

# Towards IoT: Development of an IoT-Based Smart Elder Care System

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**Abstract:** Providing elder care necessitates input from a variety of sources, which the use of digital technology can aid. Both hardware and software are potential technologies that can be integrated into elder care. Some elders spend the last part of their lives alone in home or elder homes. Further, they forget their medicine schedules, and diet plans. Soers face various troubles. There are several impacts such as burglary threats, and daily home threats. So, this system built for create the safe zone to elders. these are the focus areas, Comfort, Health, Location, Safety, Wellness. Monitoring systems for the elderly collect a variety of information, including, movement, temperature, behavioral and sleep patterns, and more. The data provides critical insights into a senior's health and daily life to careers and medical professionals.

Depending on the rules of the senior living community, medical alert devices can be utilized at home or in the community. Many have emergency buttons or sensors that detect emergencies such as fires or falls. Depending on the aging monitoring system, calls to the police or caregiver can normally be made directly or indirectly.

**Keywords:** Activity detection through camera, Web based monitoring, Physical engagements, indoor temperature analysis, Danger detection, Abnormal behavior detection

## 1. Introduction

In society, there are group of people called "The Elders". They are the oldest group of people in any society. They are getting helpless when they get old. So, their children or guardians must pay more attention on them. Because some elders need the support of a third-party person to fulfill their needs and wants. With that case, there are some places, called "Elder's Home", which provides all the facilities to the elder people and look after them very well.

The elder's home is very much useful place because they provide great responsible service to the elders. So, if the family going out on somewhere, their elders might not be able to go with them sometimes. Therefore those elders can be going to the elder's home and getting their service, help of protection safely. In that elder's home, their helpers who always ready to serve their customers (elders) all the time. They provide foods, medicines, and helping them to fulfill their all the needs and wants.

However, from these kinds of elder's homes do not use modern technology to give customers a better service and ensure their safety. And also, there are some doubtful areas that needs to be updated on the traditional elder's home procedure as well.

Here, we suggested developing and implementing an IOT Based Smart Elder Care Home system that can reduce the doubtful areas and ensure the elder's safety increasingly. It will be a web-based application that can be connected to the elder's home staff, elders, and elder's guardians. With that system, all the parties connected to this process will have quality benefits in an effective way.

This system can remind the users of mealtimes, medicine times, and other things that could be reminded of. And also, it will detect the unusual situations such as gas leak, fire, and other dangerous situations and make some precautions automatically. This system can implement in homes and elder homes. as a first level, this system implements to the elder's homes. Around the world people research about this problem and implement various kind of systems. this is a huge problem in the world.

Some countries give the priority to the elderly. Let consider the many things that such follow for them. Major changes in population structure worldwide result from decreased fertility and many countries have been transforming into aging societies. An elderly is experiencing several difficulties in living due to physical and mental declines. Such changes impact two major indices reflecting good quality of life healthiness and access to decent medical services. Moreover, lack of medical.

personnel, demographical and geographical problems are significant barriers of medical service improvement. According to the study performed by The Economist, it has been estimated that 22.3% of population will be aged 65 or over by 2100, Elder care normally consists of three groups of people including caretaker (elderly), caregiver and medical staff. As family member is considered as a caregiver, a study indicates that caregiving is already a part of most workers' daily lives.

Providing elder care requires consultancy from several sources and it can be improved by digital technology application.

Potential technologies that can be integrated into the elder care include hardware and software. Wearable devices were initially used for fitness tracker and currently applied to medical services. Several vital signs such as heart rate, blood pressure and pulse oximeter are normally measured by the devices available in the market. Those readings are then delivered to the caregivers or medical staffs. Surveillance cameras are usually used for indoor and outdoor monitoring, respectively. The devices are connected to form the IoT via data communication. The caregiver's or medical staff's mobile phone or desktop computer install an application that facilitate data display, processing, and settings to yield health monitoring. Artificial Intelligence (AI) and robotic are another field of interests and can be applied to the elder care. However, each of the technologies has its own limitations and concerns. Several opportunities include cost reduction, preventive medicine promotion, medical education, stress and anxiety relief and service diversity.

## 2. Motivation

This system is more effective for people than the available systems in the industry. There are systems that works like this way but not effective. These Systems are available for online video conferencing and Danger detection People use these kinds of systems but without any innovativeness, this system includes, Monitor the elders and their Abnormal behaviors detection

However, caring for someone from afar poses its own set of issues, modern technology, such as caregiver alert systems and geriatric monitoring gadgets, may provide you with peace of mind and a helping hand.

Many counties use this for people with disabilities. It is understood that effective care allows the elderly and disabled to live comfortably at home with complete confidence and peace of mind for themselves as well as their family members and relatives. This can be provided by combining existing or emerging technological solutions to enable seamless learning of the elderly and disabled's living patterns in order to provide personalized care in a proactive manner by monitoring and analyzing daily activities and alerting healthcare providers and relatives when early warning signals appear in order to avoid emergency situations. A sample application of smart home technology with a variety of networked sensors is described in this study. Although this is a quite simple example of smart houses, it demonstrates how smart homes could alter all aspects of the elderly and disabled's daily lives. We want to upgrade the prototype system with a software application and a set of sensors in the future to and generate sensor activity patterns to assess and predict changes in the monitored person's daily activities.

## 3. Related Works

Providing elder care need input from variety of sources, which can be aided using digital technology. Both hardware and software are potential technologies that

can be integrated into elder care. Some elders spend the last part of their lives alone in home or in elder homes. So that elders face various troubles. Sometimes they forget their medicine schedules, diet plans. There are several impacts such as burglary threats, and daily home threats. So, this system built for create the safe zone to elders.

In the face of that situation lot of countries going to smart elder care home solutions. because of they all need to protect and keep their parents or whoever of they love. so, during that situation innovative elder care systems are born day by day. but only a few systems can fulfill the requirements properly. now let's research the systems that have been developed in this regard across the universe.

Big data is crucial to the development and use of IoT devices. In turn, the phrase "big data" is used to refer to data analytics programs that use a large volume of data. Data analytics allows to determine the best solutions or predicted scenarios to acquire a competitive edge. In contrast, these commonly used smart gadgets make it easier for us to carry out our daily duties while data is being collected for business and optimization objectives, providing a win-win situation. Smart sensors, for instance, allow for the monitoring of a home's heating.

Device manufacturers may assist power suppliers in using data to forecast electricity use and can also provide consumers with tips for effective electricity use. (Breur, 2015) By 2023, the number of IoT devices is anticipated to surpass that of non-IoT devices due to the spectacular growth of IoT devices. By 2040, it is predicted that there will be close to 140 billion IoT devices, compared to a relatively static number of non-IoT devices. The expected rise of both IoT and non-IoT devices is seen in (Shenoy, 2020).The IoT gadgets will develop enormously and have an unavoidable impact on our everyday lives if the projection is even somewhat accurate. However, as these technologies are developing quickly and predicting becomes challenging within a timescale of 20 years, projections out 20 years should only be used as a guide.

IoT sensors can perceive, think, and act by communicating with one another, sharing information, and making decisions. The typical IoT components are displayed in The fundamental tenet of the Internet of Things is that every domain-specific application interacts with domain-neutral contributions, and that devices and actuators instantly link to one another in every region. IoT is anticipated to be utilized in smart homes since it enables its users to remotely operate their appliances while away from home and automatically open their garage when they arrive at their gates, switch

on the fan when the temperature rises, and inform them if there is a gas leak in the kitchen.

Although the elderly and disabled prefer to remain in their homes, it is nevertheless necessary to regularly monitor their health and activities so that assistance may be given right away in an emergency. In essence, smart homes are high-tech structures designed to facilitate domestic task automation, simpler communication, and increased security. They can improve the lives of the elderly and disabled by enabling them to remain in their homes, where they feel comfortable, as they have been designed to cater to their unique requirements. Additionally, they can assist caregivers in raising the standard of the services.

There are four basic issues with home automation systems: poor manageability, rigidity, difficulties attaining security, and high cost of ownership. The main goals of this project are to build and construct an IoT-based home automation system that can automate and control the majority of household appliances via a user-friendly web interface. WiFi technology is used by the proposed system to connect its scattered sensors to a server for home automation, giving it a high degree of flexibility. This will improve the capability of updating and system reconfiguration while lowering the deployment cost.

The home appliances are managed using a system based on the GSM network through SMS, as seen in the controller for interfacing the appliances is an Arduino board. To accomplish this interface, certain peripheral drivers and relays are used. The user interface device is a smartphone. The system leverages additional technologies to deploy the app and the visual programming tool "App Inventor" to create the user interface. Based on user commands, the program produces SMS messages and transmits them to the Arduino's GSM modem. The user is able to manage household appliances thanks to this. The technology has the same costs and reliability issues as SMS. The interface is also pre-programmed and cannot be modified according to the devices.

technological advancements have resulted in smart homes for aged care. On the other hand, it satisfies the actual needs of the elderly today. The elderly is physically and psychologically vulnerable when compared to young individuals. The smart home for senior care is a good response to this problem, and it may be able to meet the demands of the elderly for self-sufficiency. The development of smart homes for senior care in China, on the other hand, is a policy-driven product. In the beginning, intelligent technology was employed to better address the needs of the elderly, but the pace of advancement was slow. China responded by issuing a number of policy documents, including the Instruction to Promote Internet Plus Plan, the Action Plan for the Development of Smart Health and Elderly Care Services (2017–2020), and others. Since then, smart home pilot programs for elderly care have sprung up all over the country. The rapid development of China's smart

home for senior care is undeniably influenced by state regulations. Although the policy-driven nature of China's smart home for senior care has a lot of advantages, it has also resulted in some negative consequences. China's smart home for senior care is a policy-driven product rather than a demand-driven one, which has the obvious disadvantage that many elderly people do not understand smart home care. As a result, the demand for smart home care among the elderly is low. The elderly is generally price sensitive when it comes to clever items, and they have high expectations for their convenience. As a result, they have a poor level of self-efficacy when it comes to using intelligent technologies. Furthermore, people have a hard time envisioning how intelligent technologies may help them live better lives. In China, these characteristics have a detrimental impact on the elderly's general awareness of and demand for smart homes for senior care.

Many countries have developed various devices for elderly using IOT. prices here depend on the use of these devices. these data, collected over several years, underscore the importance of IOT technology.

IoT Technology – The Internet of Things (IoT) has been getting interests from both academic and industry. The key concept of the IoT is to connect numerous attached devices together via data communication over computer networks, such as the Internet, without human intervention, and to provide better services based on the collected data and processed output. There are currently several domains which that deploy the IoT, such as smart homes, smart industry, logistics and health care. Moreover, it is estimated that there will be over 25 billion IoT devices. Key required capabilities of each device are data measurement and communication. In case of elder care, several devices such as wearable devices are attached to the elderly in order to measure their vital signs. Additional devices may be attached to several locations in their home to capture more data such as movement, temperature, and humidity. All devices are then connected to the computer server by means of data communication. The server consists of some computer programs which follow the users' requirements. When some events are triggered, some actions will be automatically conducted such as temperature adjustment, warning, and emergency call. Several IoT applications focusing on wearable devices together with relevant case studies are provided.

This section examines how IoT-based smart home systems might assist solitary persons with physical or mental difficulties, such as the elderly, people with disabilities, and other people with special needs, in their daily lives. The section focuses on smart home technologies that are now available and their applications for the elderly and disabled in some countries the government is involved in this problem. Southern European countries, despite significant levels

of underinsurance and a shortage of home-based and residential care, the family's duty for care provision is still emphasized Southern European countries and regions have just recently implemented more extensive elder or long-term care policies. The complex central-local interplay in Italy, has hampered the implementation of new, more comprehensive care programs due to welfare state limits.

According to the Administration on Aging, the number of individuals over 65 in the United States will quadruple to 69.4 million by 2030, accounting for 22% of the population. Historically, 43% of adults over the age of 65 join a nursing home for at least one year, yet according to a survey conducted by the Health Care Financing Administration (HCFA), 30% of the elderly would "rather die" than do so (HCFA Thousands of families are affected each year by the financial and emotional stress of such relocations. Individual sensing and automation components can be configured to transform a legacy home into something of a full-time caregiver by giving them an integrating 'mind' with enough intelligence to coordinate and direct their behaviors for the good of the client, using emerging home sensing and control technologies, integrated through emerging networking and information transfer protocols, and managed by intelligent, adaptive systems.

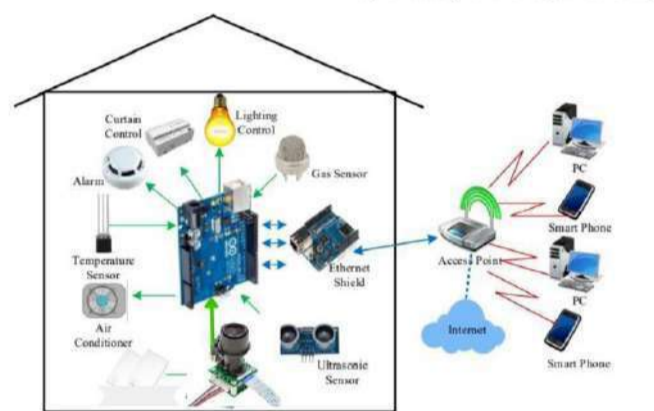
Each countries uses different technology and commonly uses Arduino IDE to develop this system.

The C programming language was used to create the software for this project. The Atmel Studio IDE [16], which supports all of Atmel's microcontrollers, was utilized. Although the Arduino IDE is the most popular IDE for developing with the Arduino hardware and has a range of peripheral drivers, we chose Atmel Studio for more precise timing control, code efficiency, and debugging ease.

#### 4. System Design

The web-based home automation system mainly consists of three modules the server, the hardware interface module, and the software package. The figure shows the system model layout. The server and hardware Interface module use Wi-Fi technology to communicate with each other. The same technology uses to login to the server web-based application. The server is connected to the Internet, so remote users can access server web-based application through the Internet using compatible web browser. Software of the latest home automation system is split to server application software, and Microcontroller (Arduino) firmware. The Arduino software, built using C language, using IDE comes with the microcontroller itself. Arduino software is culpable for gathering events from connected sensors, then applies action to actuators and preprogramed in the server. Another job is to

report the and record the history in the server DB. The server application software package for the proposed elder's home automation system, is a web-based application built using asp.net. The server application software can be accessed from internal network or from internet if the server has real IP on the internet using any internet navigator supports asp.net technology. Server application software is culpable of, maintain the whole elder's home automation system, setup, configuration. Server use database to keep log of elder's home automation system components, we choose to use XML files to save system log.



Experimental design where applicable

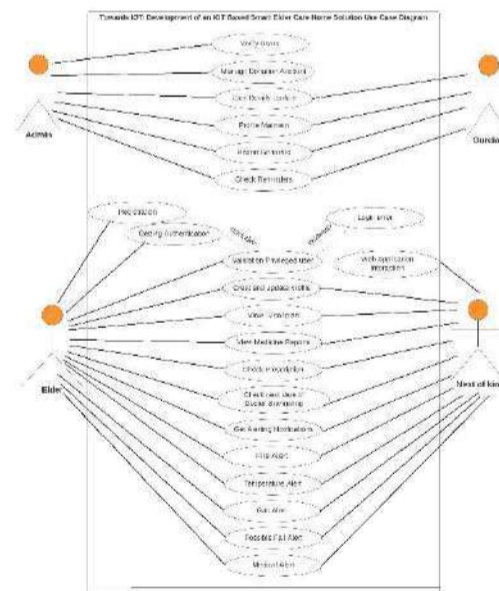


Figure 1. Use Case diagram of the system

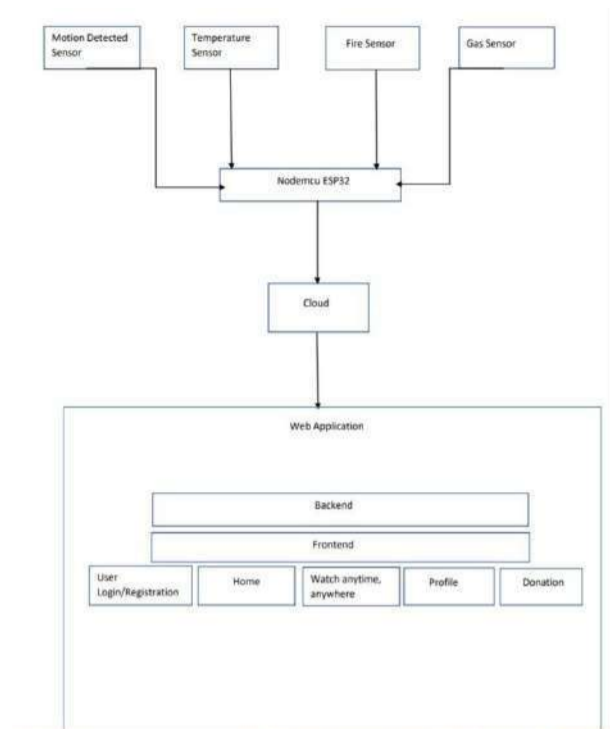


Figure 2. conceptual diagram of the system

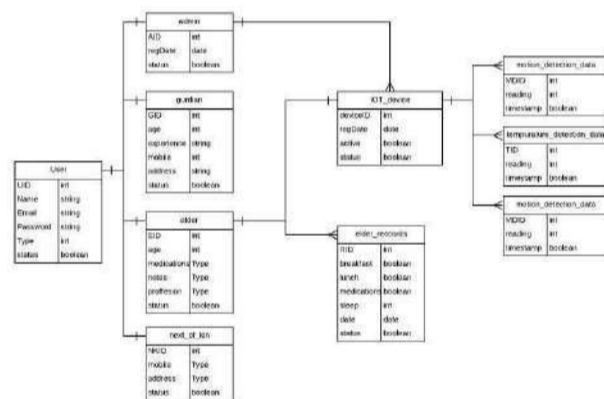


Figure 3. Eldercare Class Diagram of the system

The system proposed uses an Arduino board along with Wi-Fi communication technology. It also has the option of another automated mode where there are temperature and gas sensors which can be set to control the appliances depending on the conditions. The system uses an Android smart phone to communicate with an elder home PC those servers as a server. The system is connected to and controlled the Arduino board. The mobile phone can communicate with the GSM through SMS alert. Internet access is through Wi-Fi. Also, it depends on Wi-Fi for internet access which is not reliable and not widely available.

This paper compares all of the systems mentioned above. The systems that have been researched have a few characteristics. These systems all rely on the same fundamental communications technology. This underlying technology is

what gives the system its benefits and shortcomings. Each system has its own control circuitry for interacting with electrical equipment. To send orders to the control circuits, there must be a unified command system. The system's user interface is the following crucial component. This establishes the user's relationship with the system and the degree of control they have over it. The system's usability is impacted by this.

The major issues that many countries are transitioning to an aging society. Due to physical and mental impairments, the elderly face numerous challenges in their daily lives. Such changes have an impact on two important indicators that represent high quality of life: health and access to adequate medical services. Furthermore, a lack of medical workers, as well as demographic and regional issues, are important impediments to improving medical services. In the face of such obstacles, our elders spend the last part of their lives alone in home or in elder homes. Then they must face various troubles. There are several impacts such as burglary threats, and daily home threats. So, this concept is built to protect or minimize the dangerous situations from elders.

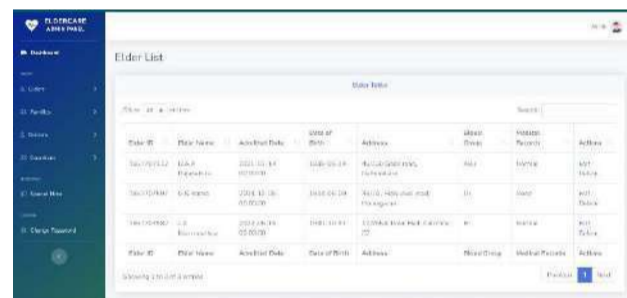


Figure 4. Admin Module

Web applications can be developed through several users, such as admin, elder, family, guardian, and doctor. The system provides connections to important modules the user can use to control the smart elder home. Mostly, admin can register elder and select guardian and keep a proper room. On the other hand, if a fire is detected, gas, or whatever dangerous situation in the room, the SMS will be received by the user.

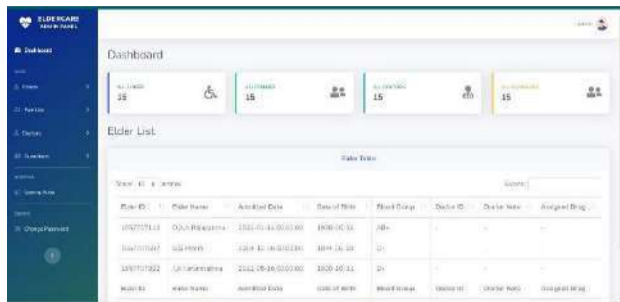


Figure 5. Dashboard

## 5. Methodology

Providing elder care need input from a variety of sources, which can be aided using digital technology. Both hardware and software are potential technologies that can be integrated into elder care. Some elders spend the last part of their lives alone in home or in elder homes. So that elders face various troubles. There are several impacts such as burglary threats, and daily home threats. sometimes they forget their medicine schedules, diet plans. So, this system built for create the safe zone to elders. By implement this smart elder care home, will solve problem of elder care in society. in the modern world so many people in busy life. so, they can't care their parents or whatever elders in properly. in that situation their parents in alone their homes or elder home centers. This is the huge problem in the world. some time they will die in alone because of unknowing matters. in this system built for avoid their dangerous situations and detect urgent situations. on the other hand, this system provides their food and medicine management. this system can implement in homes and elder homes. as a first level, this system implements to the elder's homes. In here, we suggested to develop and implement an IOT Based Smart Elder Care Home system that can be reduce the doubtful areas and ensure the elder's safety more and more. It will be a web-based application that can connected to the elder's home staff, elders and elder's guardians. With using that system, all the parties that connected to this process will be having quality benefits in an effective way.

This system can remind mealtimes, medicine times and other things that could be reminded to the users. And also, it will detect the unusual situations such as gas leak, fire, and other dangerous situations and make some precautions automatically. This system can implement in homes and elder homes. as a first level, this system implements to the elder's homes. Technologies:

- Arduino IDE
- JS
- Php
- SQL
- HTML
- CSS
- IOT Cloud

The proposed system is more effective for people than the available systems in the industry. There are systems that works

like this way but not effective. These Systems are available for online video conferencing and dangerous detection.

People use these kinds of systems but without any innovative developments.

All the functions mentioned above will on this system.

### 1. Requirement Gathering

- reviewing the available systems
- visit physical centers to gather information
- do some surveys and research about it

### 2. Design

- UML Diagram
- ER Diagram
- UI Design
- Data flow diagrams

### 3. Implementation

- Implement the elder monitoring system in the home and surrounded area
- Implement the emergency button and alerting system
- Implement the IOT system

## 6. Conclusion

It is clear that effective care may allow seniors to live comfortably at home with complete assurance. To do this, a variety of technology approaches may be used, enabling the aged and disabled to get individualized care and quick assistance. The utility of the suggested system has been demonstrated through performance assessment research that looked at a wireless sensor network-based health monitoring system for the aged and disabled. The hardware and software components of the suggested system have both been given in this study. The suggested low-cost technology enables healthcare practitioners to remotely monitor their patients' primary health metrics when linked to the Internet via a gateway. Additionally, it is a useful tool for caregivers of the aged and crippled. Assessment research in a dispersed scenario with a group of senior citizens will be the focus of this project's future work.

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