remember the 2015 public assistance.

[20] stated the RFID and Global Positioning Services for the elderly with dementia. Four principal results were disclosed in the report. First, the views of caregivers ranged from feeling compelled to use the tracking system for the sake of patient safety by promoting the use of the device for the sake of the peace of mind and minimal help of the caregivers, to objecting to the use of the device and respecting the autonomy of an individual. Second, for their own peace of mind and for the protection of the elderly in their care, family caregivers demonstrated greater enthusiasm for the use of GPS and RFID. Professionals have added greater importance to preserving the autonomy of an individual and minimal support for using GPS and RFID. Third, both family and competent care-givers decided that an intra-family concern should be the decision to monitor dementia patients. Fourth, family caregivers attach more importance to the functionality and nature of the tracking device, thereby stressing that they need to regard the tracking device as 'user-friendly'. The consequences for social work of the findings are also explored.

According to [21], the Geographic Information System (GIS) is designed to help people suffering from dementia without interfering with their everyday activities. Likewise, the aim is to locate the missing patient with the help of data creativity. In order to consolidate these observation systems, our system includes four control frameworks, including indoor home checking, open air movement territorial checking, disaster salvage, and distant observing modes, and an aid entry. It consists of a site administration worker, a data base worker, a message director worker, and a GIS welfare worker (H-GIS). More experienced individuals use tablets, PDAs, laptop PCs and other mobile phones via the help entryway [22].

In this paper, we present a wearable assistant with symptoms of gait freezing (FOG) for Parkinson's disease (which closely resembles patients with dementia). To calculate the movements of the patients, this wearable device utilizes on-body acceleration sensors. By observing frequency components inherent to these motions, it automatically detects FOG. The assistant gives a rhythmic auditory signal when FOG is observed, which stimulates the patient to start walking. The device was checked by ten PD patients when doing several walking activities in the laboratory. More than 8 hours of information was collected.

During the test, eight patients encountered FOG, and in a post hoc video investigation, 237 FOG occasions were recognized by proficient physiotherapists. When they encountered FOG, our wearable partner had the option of giving PD patients online assistive feedback. With an affectability of 73.1 percent and a precision of 81.6 percent, the system defined FOG occasions online. Most patients showed that they respected the environment of mindful programmed signaling. Finally, regarding the strolling style, the sensor situation, and the prevailing calculation limits, we define the framework execution [23].

The new method of monitoring and locating client-based cell phones was implemented in this report. The phone removes the limitations of the built-in GPS phone. It has been confirmed that in buildings and places unreachable by satellite signal, GPS use is limited. For the sake of searching the method of combining Wi-Fi signal, cell positions, and more detailed results vector measurement for monitoring and locating the location of cell phones.

In accordance with numerous chronic conditions, caregivers i.e., family members and friends play a crucial role in the continuing treatment and well-being of community-living older people with Alzheimer's disease and associated dementia [24]. However, to the detriment of their own physical, mental, and emotional health, they also do so. In their caregiving positions and duties, caregivers also face several challenges [25]. Latest research shows that web-based approaches have the ability to help caregivers by reducing the stress and responsibility of caregivers. We know nothing, however, about how Web-based aids support caregivers.

In accordance with numerous chronic conditions, caregivers (For example, family and companions) play a crucial role in the care and prosperity of more developed individuals with Alzheimer's disease and associated dementia residing in the local region [26]. In any event, they also do so to impair their own physical, emotional, and passionate well-being. Guardians also face a few challenges in their offering care roles and responsibilities. Most recent research indicates

that by decreasing the burden and responsibility of parental figures, online methodologies can assist guardians. In any case, we know little about how parental figures are maintained by Web-based guides [27]. The critical objectives of this research are to develop and test Maintenance Cognitive Stimulation Therapy for Alzheimer's patients [27]. A subsequent scheme under the Care Supporter Program for the treatment of these patients was then proposed and the achievement of this program was distinguished from the usual consideration provided to patients. Finally, a home care bundle was made for Alzheimer's patients, and the preliminary bundle was essentially reviewed. The results have shown that MCST can increase individuals' personal satisfaction and reduce the cost of actually concentrating on weakened individuals.

Furthermore, CST execution investigations reveal that several employees receive CST training over a one-day preparation period. This instructional class sets the limit for clinical personnel to truly concentrate on patients with Alzheimer's. In addition, the care managers for Alzheimer's patients have proven that it decreases long-term care for these patients and reduces their behavioral problems, making it possible to use a home consumer manual to support these patients' parental figures at home and even forestall hospitalization for patients with dementia [28].

A mobile-based framework for Alzheimer's patients was proposed by Ashfaq and colleagues. The mobile app was used to guide patients with Alzheimer's and to support them with their everyday activities [29]. In supporting Alzheimer's patients, IoT technology may play a significant role. A special Android application was created by this researcher to support relatives and guide patients with Alzheimer's. To develop the brain functions of the patient and show progress reports, the software has different games and competitions [30]. It also offers advice about where to put various things for Alzheimer's patients and daily reminders of food and medication. It also uses GPS location capabilities to provide patients with Alzheimer's placement treatment [31].

A framework using the machine-to-machine (M2M)/IoT platform was developed by Haruka and colleagues to assist Alzheimer's patients who live alone. The researchers mounted sensors in the homes of patients for this purpose that can identify early signs of behavioral change and mental illness and dementia. These sensors are also used to analyze the actions of patients with Alzheimer's disease. A questionnaire among these patients was also created and distributed. As data for their characteristics, the findings of these questionnaires were used. Then the presence or absence of dementia can be assessed by evaluating this data and comparing it with the data obtained by the sensors. [32]

For family caregivers of dementia patients, study-based psycho-educational intervention [33]. An additional target was to decide whether a community-based social service provider could incorporate the intervention. Methods Forty-six caregivers were allocated randomly to either a technology-based intervention or a condition of control only for details. Results showed a significant decrease in post-intervention burden and a significant decrease in depression was experienced by those who exhibited high depression at baseline. Conclusion This research offers evidence that technology provides caregivers with a cost-effective and realistic way to deliver treatments [34].

Innovation has many possible applications for dementia, from conclusion and diagnosis to the board's mind and incremental maturing. Objectives: To summarize the primary dementia regions' success in innovation, and to describe the predicted bearings and outcomes. Technique: Members of the US Alzheimer's Association of Technology's Specialist Interest Area are interested in conveying existing data on current and planned developments in dementia innovation to the annual pre-meeting plot. Results: The main areas of innovation progression are as follows: study, evaluation and monitoring, (ii) useful maintenance, (iii) diversion and exercise, (iv) counseling and the board of directors [35].

Conclusions: The speed of innovation progression requests prompt change in arrangement, financing and practice, away from a restricted clinical methodology, to a foundational model that advances future answers for hazard decrease and avoidance, takes into account prior finding and supports execution on a scale for an important and fulfilling dementia [36]. Dementia is the most prevalent form of neurodegenerative disease and is associated with immense social and personal costs [37]. The prevalence of this disease is relied on to increase dramatically uniformly by 2050, triggering a rapid need to make changes to the viability of the two studied by its therapy and care. Computerized developments are an increasingly propelling area that provides a previously distant opportunity for clinicians and scientists working in this field to alleviate the problems they face. The aim of this clinical survey was to sum up the information currently available on new innovation that can be used to follow insight.

Amy recognized numerous unavoidable advanced frameworks, such as mobile phones, smartwatches and genius houses, to evaluate and support old mad, prodromal and preclinical populations. For the most part, the examinations registered a solid degree of agreement between the computerized measures and the prototypes to be tested by them. Be that as it may, most gadgets are still in the early stages of use with insignificant evidence of patient acceptability. The use of advanced advances to track and support dementia-influenced intellectual areas is a promising field

of development, and further exploration is required to validate the adequacy, utility and cost-viability of these frameworks in patient populations [38].

As the risk of being cognitively disabled increases with age, the number of elderly people in Japan is increasing, which raises the problem of dementia. Caregivers who are well-trained, knowledgeable and can pay particular attention to the needs of individuals with dementia are increasingly needed [39]. In assisting such individuals and their caregivers, technology may play an important role. Another problem is a lack of shared awareness between caregivers and researchers about the suitable applications of assistive technologies [40].

The vision of individual-centered treatment focused on the use of information and communication technologies to preserve the autonomy and continuity of residents in their lives is provided by Taro. A roadmap and a list of obstacles to the realization of assistive technology have been developed based on this vision.

Literature Review

Author	Year	Paper Title	Literature Comparison
Shaikh, A. A., Gupta, N. S., Khan, A. D., & Artist, H. T.	2017	Android and internet of things (IoT) based Alzheimer care/rehabilitation system to monitor and progress patient health condition	Android Monitoring System
Association, A.	2015	What-is-Dementia//Defining Routes in App.	GPS System
Buechley, Eisenberg, Catchen, & Crockett	2018	Computing Systems for helping people brain for memory constraints	Computing System for Memory
Lin, C. C., Lin, P. Y., Lu, P. K., Hsieh, G. Y., Lee, W. L., & Lee, R. G.	2018	A Healthcare Integration System for Disease Assessment and Safety Monitoring of Dementia Patients	Safety Monitoring
Lin, C. C., Chiu, M. J., Hsiao, C. C., Lee, R. G., & Tsai, Y. S.	2016	Wireless health care service system for elderly with dementia	Wireless Services

Shende, Madrewar, & Dugade	2019	Dementia patient activity monitoring and fall detection using IoT for elderly	Patient Activity Monitoring
F. Sposaro, J. D	2015	An Android application for dementia patients keeping path tracing	Android Application Paths
Ishii, H., Kimino, K., Aljehani, M., Ohe, N., & Inoue, M	2016	An early detection system for dementia using the M2 M/IoT platform	Early Detection System
Hughes, C., Berg, L., Danziger, W., Coben, L., & Martin, R.	2020	A New Clinical Scale for the Staging of Dementia	Staging of Dementia
J. C. Huang, Y. L	2015	A Wearable NFC Wristband to Locate Dementia Patients through a Participatory Sensing System	Sensing System
Jijesh J.J., S	2017	Integration of WBAN to ATDP using technologies	WBAN to ATDP
Ratsameethammawong, P., & Kasemsan, K.	2016	Mobile Phone Location Tracking by the Combination of GPS Wi-Fi and Cell Location Technology	Mobile Phone Location Tracking
Bachlin, M., Plotnik, M., Roggen, D., Maidan, I., Hausdorff, J. M., Giladi, N., & Troster, G.	2018	Wearable Assistant for Parkinson's Disease Patients With the Freezing of Gait Symptom.	Wristwatch Assistant
Oskouei, MousaviLou, Bakhtiari, & Jalbani	2020	IoT-Based Healthcare Support System for Alzheimer's Patients	IoT-Based Healthcare Support System
Ploeg, J., McAiney, C., Duggleby, W., Chambers, T., Lam, A., Peacock, S., & Williams, A.	2018	A Web-Based Intervention to Help Caregivers of Older Adults With Dementia and Multiple Chronic Conditions:	Web-Based Intervention

Landau, R., Werner, S., Auslander, G. K., Shoval, N., & Heinik, J.	2019	Attitudes of Family and Professional Care-Givers towards the Use of GPS for Tracking Patients with Dementia	GPS for Tracking Patients with Dementia
Ryg, K.	2016	Quality of Life for Patients with Dementia: A Systematic Review	Quality of Life for Patients with Dementia
U. Anliker, J. A.	2017	A wearable multipara meter medical monitoring and alert system	Monitoring and Alert System
Lin, Y.-J., Chen, H.-S., & Su, M.-J.	2015	A cloud-based Bluetooth Low Energy tracking system for dementia patients	Cloud Based Bluetooth

Table. 1: Literature Review

Brief Comparison:

International patient health condition and Association of Dementia Patients defined some routes in the application in **2015**. In the same year paths has been updated by F. Sposaro, J. D or them to remember their paths up to their homes. Participatory Sensing has been added in wrist watch J. C. Huang, Y. L for helping them in sensing obstacle and Yaw-Jen Lin, H.-S. C.-J A improved this wrist watch which was blue tooth based with low energy tracking system with cloud based. Now in the Year **2016** Ryg, K. make a critique review on the quality of life of the patients with dementia then Mobile Phone Location Tracking by the Combination of GPS Wi-Fi and Cell Location was added by Dr., Kasemsan, P. R.

Now another author C.-C. Lin, M.-J. C.-C.-G.-S in same year made a revolutionary integration in the in the health care service system for elderly patients of dementia with wireless routing integration with their watches. H. Ishii, K. K were also working on an algorithm to make an android application that was going to detect obstacles very early for dementia patients and it was done by using multiple IoT platforms.

In the early **2017** U. Anliker, J. A. used to make an addition in a blue tooth device for medical monitoring as well as alert system for the dementia patients to predict any emergency happened with them. After mid of this year A. S. Ashfaq, S. G integrated an Android Application with all the devices used to connect with dementia patients he made this system in Health Care/Rehabilitation Center

System to observer and improvement in the health of patient's condition. Then Dr. Jijesh J.J., S made an addition of Wireless Body Area Network in the entire Health Care System.

Buechley L., E. M in 2018 developed a brain computing system which has been used for assisting people suffering from memory restraints. Later on, C. Lin, P. L. combined this with Hospitals adding some valuation and safety watching of dementia. M. Bachlin et, a. added blue tooth devices-based assistance for bitter symptom in them for identification. Dr, Ploeg, J. in the same year worked on multi responsive Web-Based application which has been used to help care takers of old people who were suffering from Dementia and Numerous Chronic Disorders like this.

D. K. Shende, M. S. in **2019** developed the patient movement observational fall detection method that was utilized with different IoT for old people especially. Now arrogances of family as well as the professional taking care of them use will be able to use GPS Tracking of the patients by R. Landau, S. W. In the year **2020** MousaviLou, Z and Oskouei, R. J. made IoT-Based Health Care System that could support the patients and Hughes, C. B developed an advanced clinical scale which has been used for the staging of dementia in the patients.

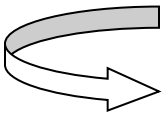
3.RESEARCH METHODOLOGY

With the aid of SPSS, we are using several statistical techniques to quantitatively evaluate our data in analysis. To check the data's validity, we use correlation, regressions, MLRs of various kinds and their mediations, if necessary, and reliability tests.

3.1 Methodology of Research

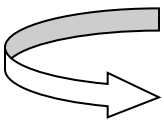
The identified systems of some theoretical analysis of the methods applied at some professional level, followed by the application of some statistics principles to study the most commonly held opinion in the field of ground reality research. It involves a theoretical evaluation of a set of principles established by a set of authorities.

And after these Statistics we are applying below Methodology:



Analysis of Questionnaire answered by Respondents

Deduct Findings by some statistical rules from % Opinions.



Make Conclusion after Findings of average Statements.

Decide Some Recommendations based on Findings and Conclusions.

Research Methodology is combinations of laws, policies and restrictions.

3.2 Research Design

In this analysis, I used a quantitative research design in which I interviewed each respondent individually and reported their responses in the qualitative data. A correlation survey research design is characterized as a sample of the population taken at a single point in time, followed by a correlation survey of that population.

3.3 SPSS Frame Work:

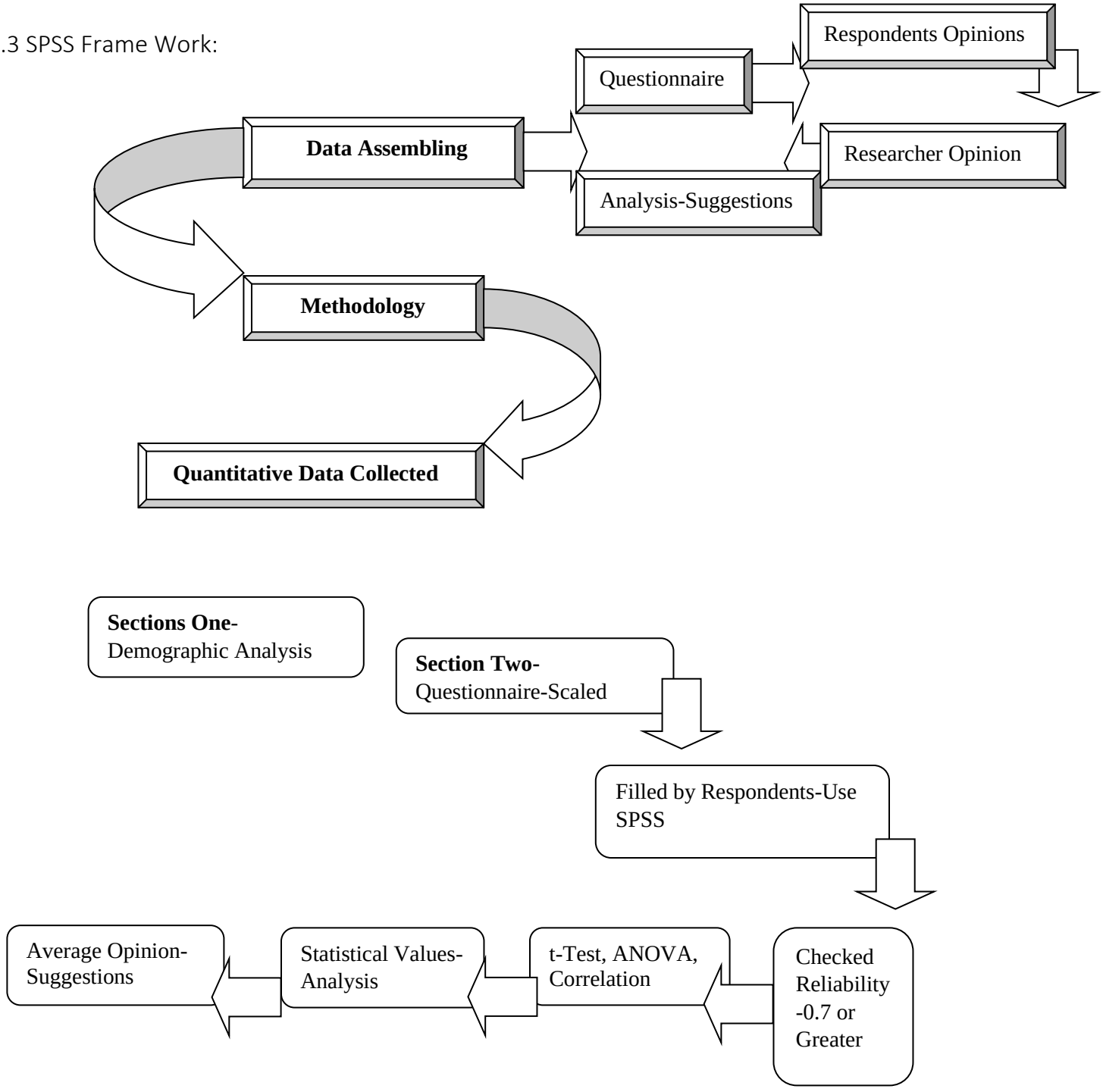


Fig.2: SPSS Framework

Research Philosophy

3.4 Research Approach

When it comes to doing studies, there are two methods (i.e., qualitative and quantitative) [41]. Quantitative analysis involves the use of a survey to collect data [42]. The data analysis and collection for this study were performed using a quantitative methodology. Questionnaires are used to collect data, and closed-ended questions are used to collect data. In a survey with a sample of people working in the medical profession, the questionnaires were filled out by dementia patients.

3.5 Population

Dementia patients made up the majority of the population. The data was gathered from various hospitals where dementia patients were treated for change by the use of technology.

3.6 Size of the Sample

Questionnaires were provided to 300 respondents, with the completed responses being registered and the incomplete recordings being discarded. A survey of respondents was taken, and the responses collected came from patients, physicians treating them, and IT specialists who were found to be interested in improving the stability of dementia patients using technology.

3.7 Form of Data Collection

The adapted questionnaire, which consists of questions with five-point Likert scales and was distributed to our samples of individuals, was used to collect quantitative data [43]. The respondent will not be influenced by the researcher's personal views while answering questions. The opinion poll was administered to two groups of people: dementia patients and those who support them, and the findings were later checked using SPSS software.

3.8 A collection of instruments

To perform experiments, various researchers and academic papers have used closed-ended questionnaire [44]. All of these measurements and objects were calculated using a self-designed questionnaire. Different statistical methods were used in this analysis. Different studies have adapted questionnaires. Questionnaire data was gathered.

3.9 Descriptive Statistics

Descriptive statistics is a statistical technique for numerically defining the characteristics of a collection of data [45]. To put it another way, it's a rundown of the information collected. It's widely used for descriptive data processing and graphical statistics.

Effect on Mental Well-Being

3.10 Profile of the Population

Typical demographics used in the survey include race, society, gender, age, education, occupation, profession, income level, and marital status.

Cronbach's alpha is a test of how well anything performs.

Cronbach's Alpha is a coefficient that is used to calculate the underlying's inner reliability and consistency. It is a rationing coefficient used to ration the internal consistency of the given data [46], greater than > 0.6 and 0.7 is acceptable, > 0.7 and 0.9 means reliability is fine, and > 0.9 is exceptional. Cronbach's Alpha test is used to assess reliability. The values of all DVs were found to be greater than 0.9, suggesting that our SPSS reliability test yielded the best performance.

3.11 Relationships

Correlation is a method of research that explores how variables are related to one another. The variables are interconnected, and the meaning of their interaction is used to determine if they have a positive or negative relationship. To determine the power, all of the variables are connected in a table of correspondence. The importance of relationships is determined by comparing variables. There are two ways to verify if our variables have a positive or negative effect on each other while running the correlation study. That they are making an effect on each other and how they are affecting each other. We have a spectrum of correlation between 0 and 1. If you get the meaning =1, it means they are 100 percent accurate. They are connected to each other, and if we get a value of -1, we realize they are diametrically opposed. And something between 1 and 0 suggests that they are somewhat related.

3.12 Regression is a phrase used to describe a

Dementia patients will be used as a dependent variable in comparison to the resources we have, and resource curses will be used as an independent variable in conjunction with prices and crises.

In certain places, as IV, as a mediator. Regression was used to see if there was any mediation between the variables. Now it's your turn.

Regression is a statistical quantity used in this thesis, investing, and other disciplines to evaluate the strength of the relationship between one dependent two variable (usually denoted by Y) and a set of other changing variables (known as independent variables or predictors). We use the correlation in most of the examples since there are two variables involved in the regression of our thesis. We use two values and their relationship to each other in correlation. First, we'll look at the R-Square values, which will indicate whether the model is right and whether it can be used for regression. However, in our study, we used a different regression model with one predictor and two dependent variables.

3.13 Validation and Assessment of the Research Model

In this chapter, we'll go over the methodology and procedures that the researcher will use to evaluate the predictors based on their usability. The regression model is used to make predictions, which are then compared to the hybrid model for ranking.

The information contained in the dataset Consisting of instances (of various usability factors) that were created for the purpose of model prediction. The key reason for using the Stepwise multi-linear regression technique is to substantially reduce the gap between predictor responses.

This method builds the model by integrating single and multiple independent variables with the dependent variable in various ways, such as holding two factors as IV, three factors as IV, four factors as IV, and so on until all eight factors are included. The R2 value is determined using all possible combinations of predictors that are statistically important at a value of 0.000. The presence of multi-co-linearity between predictors was also investigated using the Variance Inflation Factor (VIF). MLR results with various combinations of predictors are given in the following sub-sections.

To achieve the extraordinary accuracy of the predicted model, de facto standard metrics of prediction accuracy are used. For accuracy checks, by the value of R-Square most widely used. The literature usually uses values should be greater than 0.5 for the good fitness of selected model. Meanwhile, to monitor the validity of the suggested model for prediction accuracy, KMO and Bartlett has been applied where values will point out about the data normality for further tests to be conducted or not must be greater than or equal to 0.5, and Beta must be equal to R-Square not adjusted, where Y is the real value (user rating) and Y is the expected value (model value).

3.14 Validation Process

Above validation is a method for model validation that isn't exhaustive. This method makes use of the projected model's output on a separate data set. Depending on the data size, the data set is split into an equal number of folds. Via KMO based data legitimacy, data calibration and validation will double-check the data points. In each encounter, the training data set consists of responses recorded in the SPSS from n=1 to n=n responses. Since our dataset contains all responses, it was divided into folds of responses with each fold containing a different number of responses.

3.15 Questionnaire

Name

Gender

1-Male 2-Female

1. Would this application will be useful for my work?

1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree

2-Do you think such an application would help me to become more effective?

1-Yes 2-No

3-Would this application help you to be more efficient? *

1-Yes 2-No 3-May be

4-Would this app make me able to achieve everything I would expect it to do?

1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree

5-This application would allow me to complete my tasks easily.

1-Yes 2-No

6-This application would make me complete my tasks quickly.

1-Yes 2-No

7. Is this application would allow me to have better control over my tasks?

1-Yes 2-No 3-May be

8. How much you would be satisfied from this application?

1-Unsatisfied 2-Satisfied 3-Partially Satisfied 4-Strongly Satisfied

9. Do you think this application would allow me to provide safer care?

1-Yes 2-No

10.This application would answer my needs.

1-Yes 2-No

11. Do you think that the contents of this app help you to remind things more?

1-Yes 2-No 3-Other

Table. 2: Questionnaire

4.RESULTS AND ANALYSIS

A sample of responses will be taken with an age range of 50 years above. The sample will be collected from different hospitals for dementia patients. The sample will be collected from different areas of my jurisdiction. The sample will be collected from different hospitals

For the measurement of variables, I used some scales and theses are Application Rated This scale was created by [47]. There were six things on this scale. It was a simple, self-explanatory, and time-saving scale that differentiated perceived social support from three different sources: family, friends, and a significant other. The English version of this scale was used to evaluate dementia problems in the current report. Scale helped the patient's condition improve. This scale was a self-report inventory of four items.

The rating scale was graded in the same manner as the previous one. In this study, an implementation version of a scale was used to measure the condition of the patients to see how much they had improved as a result of the application. All these scales were developed to made an analysis if it is possible for the patients that they can improve their lives. The scale is made up of various components. The system is based on the Nominal Scale. Yes, or No are the answer options. Statistical Kit for the Social Sciences (SPSS) was used to construct a behavior scale (SPSS).

The study's sample was chosen using a method known as purposive sampling. Data was collected from various parts of Lahore. The sample of was collected from different hospitals. The contemporary research was carried out into two phases. Both descriptive statistics and inferential statistical technique was used to test the Questionnaire and fulfill the aims and objectives of the study.

To test the hypotheses, the collected data will be statistically analyzed by using SPSS (20). Pearson product moment correlation will be used to assess relationship among study variables. The data will be statistically analyzed by using Pearson Product Moment Correlation and the collected data will be statistically analysed by using independent sample t- test to judge the variables impact between males and females. And we have applied ANOVA to judge it demographically about the variables that to which extent is the impact of gender upon variables. But before running the analysis for hypotheses, reliabilities of scales were checked.

Reliability in research. Reliability, like strength, is a way of measuring the worth of the quantity procedure used to gather data in a thesis. In order for the consequences from a homework to be reflected valid, the dimension procedure must first be reliable. Cronbach's Alpha is a measure of how well anything works. Generally used to assess a Questionnaire's internal accuracy. Before you use the instrument in your analysis, it must have a reliability of 0.7 or higher in your pilot sample. Select all the Variables that are involved and apply reliability test

Results showed the value of Cronbach alpha is .790 for Application Quality, .809 for improvement in patient's health.

Reliability Statistics for Application Rated

Cronbach's Alpha	N of Items
.790	6

Reliability Statistics Improvement in Patient's Health

Cronbach's Alpha	N of Items
.809	4

Item-Total Statistics for Application Rated

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Would this application will be useful for my work?	11.65	9.245	.594	.745
Do you think such an application would help me to become more effective?	12.83	8.870	.779	.699
Would this application help you to be more efficient?	13.35	10.433	.426	.785
Would this app make me able to achieve everything I would expect it to do?	12.98	9.413	.734	.716
This application would allow me to complete my tasks easily.	12.63	8.402	.749	.701
This application would make me complete my tasks quickly.	12.83	13.014	.020	.855

Table.3: Reliability results of Application Rated

Item-Total Statistics for Improvement in Patient's Health

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Do you think that this application would allow me to have better control over my tasks?	8.43	5.648	.697	.741
How much you would be satisfied from this application?	8.42	5.227	.753	.709
Do you think this application would allow me to provide safer care?	8.43	5.360	.596	.774
This application would answer my needs.	6.78	4.580	.549	.827

Table.4: Reliability Results of Patient's Health

The reliability of all of the values is showing good results, indicating that the data is accurate. The table below shows the reliability that has the highest values. The reliability of all of the values is showing good results, indicating that the data is accurate. The table below shows the reliability that has the highest values.

Now we are going to explore relationship between Application Rated and Improvement in Health of Patients among Dementia Patients. Not only this we are also going to check from Model point of view and the Model Good fit as shown by R-Square.

Now to test these Questionnaire we are going to apply correlation. By correlation you can check individually and or collectively applying SPSS Pearson correlation. To check out that how they are engaged as an association with each other.

Table: 3.2

		App Rated	Improvement
App Rated	Pearson Correlation	1	.855**
	Sig. (2-tailed)		.000
	N	168	168
Improvement	Pearson Correlation	.855**	1
	Sig. (2-tailed)	.000	
	N	168	168

Table.5: Correlation of Application Rated & Improvement in Health

The result of the analysis is showing that Application Rated and Improvement in Health of Patients has positive correlation with each other and Application Rated has positive correlation with personality trait. And Improvement in Health of Patients has an also weak correlation with personality trait. It means that Application Rated will increase with increase in the Improvement in Health of Patients and will decrease but on the other hand Application Rated will increase with increase in the application in their life. Improvement in Health of Patients will increase in the application factors with increase in the personality trait. Application Rated and Improvement in Health of Patients which implying that if are going to increase sub-items of the applications if we want to improve Health of Patients which could be decreasing due to other ailments.

Table 3.3

Independent sample t-test was carried out to assess differences in Improvement in Health of Patients, personality trait and Application Rated among male and female. The finding of analysis is given below in the table).

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
App Rated	Equal variances assumed	.552	.459	.221	166	.825	.02070	.09351	-.16392	.20532
	Equal variances not assumed			.216	110.869	.829	.02070	.09585	-.16925	.21064
Improvement	Equal variances assumed	.046	.831	-.102	166	.919	-.01073	.10534	-.21871	.19725
	Equal variances not assumed			-.103	122.577	.918	-.01073	.10428	-.21714	.19568

Table.6: t-test for Independence check

Tables show the mean, standard deviation and t values for male and female against our variables Results. Above were independent sample t-test publicized for the significant gender differences with reference to scale of application rated Scale, Improvement in Health of Patients Scale for both males and females. All the behaviors were observed almost equivalent in both in males and females there is mean value of app rated in male is 2.99 and mean value in females is 2.97 which are equal very negligible difference is found in decimal values. Improvement in Health of Patients of dementia via app rated scale is a little more in the males.

Mean value of Improvement in Health of Patients in males is 3.19 and mean value in the females is 3.20 which is a decimal above than mean value of male respondents. Again, it is depicting that

both males and females are almost equal in both male and females in the environment generated or controlled by application there is just a little difference in their behavior in males than in females.

ANOVA to Check impact of Age on the Health Improvement and Application rated

			N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	Between-Component Variance
							Lower Bound	Upper Bound			
App Rated	50-55		63	3.0349	.48797	.06148	2.9120	3.1578	2.00	4.20	
	55-60		51	2.8549	.48675	.06816	2.7180	2.9918	1.00	3.80	
	60 Above		54	3.0537	.72286	.09837	2.8564	3.2510	1.60	4.40	
	Total		168	2.9863	.57689	.04451	2.8984	3.0742	1.00	4.40	
	Model	Fixed Effects			.57368	.04426	2.8989	3.0737			
		Random Effects				.06178	2.7205	3.2521			.00553
Improvement	50-55		63	3.2698	.54496	.06866	3.1326	3.4071	2.00	4.00	
	55-60		51	3.0392	.52767	.07389	2.8908	3.1876	1.00	4.00	
	60 Above		54	3.2593	.82839	.11273	3.0332	3.4854	2.00	5.00	
	Total		168	3.1964	.64982	.05013	3.0974	3.2954	1.00	5.00	
	Model	Fixed Effects			.64528	.04978	3.0981	3.2947			
		Random Effects				.07371	2.8793	3.5136			.00879

Table.7: ANOVA to Check impact of Age on the Health Improvement and Application rated

People above 60 has been showing more improvement in health as well as in application rated it means age factor does count on the people of more age as dementia increases at the high age.

Results of the analysis show that there is a significant effect of age on Distress and personality Behavior of dementia patients. Whereas Satisfaction level is also showing significance value means application used do have significance effect on Satisfaction it is because application is under study to check outcome by results. It is also observed that people are less satisfied when they are not using this application their values of were depicting low distress and personality dispersions by lost in memory. Before running regression KMO would be applied to check if data is valid for processing of regression analysis.

Kaiser-Meyer-Olkin (KMO) and Bartlett's Test

This test is trial of sphericity to check the networking among the variables. A significance value of less than.001 indicates that the relationship between the variables is strong enough to allow us to go on. KMO is a metric for determining whether the sample size chosen for the analysis is sufficient. The benchmark value is ">0.5" with significance value to be "0.000" (Bartlett, 1954). Indicates the suitability of employing factor analysis. It is general rule of thumb values ranges 0.00 to 0.49 unacceptable, 0.50 to 0.59 fair, 0.60 to 0.69 mediocre, 0.70 to 0.79 middling, 0.80 to 0.89 meritorious and 0.90 to 1.00 marvelous.

Constructs	No. of items	KMO adequacy	Bartlett's Test of Sphericity Chi-square	Sig.
"App Rated"	6	**.796**	**520.020**	**.000**
"Health Improvement"	4	**.692**	**343.850**	**.000**

Table.8: KMO& Bartlett's Test

There is total 2 constructs, with values of KMO= (0.796) for "Application", and for improvement in dementia patients was, KMO= (0.692). A p-value of less than 0.05 implies that the relationship between variables is important. The table shows that the p-value of Bartlett's test is less than 0.001 for all constructs, indicating that the null hypothesis of no correlation is false. As a result, factor analysis was used to continue the process.

Eigenvalues

The components of structures that are known to be principal components have an eigenvalue greater than 1 and are used for further analysis. Using the (PCA) scheme, the principal variable was extracted from four constructs. The term "total variance explained" refers to the different levels of variance that can be explained in the products themselves.

Constructs	Components	Total	Total eigenvalues	
			%Var Exp	Cumulative% Var Exp
"Application"	Comp 1	3.255	54.252%	54.252%
"Health"	Comp 1	2.675	66.868%	66.868%

Table.9: Total Variance explained by Eigenvalues

"App Rated" contains 6 items explaining 54% variance, "Health" contains 4 items explaining 66.868% variance.

Regression Analysis

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.855[a]	.732	.730	.33759	.732	452.745	1	166	.000
a. Predictors: (Constant), App Rated									

Table.10: Regression Analysis

The R-Square value is 0.855, and the adjusted R-Square is 0.730, all of which are statistically important. It implies that our model is well-fitting and producing good, if not optimal, results, and that we have chosen the appropriate set of variables. Further investigation revealed that our IVs account for 73 percent of our DV, which is satisfaction.

ANOVA[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	51.599	1	51.599	452.745	.000[a]
	Residual	18.919	166	.114		
	Total	70.518	167			

Table.11: Calculating F Value

a. Predictors: (Constant), App Rated

b. Dependent Variable: Improvement

This model has a F value of 452.745>10 and a P-value of. 000.05, indicating that it is meaningful at the level of 0.01. As a consequence, the model is a good match.

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.319	.138		2.316	.022
	App Rated	.964	.045	.855	21.278	.000

Table.12: Calculating B Value

a. Dependent Variable: Improvement

B value of "online shopping" is 0.855. This means that modifying only one unit in an application will increase the health of dementia patients by 86 percent. In terms of dementia and memory improvement, one's health has been assessed.

5.Discussion

In this chapter we are going to make a detailed discussion on our results that to which extent they have been correlating in biased or unbiased way to the statistical analysis carried out. Responses will be taken with an age range of 50 years above. The sample will be collected from different hospitals for dementia patients. The sample will be collected from different areas of my jurisdiction. The sample will be collected from different hospitals.

Then data has been instrumented in the SPSS to analyse the results and for the measurement of variables, I used some scales and theses are Application Rated This scale was created by John and Srivastava (1999). There were six things on this scale. It was a simple, self-explanatory, and time-saving scale that differentiated perceived social support from three different sources: family, friends, and a significant other. The English version of this scale was used to evaluate dementia problems in the current report. Scale helped the patient's condition improve. Lawrence is a city in Kansas. This scale was a self-report inventory of four items. The rating scale was graded in the same manner as the previous one. In this study, an implementation version of a scale was used to measure the condition of the patients to see how much they had improved as a result of the application.

All these scales were developed to made an analysis if it is possible for the patients that they can improve their lives. The scale is made up of various components. The system is based on the Nominal Scale. Yes, or No are the answer options. Statistical Kit for the Social Sciences (SPSS) was used to construct a behavior scale (SPSS). The study's sample was chosen using a method known as purposive sampling. Data was collected from various parts of Lahore. The sample of was collected from different hospitals. The contemporary research was carried out into two phases. Both descriptive statistics and inferential statistical technique was used to test the Questionnaire and fulfill the aims and objectives of the study.

But before running the analysis for hypotheses, reliabilities of scales were checked. That is the data mined in the SPSS has been properly instrumented or not. For this reliability in research has been carried out. Reliability, like strength, is a way of measuring the worth of the quantity procedure used to gather data in a thesis. In order for the consequences from a homework to be reflected valid, the dimension procedure must first be reliable. Cronbach's Alpha is a measure of how well anything works. Generally used to assess a Questionnaire's internal accuracy. Before you use the instrument in your analysis, it must have a reliability of 0.7 or higher in your pilot sample. Select all the Variables that are involved and apply reliability test. Reliability was found good against all the variables.

Then we process to the tests. To test the hypotheses, the collected data will be statistically analyzed by using SPSS (20). Pearson product moment correlation will be used to assess relationship among study variables. The data will be statistically analyzed by using Pearson Product Moment Correlation and the collected data will be statistically analysed by using independent sample t- test to judge the variables impact between males and females. And we have applied ANOVA to judge it demographically about the variables that to which extent is the impact of gender upon variables and all these tests were conducted to check if the patients have been actually comforted by the application devised.

Correlation when conducted the result of the analysis is showing that Application Rated and Improvement in Health of Patients has positive correlation with each other and Application Rated has positive correlation with personality trait. And Improvement in Health of Patients has an also weak correlation with personality trait. It means that Application Rated will increase with increase in the Improvement in Health of Patients and will decrease but on the other hand Application Rated will increase with increase in the application in their life.

Improvement in Health of Patients will increase in the application factors with increase in the personality trait. Application Rated and Improvement in Health of Patients which implying that if are going to increase sub-items of the applications if we want to improve Health of Patients which could be decreasing due to other ailments.

Below are some researches that has been conducted and supporting our results: There was a European 1st funded project in which an application has been developed and introduced and tried the referenced wrist-worn by patient's framework, a correspondence link and a full clinical focus programming package. This application showed improvement in the patients of dementia and is rated positive by them. The efficacy of the application was accepted by a clinical review involving a group of 33 subjects rated it positively. The paper plots a correlation whose results were almost the same as our results the essential standards behind the structure and offers representations of the application of the individual subsystems and structures as well as the outcomes of clinical approval.

Sposaro introduced an android platform that increases care efficiency for patients with dementia. This programed, iWander, runs with GPS and communication capabilities on many Android-based devices. The Research was carrying out some features that would be having strong correlation in the application developed and the patients of dementia's health. This was another assistive tool whose correlation positive like our results has been showing It allows caregivers to remotely track their patients. Using Bayesian network techniques that estimate the likelihood of wandering activity, the information

uncollected from the system is assessed. Upon assessment, multiple action courses can be taken on the basis of the severity, complex settings and likelihood of the situation. These activities include supplying the patient with audio prompts, providing instructions to access them at home, and sending alerts containing the patient's position to the caregiver.

Wilson made a bit change in the above mentioned sposaro's research and added some new norms in that. Author added a RFID and PDA invention have been used in this study to establish a dual indoor protection and open-air portable consideration system designed to prevent dementia patients. This is the third results that is supporting our results in terms of increase in the use of application will not only improve health even would be rated positively and recommended highly by the doctors. Correlation was positive from evaluating the dangerous patients, despite the creation of a dementia screening framework that can be used by professional associations or linked to dementia survey and re-examination

Hughes in 2020 run a regression for accurate clinical organization of dementia in more seasoned subjects has not recently been achieved, regardless of the use of such regression was conducted in terms of methods as psychometric testing. This research was a bit different from our because it is not dealing just in correlation only but also having some sub-items of dementia web application which has been re-enforcing the results a bit more, action placement, and various varieties of simpler psychometric assessments. The Clinical Dementia Rating, a worldwide rating device, was created for an imminent investigation of mellow decrepit dementia type Alzheimer's. This leads to unwavering continuity, validity, and correlational evidence. The CDR was found to distinguish unambiguously among more experienced subjects with a wide range of psychological capabilities, from healthy to truly handicapped [48].

Now we are going to make a discussion based on gender toward dementia patients. For this an independent sample t-test was carried out to assess differences in improvement in Health of Patients with respect to males and females. The developed Application Rated among male and female.

The finding of analysis is given Above were independent sample t-test publicized for the significant gender differences with reference to scale of application rated Scale, Improvement in Health of Patients Scale for both males and females. All the behaviors were observed almost equivalent in both in males and females there is mean value of app rated in male is 2.99 and mean value in females is 2.97 which are equal very negligible difference is found in decimal values. Improvement in Health of Patients of dementia via app rated scale is a little more in the males. Mean value of Improvement in Health of

Patients in males is 3.19 and mean value in the females is 3.20 which is a decimal above than mean value of male respondents. Again, it is depicting that both males and females are almost equal in both male and females in the environment generated or controlled by application there is just a little difference in their behavior in males than in females.

In 2015 a chines scientist conducted a t-test between male and female patients with dementia using ease of portable identification, we are setting up a high-level, easy to-use, orderly quick admonition system. Using installed wristbands close to managing communication marks, individuals who discover individuals wearing the wristband will send their GPS place to choose the best solution using the highlights of the proposed system. Such highlights are remembered for reminding comparable assistance location staff, neighborhood police stations, and families. The researches have been found to be a bit different form our research because it has been showing a bit more progressive approach for females as compared to the males distinguishing missing dementia patients will be enormously improved by this. A proposed pilot is currently being presented in two urban areas in Taiwan and will be reached in order to remember the 2015 public assistance. But our research was only showing same about both males and females.

In 2019 Landau used RFID and Global Positioning Services for the elderly male and female with dementia. Four principal results were disclosed in the report. Firstly, the results were more inclined toward males and then more inclined toward females in RFID and Global Positioning respectively. In the views of caregivers ranged from feeling compelled to use the tracking system for the sake of patient safety by promoting the use of the device for the sake of the peace of mind and minimal help of the caregivers, to objecting to the use of the device and respecting the autonomy of an individual. Second, for their own peace of mind and for the protection of the elderly in their care, family caregivers demonstrated greater enthusiasm for the use of GPS and RFID. Professionals have added greater importance to preserving the autonomy of an individual and minimal support for using GPS and RFID. Third, both family and competent care-givers decided that an intra-family concern should be the decision to monitor dementia patients. Fourth, family caregivers attach more importance to the functionality and nature of the tracking device, thereby stressing that they need to regard the tracking device as 'user-friendly'. The consequences for social work of the findings are also explored.

The Geographic Information System (GIS) is designed by [49]to help people suffering from dementia without interfering with their everyday activities. The research was gender based and found to be same in both males and females likewise which has been showing same results as ours. The aim is to locate

the missing patient with the help of data creativity. In order to consolidate these observation systems, our system includes four control frameworks, including indoor home checking, open air movement territorial checking, disaster salvage, and distant observing modes, and an aid entry. It consists of a site administration worker, a data base worker, a message director worker, and a GIS welfare worker (H-GIS). All of the above-mentioned researches have been showing a strength to our research.

ANOVA test was conducted to check if the application has been showing any differences among age-based group. Results shown people above 60 has been showing more improvement in health as well as in application rated it means age factor does count on the people of more age as dementia increases at the high age.

According to fincal for family caregivers of dementia patients with higher age required more such applications, study-based psycho-educational intervention. An additional target was to decide whether a community-based social service provider could incorporate the intervention. Methods Forty-six caregivers were allocated randomly to either a technology-based intervention or a condition of control only for details. Results showed a significant decrease in the dementia disease when application has been used in old age people especially above 60 which is also shown in our results in post-intervention burden and a significant decrease in depression was experienced by those who exhibited high depression at baseline. Conclusion This research offers evidence that technology provides caregivers with a cost-effective and realistic way to deliver treatments.

Karger in 2019 has made a research which was specifically for the high age people having dementia like above sixty. Its Innovation has many possible applications for dementia, from conclusion and diagnosis to the board's mind and incremental maturing. Objectives: To summarize the primary dementia regions' success in innovation, and to describe the predicted bearings and outcomes. Technique: Members of the US Alzheimer's Association of Technology's Specialist Interest Area are interested in conveying existing data on current and planned developments in dementia innovation to the annual pre-meeting plot. Results: The main areas of innovation progression are as follows:

(i) study, evaluation and monitoring,

(ii) useful maintenance,

(iii) diversion and exercise,

(iv) counseling and the board of directors.

This Research was more supporting to our results as it has been showing same results as our research has. At last, the regression has been carried out to check that to which extent our predictors have been fulfilling the model or not the value of R-Square value is 0.855, and the adjusted R-Square is 0.730, all of which are statistically important. It implies that our model is well-fitting and producing good, if not optimal, results, and that we have chosen the appropriate set of variables. Further investigation revealed that our IVs account for 73 percent of our DV, which is satisfaction. This model has a F value of 452.745>10 and a P-value of. 000.05, indicating that it is meaningful at the level of 0.01. As a consequence, the model is a good match. B value of "online shopping" is 0.855. This means that modifying only one unit in an application will increase the health of dementia patients by 86 percent. In terms of dementia and memory improvement, one's health has been assessed.

Amy in 2019 made a model summary in which R-Square was showing dementia application's rating at 90% value as predictor against health improvement. Hence this was supporting our results that Dementia is the most prevalent form of neurodegenerative disease and is associated with immense social and personal costs. The prevalence of this disease is relied on to increase dramatically uniformly by 2050, triggering a rapid need to make changes to the viability of the two studied by its therapy and care [50]. Computerized developments are an increasingly propelling area that provides a previously distant opportunity for clinicians and scientists working in this field to alleviate the problems they face. The aim of this clinical survey was to sum up the information currently available on new innovation that can be used to follow insight.

Amy recognized numerous unavoidable advanced frameworks, such as mobile phones, smartwatches and genius houses, to evaluate and support old mad, prodromal and preclinical populations. For the most part, the examinations registered a solid degree of agreement between the computerized measures and the prototypes to be tested by them. Be that as it may, most gadgets are still in the early stages of use with insignificant evidence of patient acceptability. The use of advanced advances to track and support dementia-influenced intellectual areas is a promising field of development, and further exploration is required to validate the adequacy, utility and cost-viability of these frameworks in patient populations.

Sugihara in 2015 made a research in which R-Square was a bit different as compare to the application but it was because of two or more predictors whereas our research has been showing good R-Square against one predictor. As the risk of being cognitively disabled increases with age, the number of elderly

people in Japan is increasing, which raises the problem of dementia. Caregivers who are well-trained, knowledgeable and can pay particular attention to the needs of individuals with dementia are increasingly needed [51]. In assisting such individuals and their caregivers, technology may play an important role. Another problem is a lack of shared awareness between caregivers and researchers about the suitable applications of assistive technologies.

Conclusions

Most of the Results as well as previous researches has been showing a good result when a dementia application has been rated by the patients in all terms, like gender, age, correlation as well as level of application by model summary highlighting level on influence. The speed of innovation progression requests prompt change in arrangement, financing and practice, away from a restricted clinical methodology, to a foundational model that advances future answers for hazard decrease and avoidance, takes into account prior finding and supports execution on a scale for an important and fulfilling dementia. The vision of individual-centered treatment focused on the use of information and communication technologies to preserve the autonomy and continuity of residents in their lives is provided by Taro. A roadmap and a list of obstacles to the realization of assistive technology have been developed based on this vision.

References

[1] J. C. S. Huang, Y. T. Lin, J. K. L. Yu, K. Liu and Y. H. Kuo, "A wearable NFC wristband to locate dementia patients through a participatory sensing system," in *2015 International Conference on Healthcare Informatics*, IEEE., pp. 208-212.

[2] S. Rathnayake, W. Moyle, C. Jones and P. Calleja, "Family carers' needs related to management of functional disability in dementia care and use of mHealth applications in health information seeking: An online survey.," *Collegian, 27(3),* 2020.

[3] K. Ryg, "Quality of Life for Patients with Dementia: A Systematic Review.," Retrieved from Sophia, the St. Catherine University repository, 2016. [Online]. Available: https://sophia.stkate.edu/msw_papers/670.

[4] H. Kaur, M. A. Alam, R. Jameel, A. K. Mourya and V. Chang, "A proposed solution and future direction for blockchain-based heterogeneous medicare data in cloud environment.," *Journal of medical systems, 42(8),* pp. 1-11, 2018.

[5] Buechley, Eisenberg, Catchen and Crockett, "Computing Systems for helping people brain for memory constraints," in *Proceedings of the Twenty-Sixth Annual CHI Conference on Human Factors*, 2018.

[6] V. Lichtner, D. Dowding, N. Allcock, J. Keady, E. L. Sampson, M. Briggs and S. J. Closs, "The assessment and management of pain in patients with dementia in hospital settings: a multi-case exploratory study from a decision making perspective," *BMC health services research, 16(1),* 2016.

[7] I. Asghar, S. Cang and H. Yu, "A Systematic Mapping Study on Assitive Technologies," in *2015 9th International Conference on Software, Knowledge, Information Management and Applications (SKIMA)*, 2015.

[8] G. Muhammad, F. Alshehri, F. Karray, A. El Saddik, M. Alsulaiman and T. H. Falk, "A comprehensive survey on multimodal medical signals fusion for smart healthcare systems," *Information Fusion,* 2021.

[9] G. Rizzo, S. Arcuti, M. Copetti, M. Alessandria, R. Savica, A. Fontana and G. Logroscino, "Accuracy of clinical diagnosis of dementia with Lewy bodies: a systematic review and meta-analysis," *ournal of Neurology, Neurosurgery & Psychiatry, 89(4),* pp. 358-366, 2018.

[10] V. Sadeghian, A Framework for Multi-Platform Analytical and Experimental Simulations of Reinforced Concrete Structures, (Doctoral dissertation, University of Toronto (Canada)), 2017.

[11] M. Zubayer and S. Hoque, "Health care service quality and in patients' satisfaction: An empirical investigation on healthscape'stangible quality," *Global Journal of Arts, Humanities and Social Sciences.,* 2019.

[12] J. Rodríguez, A. Pérez and J. Lozano, "Sensitivity Analysis of k-Fold Cross-Validation in Prediction Error Estimation. Pattern Analysis and Machine Intelligence," *IEEE transactions on pattern analysis and machine intelligence, 32(3),* Vols. 32. 569 - 575, pp. 569-575., 2009.

[13] H. Ishii, K. Kimino, M. Aljehani, N. Ohe and M. Inoue, "An early detection system for dementia using the M2 M/IoT platform," *Procedia Computer Science, 96,* vol. vol. 96, p. 1332–1340, 2016.

[14] C. C. Lin, P. Y. Lin, P. K. Lu, G. Y. Hsieh, W. L. Lee and R. G. Lee, "A Healthcare Integration System for Disease Assessment and Safety Monitoring of Dementia Patients," in IEEE Transactions on Information Technology in Biomedicine," *IEEE Transactions on Information Technology in Biomedicine, 12(5),* Vols. vol. 12, no. 5,, September 2018.

[15] M. Manimaraboopathy, S. Vijayalakshmi, D. Hemavathy and A. Priya, "A wearable multiparameter medical monitoring and alert system", IEEE Trans. Inf. Technol. Biomed," *International Journal on Smart Sensing and Intelligent Systems, 10(5),* Vols. vol. 8, no. 4, pp. 415-427, December 2017.

[16] F. Sposaro, J. Danielson and G. Tyson, "iWander: An Android application for dementia patients," in *Annual International Conference of the IEEE Engineering in Medicine and Biology*, Buenos Aires, 2015.

[17] D. H. Wilson, Assistive intelligent environments for automatic health monitoring, Carnegie Mellon University, 2005.

[18] C. Hughes, L. Berg, W. Danziger, L. Coben and R. Martin, A New Clinical Scale for the Staging of Dementia. British Journal of Psychiatry, Vols. 140(6),, Carnegie Mellon University., 2020, pp. Page-566-572..

[19] Y.-J. Lin, H.-S. Chen and M.-J. Su, "A cloud based Bluetooth Low Energy tracking system for dementia patients," *Eighth International Conference on Mobile Computing and Ubiquitous Networking (ICMU),* vol. Hakodate, pp. pp. 88-89,, 2015.

[20] R. Landau, S. Werner, G. K. Auslander, N. Shoval and J. Heinik, "Attitudes of Family and Professional Care-Givers towards the Use of GPS for Tracking Patients with Dementia: An Exploratory Study," *The British Journal of Social Work,* Vols. Volume 39, Issue 4, p. 670–692, June 2019.

[21] C. C. Lin, M. J. Chiu, C. C. Hsiao, R. G. Lee and Y. S. Tsai, "Wireless health care service system for elderly with dementia", IEEE Trans. Inf. Technol. Biomed," *IEEE Transactions on*

Information Technology in Biomedicine, 10(4), Vols. vol. 10, no. 4,, pp. 696-704, ., October 2016.

[22] M. Bachlin, M. Plotnik, D. Roggen, I. Maidan, J. M. Hausdorff, N. Giladi and G. Troster, "Wearable Assistant for Parkinson's Disease Patients With the Freezing of Gait Symptom," *IEEE Transactions on Information Technology in Biomedicine,* Vols. vol. 14, no. 2, pp. 436-446, March 2018.

[23] P. Ratsameethammawong and K. Kasemsan, "Mobile Phone Location Tracking by the Combination of GPS Wi-Fi and Cell Location Technology," *Communications of the IBIMA,* Vols. Vol. 2010 (2010), Article ID 566928, 7 pages, 2010.

[24] J. Ploeg, C. McAiney, W. Duggleby, T. Chambers, A. Lam, S. Peacock and A. Williams, " A web-based intervention to help caregivers of older adults with dementia and multiple chronic conditions: qualitative study.," *JMIR aging, 1(1),* 2018.

[25] A. Au, D. W. Lai, H. M. Yip, S. Chan, S. Lai, H. Chaudhury and G. Leeson, "Sense of community mediating between age-friendly characteristics and life satisfaction of community-dwelling older adults," *Frontiers in psychology, 11,,* 86.

[26] J. Ploeg, C. McAiney, W. Duggleby, T. Chambers, A. Lam, S. Peacock and A. Williams, "A Web-Based Intervention to Help Caregivers of Older Adults With Dementia and Multiple Chronic Conditions: Qualitative Study," *JMIR aging, 1(1),* Vols. Vol 1, No 1 , 2018 .

[27] R. J. Oskouei, Z. MousaviLou, Z. Bakhtiari and K. B. Jalbani, "IoT-Based Healthcare Support System for Alzheimer's Patients", Wireless Communications and Mobile Computing," *Wireless Communications and Mobile Computing,2020,* Vols. vol. 2020, Article ID 8822598, 15 pages,, 2020.

[28] A. A. Shaikh, N. S. Gupta, A. D. M. Khan and H. T. Artist, "Android and internet of things (IoT) based Alzheimer care/rehabilitation system to monitor and progress patient health condition," *International Journal of Innovative Research in Computer and Co,* Vols. vol. 5, no. 3, 2017.

[29] J. Lorca-Cabrera, R. Martí-Arques, N. Albacar-Riobóo, L. Raigal-Aran, J. Roldan-Merino and C. Ferré-Grau, "Mobile Applications for Caregivers of Individuals with Chronic Conditions and/or Diseases: Quantitative Content Analysis," *International Journal of Medical Informatics, ,* 2020.

[30] A. J. Astell, P. Joddrell, H. Groenewoud, J. de Lange, M. Goumans, A. Cordia and Y. Schikhof, "Does familiarity affect the enjoyment of touchscreen games for people with dementia?," *. International journal of medical informatics, 91,* 2016.

[31] D. Shende, S. Madrewar and S. Dugade, "Dementia patient activity monitoring and fall detection using IoT for elderly," *International Journal of Trend in Scientific Research and Development,* Vols. vol. 3, no. 4, p. pp. 363–367, 2019.

[32] S. Finkel, S. J. Czaja, Z. Martinovich, C. Harris, D. Pezzuto and R. Schulz, "E-Care: A Telecommunications Technology Intervention for Family Caregivers of Dementia Patients," *The American Journal of Geriatric Psychiatry,,* vol. 5, no. 5, pp. 443-448, May 2007.

[33] C. Lethin, E. Hanson, E. Margioti, C. Chiatti, C. Gagliardi, C. Vaz de Carvalho and A. Malmgren Fänge, "Support needs and expectations of people living with dementia and their informal carers in everyday life: A European study," *Social Sciences, 8(7),,* p. 203, 2019.

[34] B. Karger AG, "Dementia and Geriatric Cognitive Disorders," *Technology and Dementia: The Future is Now,* vol. 47, pp. 131-139, 2019.

[35] A. Almeida, R. Mulero, P. Rametta, V. Urošević, M. Andrić and L. Patrono, "A critical analysis of an IoT—aware AAL system for elderly monitoring," *Future Generation Computer Systems, 97, ,* 2019.

[36] A. Chinner, J. Blane, C. Lancaster, C. Hinds and I. Koychev, "Digital technologies for the assessment of cognition: a clinical review," *Evid Based Ment Health,* vol. 21, no. 2, pp. 67-71, 21 May 2018.

[37] S. Rathnayake, W. Moyle, C. J. Jones and P. Calleja, "Development of an mHealth application for family carers of people with dementia: A study protocol.," *Collegian, 26(2),,* 2019.

[38] T. Sugihara, T. Fujinami, R. Phaal and Y. Ikawa, "A technology roadmap of assistive technologies for dementia care in Japan," *Epub,* vol. 14, no. 1, pp. 80-103, Jan 2015.

[39] T. Sugihara, T. Fujinami, R. Phaal and Y. Ikawa, "A technology roadmap of assistive technologies for dementia care in Japan," *Dementia, 14(1),* pp. 80-103, 2015.

[40] G. Aceto, V. Persico and A. Pescapé, "The role of Information and Communication Technologies in healthcare: taxonomies, perspectives, and challenges," *Journal of Network and Computer Applications, 107,* pp. 125-154, 2018.

[41] A. Queirós, D. Faria and F. Almeida, "Strengths and limitations of qualitative and quantitative research methods.," *European Journal of Education Studies,* 2017.

[42] O. D. Apuke, "Quantitative research methods: A synopsis approach.," *Kuwait Chapter of Arabian Journal of Business and Management Review, 33(5471),,* 2017.

[43] D. Gundry and S. Deterding, "Validity threats in quantitative data collection with games: A narrative survey.," *Simulation & Gaming, 50(3),* pp. 302-328, 2019.

[44] R. Zhou, X. Wang, L. Zhang and H. Guo, "Who tends to answer open-ended questions in an e-service survey? The contribution of closed-ended answers.," *Behaviour & Information Technology, 36(12),* pp. 1274-1284, 2017.

[45] P. Mishra, C. M. Pandey, U. Singh, A. Gupta, C. Sahu and A. Keshri, "Descriptive statistics and normality tests for statistical data," *Annals of cardiac anaesthesia, 22(1),* p. 67, 2019.

[46] J. M. Bland and D. G. Altman, " Statistics notes: Cronbach's alpha.," *Bmj, 314(7080),,* 1997.

[47] O. P. John and S. Srivastava, The Big-Five trait taxonomy: History, measurement, and theoretical perspectives, . Berkeley: University of California., 1999.

[48] S. K. A. Lee, " Classification of SmartMentalTech services and application for comprehensive mental healthcare stepped-care model (CMHSCM): health psychological approach.," *Procedia Computer Science, 141,* pp. 302-310., 2018.

[49] S. Li, S. Wang, Y. Guan, Z. Xie, K. Huang, M. Wen and L. Zhou, "A High-performance Cross-platform Map Rendering Engine for Mobile Geographic Information System," *ISPRS International Journal of Geo-Information, 8(10),* 2019.

[50] D. Imtiaz, Y. Anwar and A. Khan, "Wearable sensors and a multisensory music and reminiscence therapies application: To help reduce behavioral and psychological symptoms in person with dementia.," *Smart Health, 18,,* 2020.

[51] H. L. Christie, J. L. Martin, J. Connor, H. J. Tange, F. R. Verhey, M. E. de Vugt and M. Orrell, " eHealth interventions to support caregivers of people with dementia may be proven effective, but are they implementation-ready?," *Internet interventions, 18,,* 2019.