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*Retraction*

# Retracted: An Investigation in Applying Internet of Things Approach in Safe Food Dietary Plan for Better Chronic Diabetes Management among Elderly Adults

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

## References

[1] G. Geetha, R. Radeep Krishna, S. Vyas et al., "An Investigation in Applying Internet of Things Approach in Safe Food Dietary Plan for Better Chronic Diabetes Management among Elderly Adults," *Journal of Food Quality*, vol. 2022, Article ID 4281237, 12 pages, 2022.

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*Research Article*

# An Investigation in Applying Internet of Things Approach in Safe Food Dietary Plan for Better Chronic Diabetes Management among Elderly Adults

**G. Geetha**,[1] **R. Radeep Krishna**,[2] **Swati Vyas**,[3] **Isha Sukhwal**,[4] **Ankit Jain**,[5] **Abhay Chaturvedi**,[6] **and Mohd Asif Shah**[7]

[1]*Department of IT, VR Siddhartha Engineering College, Vijayawada, India*
[2]*Department of ECE, Mangalam College of Engineering, Ettumanoor, Kerala, India*
[3]*Department of Home Science: Foods and Nutrition, IIS Deemed to be a University, Jaipur, India*
[4]*Department of Home Science, IIS Deemed to be University, Jaipur, India*
[5]*Amity University, Jaipur, Rajasthan, India*
[6]*Department of Electronics & Communication Engineering, GLA University, Mathura, U.P., India*
[7]*Bakhtar University, Kabul, Afghanistan*

Correspondence should be addressed to Mohd Asif Shah; ohaasif@bakhtar.edu.af

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Chronic diabetes among adults is a public health concern and clinicians are trying to implement new strategies to effectively manage the disease. Traditionally, healthcare professionals are used to monitor and track the lab reports of patients. After that, they used to provide respective medicines and lifestyle plans to manage the chronic disease. The lifestyle of the patients and access to safe and secure food products is also responsible for developing chronic diseases. Thus, the Internet of Things (IoT) has taken an utmost interest in managing diabetes. This research is going to analyze the accuracy of IoT in assisting chronic diabetes management and determining food safety. To accomplish the research objectives, the researchers performed a linear regression analysis to understand whether IoT devices and Artificial Intelligence (AI) assist in assessing food safety and diabetes management. The independent variables selected were lab test values, treatment records, epoch size of AI, and image resolution of the training dataset. Dependent variables were the accuracy of IoT. Here, the accuracy of IoT and AI has been determined. Moreover, the accuracy of clinicians in diabetes management has been observed. It has been found that clinicians have high variance in accuracy (max 99%) whereas machines have limited variance in accuracy (max. 98%). Secondary research identified that clinicians need to be involved along with IoT devices for better management of this chronic disease and help patients by providing the safest food options.

## 1. Introduction

Developments in digital technology have led to the formalization of advanced technologies in a variety of industries, including nursing, aviation, agriculture, and nutrition, including logistics support. Automation and deconcentrated information are considered innovative engines for the future market, with the Internet of Things (IoT) functioning as a crucial technological performer. IoT applications are being used to integrate material reality with the cyber-world, allowing autonomous data evaluation and smart judgment as the potential to include ambient smartness grows [1]. The nodes of the international development tree have developed concepts including Smart City, "Cyber-physical Systems" (CpS), and "Industry 4.0," using IoT as the foundation. Edge computing has emerged as a computational breakthrough to improve the quality and quantity of real-time customer satisfaction as an IoT addition. Figure 1 shows the revolution of IoT in healthcare.

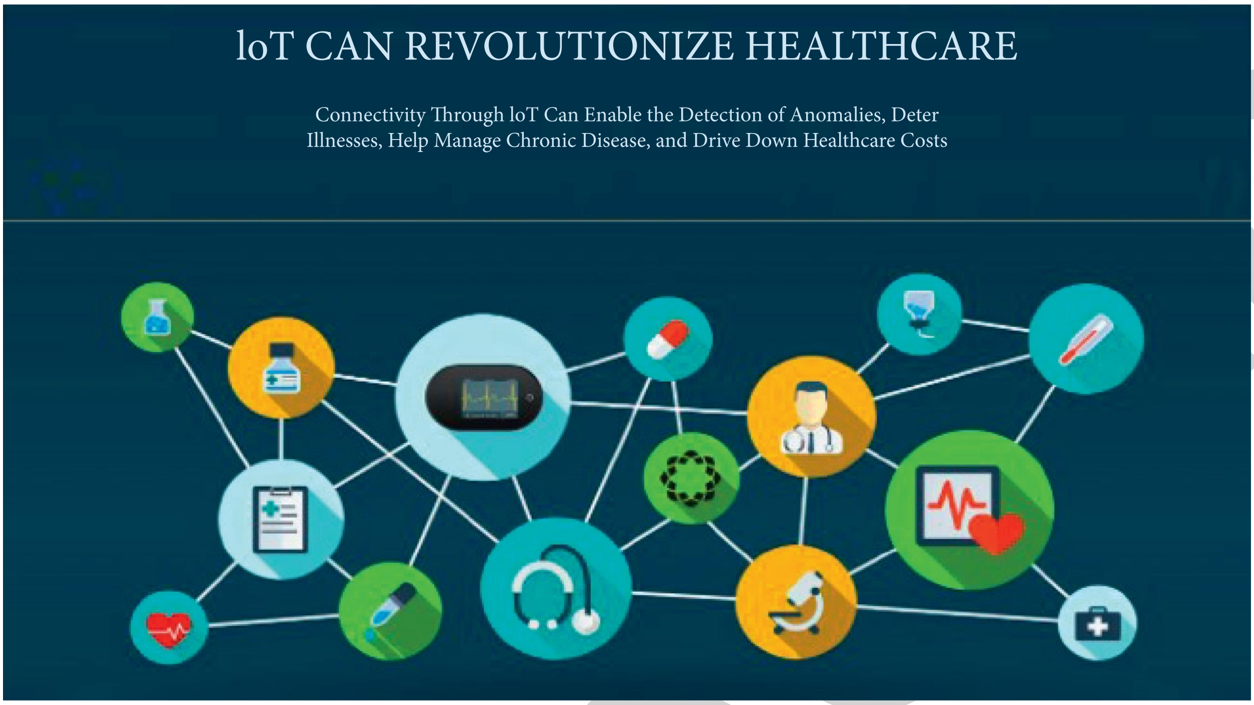


Figure 1: IoT revolution in healthcare [1].

For IoT-based medical systems, Big Data as well as AI can open up plenty of possibilities. Big Data processing approaches based on AI have the potential to enhance worldwide public health dramatically. IoMT solutions provide for a reduction in the worldwide cost of preventing chronic diseases. These systems' real-time health information can be analyzed to support clients during self-administration therapy [2]. The intention of the Internet of Medical Things and digitized health system will be to make it simple for patients to take elevated treatment for their comfort. As a consequence, the aim of IoMT is to enable comfy health services universal. Implementing similar systems that are intuitive and efficient for the timely detection of deadly illnesses could save thousands of lives while simultaneously relieving the pressure on the local care system, such as hospitals. In the diagnosis of diabetes, the IoT concept plays a vital role in self-management. Sensors in the Internet of Things better facilitate diabetes by measuring blood circulation, insulin sensitivity, caloric intake, and physical fitness [3]. Through the IoMT, smartphones with smartphone apps are often employed and connected to remote patient monitoring and mHealth. The outcomes of such platforms' medical data analytics improve the appropriateness of data analyses and reduce the time it takes to assess data outcomes. Patients who do not have access to a reliable "health monitoring system" can be monitored using networked detectors. Furthermore, by combining machine learning (ML) with wireless technology, clinicians can assess patient records and provide appropriate suggestions. This research presents a detailed assessment of IoMT's medical applications. It goes through exactly what sort of IoMT devices were employed in various therapeutic areas, as well as the techniques used to collect medical information to assist analysis and diagnosis. Figure 2 shows the IoT application in supporting diabetes treatment monitoring system.

Even in developed economies, food insecurity is a serious public health concern, especially among vulnerable populations. Following a balanced diet is a key component in preventing and managing major cardiometabolic disorders such as hypertension, hyperglycemia, and diabetes. Food insecurity, characterized as the inadequate or uncertain accessibility of safe and nutritious food, makes it far more challenging. Food insecurity can influence everyone in the family, from youngsters to the elderly, and is more common in low-income areas. The link between food and nutrition security and systemic diseases such as diabetes is becoming more popular and widespread. While the causes are not completely comprehended, there is a considerable belief that those who are vulnerable to food insecurity are often more likely to experience negative health outcomes and have poor disease management [3]. The development of decreased nanosensors, such as "Continuous Glucose Monitoring" (CGM) devices that track individuals' blood sugar levels over time, has been aided by technological advancements as depicted in the picture above. This essentially aids medical professionals in better understanding glucose fluctuation "modeling techniques" that improve DM1 therapy and management techniques by leveraging new technological developments such as "Cloud-based solutions," "Big Data," "Smart Data Analysis," and "Internet of Things" (IoT). It has been about half a century since the first attempt at creating an "artificial pancreas (AP)." The metabolic disorder is an illness that affects the bodies "Type 1 Diabetes Mellitus" (DM1) is characterized by a decrease in "pancreatic insulin synthesis," resulting in persistent hyperglycemia. Persons with DM1 must utilize capillary glucometers to measure glucose presence in the blood on a regular basis and ensure their glucose levels fluctuate [4].

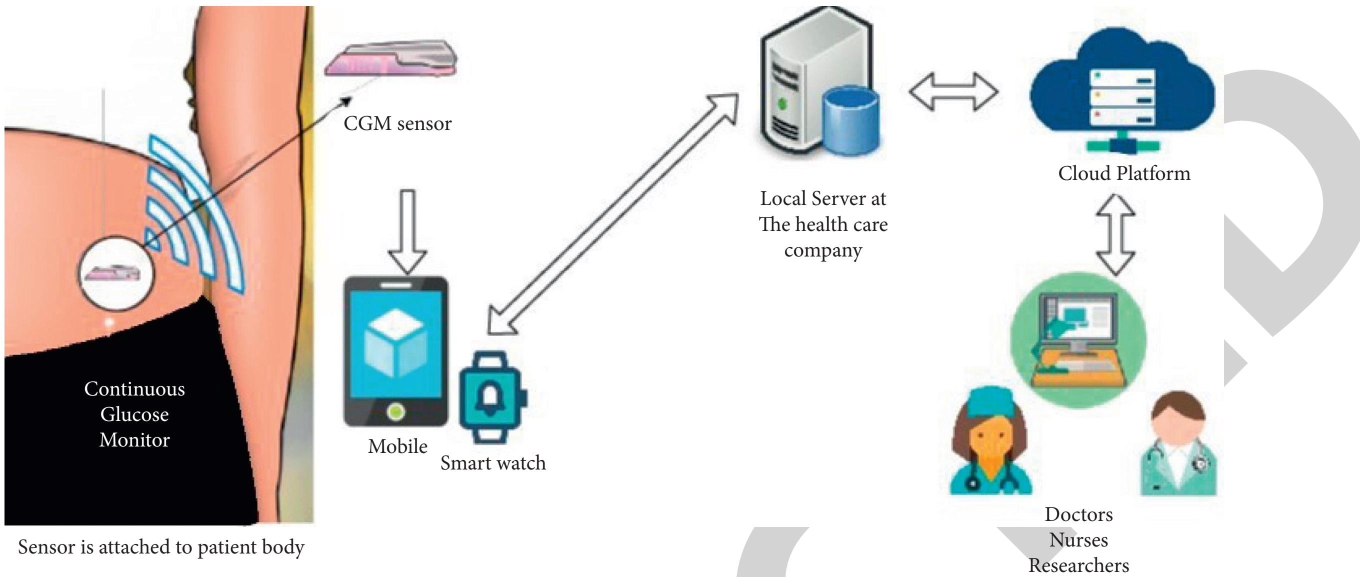


Figure 2: IoT application in supporting diabetes treatment monitoring [4].

A computer-based approach was developed to facilitate this particular purpose, which would use a mathematical model to simulate the activities of the pancreas; however, the revolutionary improvements now projected are expected to be recognized as a game-changer. These still-in-development APs are thought to include a "Continuous Glucose Monitoring" (CGM) gadget that monitors real-time glucose levels for an individual and injects the necessary insulin, guided by applying a mathematical formula capable of replicating the "optimum glycemia equilibrium" [5].

The accuracy of IoT in facilitating chronic diabetes management and assessing food safety will be evaluated in this study. To achieve the study's goals, the researchers used a linear regression analysis to see if IoT devices and artificial intelligence (AI) can aid in food safety and diabetes management. Lab findings, treatment records, AI epoch size, and image resolution of the training dataset were picked as independent variables. The precision of the IoT was one of the dependent variables. The accuracy of IoT and AI has been determined in this experiment. Furthermore, physician accuracy in diabetes treatment has been demonstrated.

*1.1. Organization.* In this study, Section 1 elaborates the discussions on about the introduction part, followed by Section 2 which elucidates the literature review. Section 3 states about the proposed methodology of the research conducted, followed by the analysis and interpretation part. The penultimate section clarifies about the discussions and findings that are conducted during the investigation, and the ultimate section is the conclusion section of the paper.

## 2. Literature Review

It is proven more necessary to obtain data systematically as well as retrieve it from the locations where it used to be, thanks to the "Internet of Things" and "Big Data Analytics" in healthcare [6]. With tremendous opportunities and possibilities, the "Internet of Things" (IoT) is changing various industries. The health sector is considered a significant area that has an immense influence on humans. While IoT technologies may be found in medical distribution networks in the healthcare industry, they have yet to be broadly implemented in other domains and services [7]. Diabetic patients have increased rapidly in the previous four decades, and this trend is expected to continue in the coming decades. The ailment currently appears to have no cure, and the lack of effective and right treatment with time can essentially cause patient fatalities. Balance between high and low GI diet is one approach to relieve symptoms through dietary adjustment. Meals with a high GI increase insulin sensitivity significantly as compared to foods with a low glycemic index. To lessen the impact on blood glucose and feel replete for longer, limit portions of high-GI foods and match them with protein sources or healthy fat. The "Internet of Things" (IoT) is being regarded as a game-changer in the healthcare industry, and the purpose of the concerned paper is assessing and studying the way IoT can enhance an individual's quality of life and aid individuals in battling chronic disorders. Digital temperature sensors, for example, transmit real-time observations to worldwide health care services. Figure 3 shows the impact of the IoT on healthcare.

Experts at the bank assess patient data on a real-time basis and release the findings to hundreds of health surveillance equipment. IoT data can be integrated with statistics, "GIS data," "land use information," "social media network warnings," and many other "Virginia Tech Network Dynamics and Simulation Labs feeds," such as Zika, in apps like Health Map and Epic Aster. Keep track of the latest concerns in global health, including H1N1 [7]. Since the "Internet of Things" is a system of interconnected devices or artifacts with sensing devices that can communicate with one another in far-flung areas to collect information without the use of a broader internet, it does not require a larger

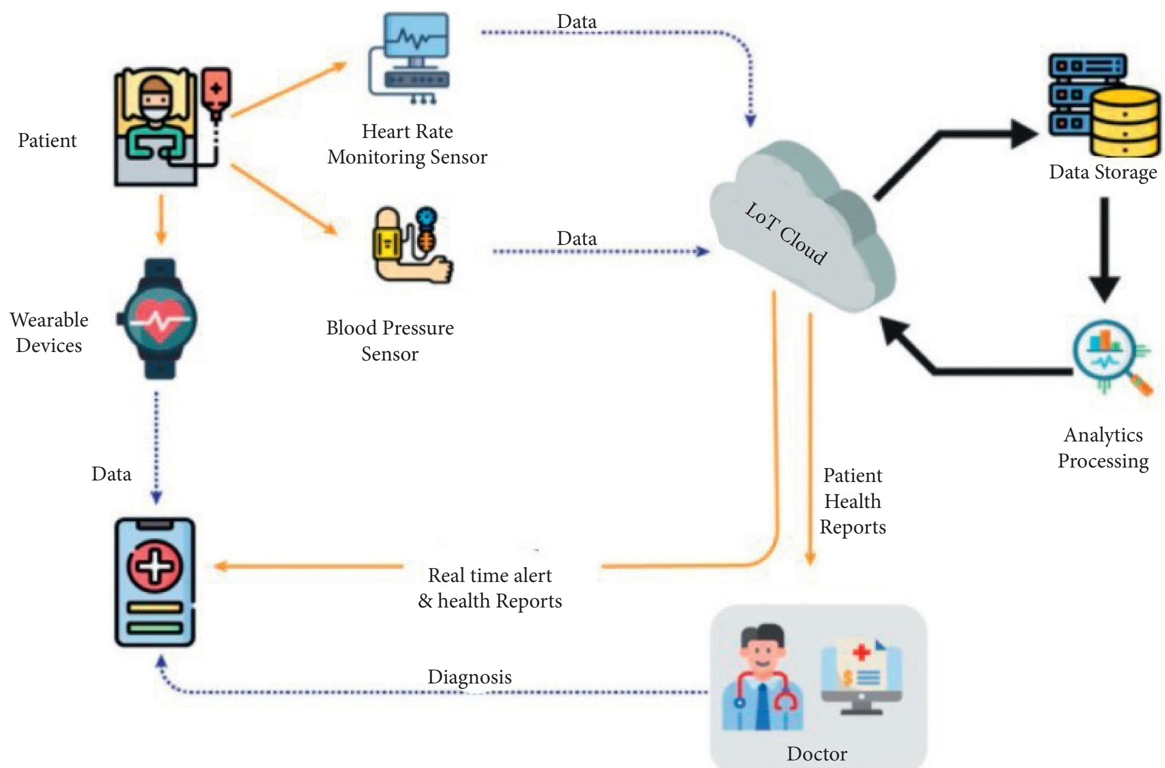


Figure 3: Impact of IoT on healthcare [7].

internet. Finally, users may link the information to a larger network to interact with the worldwide health database server and track real-time sickness and perform predictive modelling to prevent it from spreading. Nowadays, transportable healthcare systems play an important part in a variety of situations, including continuous monitoring of people's health, traffic flow management, weather prediction, smart homes, and more. These gadgets also generate and keep vast amounts of information in the cloud. The concerned chapter proposes an "Internet of Things" (IoT) system for storing and processing data from flexible sensors (Big Data) for smart healthcare.

The purpose of food safety, according to the World Food Summit, is to ensure that everyone has access to reliable, nourishing, and sufficient food to meet their dietary needs and requirements to lead a healthy and active life [8]. In modern times, food safety plays an essential part in the economy and trade of the food sector. Furthermore, in both underdeveloped and developed nations, it is crucial for human health [9]. AI, ML, Big data, blockchain, etc., have found their applications in identifying, sorting, and determining safety in food products that fasten this screening process, ultimately benefiting the food industry [10, 11]. Food-borne illnesses, pathogenic genomes, and emerging dynamic data, such as literary, commercial, and market data, have seen developing machine learning applications, such as antibiotic-resistant forecasting, pathogen source tracing, and food-borne epidemic identification and vulnerability assessment [12]. One of the most important benefits of AI, ML, and blockchain applications is that they may effectively prevent mistakes while also increasing accuracy and reliability. The knowledge obtained before and a collection of methods are used to guide 'AI's judgments at each phase. Such mistakes can be eliminated if correctly coded. In 'today's world, these applications are crucial to the food 'industry's profitability and trade. Although user engagement is low, the IoT applications give 'consumers' users information in great depth. As a result, consumers have less security.

The number of people aged 65 and older is expanding at a greater rate than any other age group around the world. As per the "World Health Organization" (WHO), people aged 60 and above will approximately double between "2015 and 2050," from "12 percent to 22 percent." Nearly 80% of older persons have at least one chronic condition, with 77% having two or more [13]. The continuous glucose monitoring chart is shown in Figure 4.

The "Internet of Things" (IoT) is rapidly developing FUNCTIONING that is bringing a dramatic transformation to a variety of industries, especially healthcare. It is to be seen that the concept "Internet of Things" can be characterized as an overarching framework that encompasses a variety of areas relating to the implication of the internet and other digital into the physical world through the massive implementation of spatially distributed gadgets with integrated recognition, detecting, and/or actuation functionality, enabling a new category of apps and data.

Especially with the emergence of advanced communication standards particularly built for IoT systems, such as "NB-IoT," "LoraWan," or "Sigfox," such applications will tend to develop. Furthermore, the most recent advancements in IoT network connectivity, such as the 3GPP

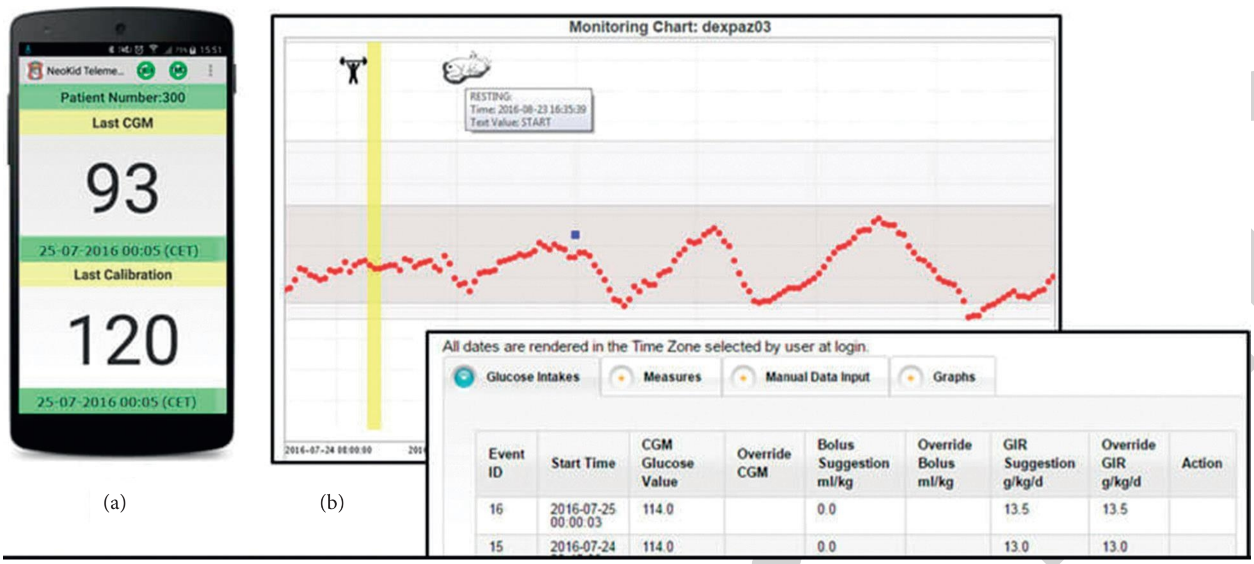


Figure 4: Continuous glucose monitoring chart [13].

framework (5G IoT), are strategically positioned to enable "low-power," "low-data rate," and "broad-area coverage cellular connectivity" to a wide range of IoT devices [14]. Smart healthcare equipment (e.g., tracking "blood pressure," "glucose metres," "temperature monitoring," "weight scales," etc.) and activity trackers (e.g., "ECG," "accelerometer," "SPo2," "pulse rate," etc.) are becoming more popular, with qualities such as lower power consumption, compact size, adaptability, and simplicity of use. Wearable sensors have steadily evolved into accessories (e.g., wristbands, rings), smart clothes, body attachments, and penetrations (e.g., "insulin pumps," "implanted devices,"), along with improvements in biosensors, smart textiles, smart clothes, or e-textiles, which are made up of appropriate textile elements that are connected and have been developed together [8].

"Implantable sensors" including biomedical applications for remote diagnosis and management have been developed thanks to remarkable advances in low-profile biosensors, nanotechnology, and materials [15]. The volume of sensing devices, battery capacity, and the advancement of flexible and appropriate types of electronic gadgets that can constantly and invisibly supervise the activities of individual and biomedical indicators without obstructing people's everyday routines were all overcome during this advancement. Wireless transmission system technologies, such as Bluetooth, Zigbee, infrared, RF identification (RFID), Wi-Fi connectivity, and near-field communication (NFC), are included in wearable technology [16]. These technologies enable devices to link to other connected devices (such as a smartphone) for online diagnosis and management, resulting in higher-quality treatment.

During the last few years, in-home remote monitoring apps have grown to describe a wide range of healthcare issues [17]. They aspired to deliver more efficient and productive healthcare services, resulting in higher living standards and cost savings. The variety of mHealth smartphone apps aimed at remote access and self-management of different diseases has risen dramatically, allowing patients to better control their health problems and live independently [18]. Its goal is to empower people via prevention of illness, prevention and treatment, and self-management of their conditions. These are "invasive" and "noninvasive" sensors that help detect biological signals and abnormalities in the living situation. Biological signals are influenced by a person's lifestyle, mental health, and medical diseases (such as diabetes, COPD, cancer, and mental illness). Some factors, including glucose level, blood pressure, temperature, ECG, and weight, must be managed and controlled in such medical circumstances [19]. Figure 5 shows the usage of IoT in healthcare systems.

As a result, sensing devices to measure these conditions are required. The living environment is determined by the assistive living technology that persons require, such as personal alarms, sensor mats, cameras, and other similar devices. These sensors can be connected to wireless transmission modalities such as "RFID," "NFC," "Bluetooth," "BLE," "Wi-Fi," and "ZigBee" to enable transmission of the measured data to the outside world [20]. To facilitate compatibility and connection with software, the majority of these sensing devices are built to digital communications specifications. This research suggests that IoT can aid in remote patient monitoring, including continuous glucose testing, and can also assist patients in leading healthier lives by analyzing their behaviour and diet. CGM ("continuous glucose monitoring") is a better way for diabetics to evaluate their glucose levels in real time. The CGM monitors the patient's blood glucose levels and is connected to an insulin pump that suspends insulin infusion automatically. Numerous CGM systems that are based on IoT-based technologies have been proposed earlier. These devices capture glucose information and put it in a clinical computer system, enabling medical professionals to receive information from respective patients in real time [21].

Many folks these days are having difficulty sustaining a healthy diet as a result of changes in lifestyle and increased

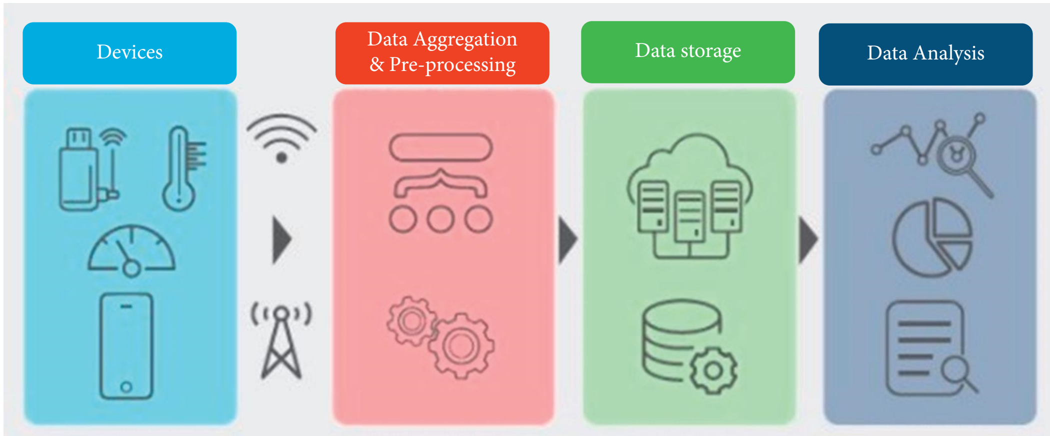


Figure 5: Usage of the IoT in healthcare [20].

work load, and as a result, there is a substantial rise in chronic conditions. The Japanese Cabinet enacted the 5th Science and Technology Basic Plan in January 2016, which included a basic concept termed "Society 5.0." It is an information society that aspires to be a wealthy, sapient society with the ability to address a wide range of difficulties in areas such as transportation, healthcare, agriculture, food, manufacturing, emergency preparedness, energy, and many more. Cyberspace (virtual space) and physical space are highly converged in Society 5.0 (real space). AI, IoT, cyber-physical systems, VR/AR, big data analytics, Blockchain, and other modern technologies are critical to accomplishing the aims of a super smart society. A society that can respond to the different demands in depth by distributing essential goods and services to those that need them. A remarkable society will emerge, employing internet devices to tackle societal problems and achieve wealth. This will add incremental benefits to people's life, employment, and community engagements, and emissions reductions are required to achieve a viable future. These digital technologies have the potential to improve health while also making healthcare more accessible and cost-effective [22]. This work offers a blueprint for monitoring the patient's health with diabetes mellitus, a condition that affects a lot of people, mainly the aged as well as young. Research to the present clinically proven technology for ongoing diabetes testing is detailed in detail [23].

Many continuous glucose monitors have evolved since the first CGM was introduced and made accessible in 1999 to become more precise and user-friendly. CGM has been shown to reduce long-term issues in patients by 40% to 75% of the time, according to statistics. As per the "World Health Organization," 30 minutes of daily movement can hopefully minimize or postpone the incidence of type 2 diabetes. A balanced diet, which avoids sweets, is also essential for achieving and maintaining weight. The patient's activity level may be readily monitored using IoT technology such as fitness trackers or wristband sensors [23]. Smart watches can track how many steps you take, how far you walk, how many calories you burn, how fast you walk, how much time you spend active vs sedentary, and so on. Some of them even include diet-tracking features. Researchers have created a wearable sensor that can be attached to a single tooth and track the user's food based on biochemical processes in their mouth.

The sensors use a wireless connection to interface with a smartphone and provide data on glucose, alcohol, and sodium intake [24]. The information gathered by the watch/wristbands may be readily transferred to linked software, providing a full picture of the patients' movement and nutrition. The use of "radio frequency identification" (RFID) technology to enhance "healthcare delivery" in hospitals and at home is thought to offer large promise. This technology transmits information from an embedded controller attached to an object using electromagnetic radiation to determine and track the thing inside the infrastructure. RFID tags, according to researchers, might be used to create accessible health records. The continuous information link RFID function has also been used to track mobility and psychological data in old people's homes [25].

## 3. Methodology

The research has followed both primary and secondary research approaches to meet the objectives. The research objective is to identify whether IoT is beneficial in terms of detecting chronic diabetes and its management and assessing food safety. Past studies showed that chronic diabetes is responsible for affecting the "quality of life" of humans. Thus, researchers are trying to improve the accuracy of diabetes detection and its management through implementing several technologies. One interesting technology that has been selected here is IoT and its respective devices to manage chronic diabetes and a patient's dietary intake. This research is going to identify whether IoT can better manage chronic diabetes among adults or not.

Initially, the researchers selected a primary research approach that follows regression analysis. The regression analysis has been done to understand whether the trained model is beneficial in predicting and managing chronic diabetes or not; in the meanwhile, it also assesses and determines safe and healthy food products. The regression model is trained with various input datasets that will determine the accuracy of the IoT system. For example, the input lab test values, input training images, and textural datasets have been used to train the regression model. These values can also be used to train other artificial intelligence based algorithms for better management of diabetes. Usually, different IoT devices are used to monitor and track the blood glucose levels of adults. These data are collected by the healthcare sector to manage the chronic diabetes of adults.

In this research, the patient data have been collected from the NHS-UK database (england.nhs.uk database of 2013) to train the regression model. A total of 20 experiments have been executed by increasing the order of lab test value, textural data, and image dataset. After that, the accuracy of IoT in diabetes management has been observed.

The independent variables for the regression analysis are as follows: lab test values, dietary requirements and changes, treatment records, image resolution, and epoch size.

Dependent variables selected are as follows: The accuracy of IoT in chronic diabetes management, the accuracy of IoT in ascertaining the safety of food products, and the accuracy of doctors.

An accuracy based on these two criteria has been selected to compare the accuracy. Apart from this, research has identified the accuracy of an IoT device "The Eversense Continuous Glucose Monitoring System" (CGM) in monitoring blood glucose levels in adults. A total of 20 cases have been observed and the accuracy of CGM devices has been recorded.

After the execution of linear regression analysis, the research has moved forward with a descriptive analysis to identify the maximum and minimum accuracies of IoT technology, doctor's view, and CHM systems.

Random and purposive sampling techniques have been selected to collect random patient data to train the regression model. The purposive sampling technique has been used to draw judgments based on the findings from the analysis. Apart from providing the judgments of the researchers, secondary data has been analyzed as well. The researchers have selected journal articles from the last five years (2018–2022) to accomplish the research objectives. The reason for the secondary analysis is to validate the primary research findings. Findings from the primary research may not be 99% accurate, and thus, other available research findings have been observed to understand the sensitivity and specificity of the current model. The research framework is shown in Figure 6.

### *3.1. Research Questions*

What is the comparison between the accuracy of IoT and doctor-based chronic diabetes management?

What is the mean, minimum, and maximum accuracy of a CGM device?

Is IoT better than the traditional system to manage chronic diabetes in adults?

Is IoT effective in ascertaining nutritious food safety in managing chronic diabetes?

## 4. Analysis and Interpretation

*4.1. Primary Data Analysis.* The primary data have been analyzed with regression analysis with four independent and two dependent variables. The impact of lab test values, treatment record training, image resolution, and epoch size on the accuracy of IoT devices and the accuracy of doctors has been analyzed. A linear regression analysis has been performed at a 95% confidence level to measure the statistical significance.

According to the above value in Table 1, the mean value of the accuracy of CGM devices is 89.75 and the accuracy of doctors is 70.75. The mean accuracy of IoT devices is 86.65, and the standard deviation (SD) is 7.513. The SD of "accuracy of doctors" is 17.621, which is higher than the SD of the accuracy of IoT devices. Thus, it can be observed that the value of "accuracy by doctors" has deviated more from its mean value compared to the mean accuracy of IoT devices.

Table 2 shows the regression analysis between all four independent variables and one dependent variable which is the accuracy of doctors. The $R$ square value is observed at 0.273 and the adjusted $R$ square value is 0.013. This low $R$ squared value indicates a scattered value which again dictates nonstatistical significance.

The above analysis in Table 3 has been done between the independent variables and the accuracy by doctors. According to the above ANOVA regression analysis, the significance value is 0.428, which shows a statistical nonsignificance.

Figure 7 shows the histogram analysis between the independent variables and the accuracy of doctors and a symmetrical curve.

Table 4 shows the regression analysis between all four independent variables and one dependent variable which is the accuracy of IoT devices. The $R$ square value is observed at 0.989 and the adjusted $R$ square value is 0.986. This high $R$ squared value indicates a less scattered value which dictates statistical significance.

According to the above value in Table 5, the statistical significance value between the four independent variables and the accuracy of IoT is 0.000, which shows a strong statistical significance. Therefore, from the regression analysis, it can be stated that the lab test value, treatment record chain, image resolution, and epoch size have statistical significance to the accuracy of IoT devices.

Figure 8 shows the histogram analysis between the independent variables and the accuracy of IoT devices and a symmetric curve.

## 5. Discussion and Findings

To accomplish the research objectives, the researchers performed a linear regression analysis to understand whether IoT devices and Artificial Intelligence (AI) assist in assessing food safety and diabetes management. The independent variables selected were lab test values, treatment records, epoch size of AI, and image resolution of the training dataset. Dependent variables were the accuracy of IoT. Here, the accuracy of IoT and AI has been determined.

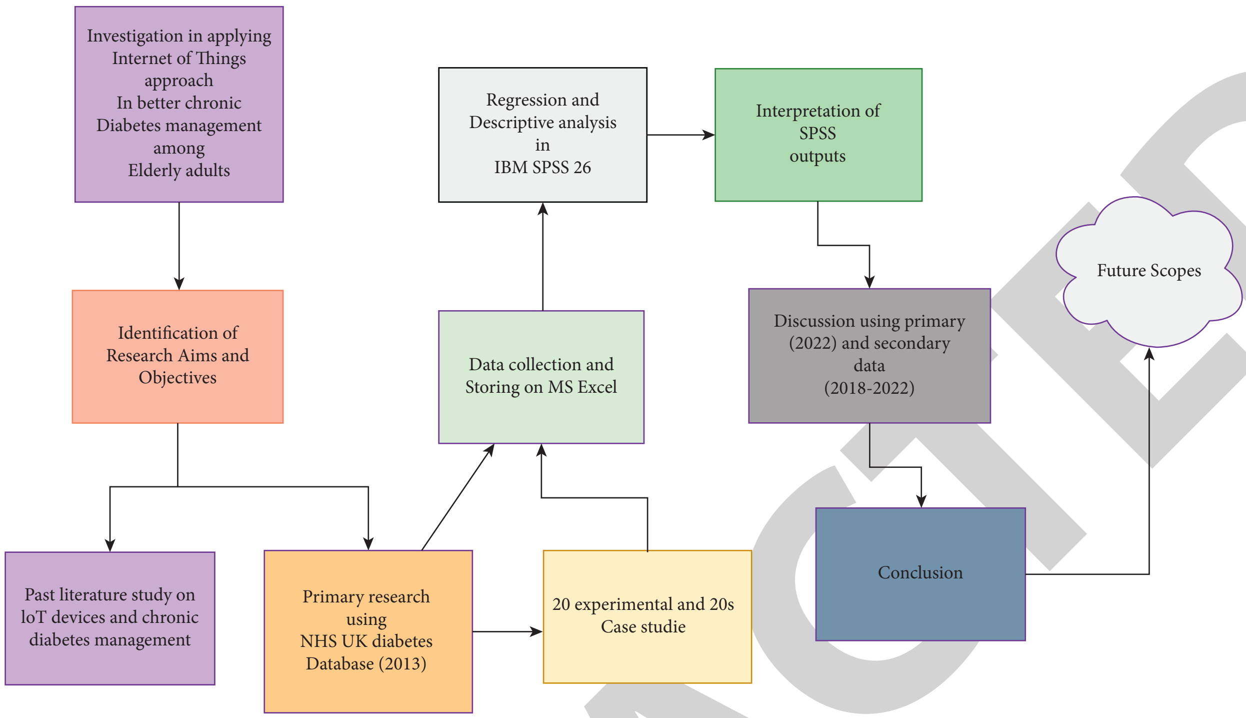


Figure 6: Research framework.



Table 1: Descriptive statistics.

| | Descriptive statistics | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *N* | Minimum | Maximum | Mean | | Std. deviation | Variance | Skewness | |
| | Statistic | Statistic | Statistic | Statistic | Std. error | Statistic | Statistic | Statistic | Std. error |
| Experiment ID | 20 | 1 | 20 | 10.50 | 1.323 | 5.916 | 35.000 | 0.000 | 0.512 |
| Lab test values | 20 | 2 | 46 | 22.80 | 3.085 | 13.798 | 190.379 | 0.145 | 0.512 |
| Treatment record train | 20 | 50 | 407 | 317.65 | 21.629 | 96.728 | 9356.345 | −1.823 | 0.512 |
| Image resolution | 20 | 96 | 1024 | 539.20 | 74.422 | 332.826 | 110773.221 | 0.150 | 0.512 |
| Epoch size | 20 | 50 | 157 | 95.10 | 7.539 | 33.717 | 1136.832 | 0.240 | 0.512 |
| Accuracy of IoT devices | 20 | 68 | 97 | 86.65 | 1.680 | 7.513 | 56.450 | −0.790 | 0.512 |
| Accuracy of CGM system | 20 | 74 | 99 | 89.75 | 1.736 | 7.765 | 60.303 | −0.544 | 0.512 |
| By doctors | 20 | 24 | 98 | 70.75 | 3.940 | 17.621 | 310.513 | −0.924 | 0.512 |

Table 2: Regression analysis 1.

| Coefficients | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model | | Unstandardized coefficients | | Standardised coefficients | *t* | Sig. | 95.0% confidence interval for *B* | |
| | | *B* | Std. error | Beta | | | Lower bound | Upper bound |
| 1 | (Constant) | 170.322 | 64.112 | | 2.657 | 0.019 | 32.816 | 307.828 |
| | Experiment ID | 9.110 | 14.076 | 3.058 | 0.647 | 0.528 | −21.080 | 39.299 |
| | Lab test values | 0.742 | 5.215 | 0.581 | 0.142 | 0.889 | −10.444 | 11.927 |
| | Treatment record train | −0.123 | 0.123 | −0.676 | −1.004 | 0.332 | −0.386 | 0.140 |
| | Image resolution | 0.002 | 0.014 | 0.030 | 0.118 | 0.908 | −0.028 | 0.031 |
| | Epoch size | −1.828 | 1.307 | −3.498 | −1.399 | 0.184 | −4.631 | 0.975 |

a. Dependent variable: by doctor.

Moreover, the accuracy of clinicians in diabetes management has been observed. It has been found that clinicians have a high variance in accuracy (max 99%) whereas machines have a limited variance in accuracy (max. 98%). Secondary research identified that clinicians need to be involved along with IoT devices for better management of this chronic disease and to help patients by providing the safest food options. The results of the current study showed a significant result when regression analysis was carried out between the independent variables and the accuracy of IoT devices. The results suggest that the current study of training a regression model shows statistically valuable results [26].

Table 3: ANOVA.

| ANOVA | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of squares | df | Mean square | $F$ | Sig. |
| | Regression | 1608.751 | 5 | 321.750 | 1.050 | 0.428[b] |
| 1 | Residual | 4290.999 | 14 | 306.500 | | |
| | Total | 5899.750 | 19 | | | |

a. Dependent variable, by doctors. b. Predictors, (constant), epoch size, image resolution, treatment record train, lab test values, and experiment ID.

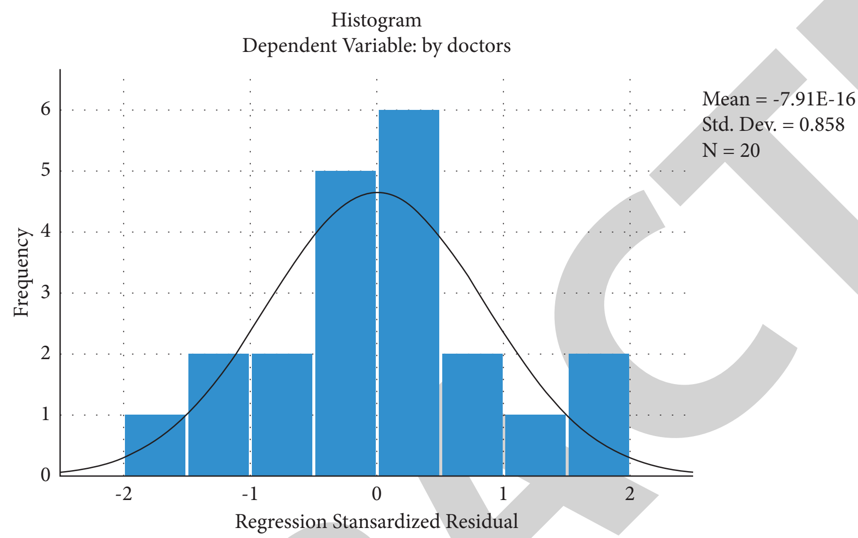


Figure 7: Histogram analysis of accuracy by doctors.

Table 4: Regression analysis 2.

| Coefficients | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model | | Unstandardized coefficients | | Standardised coefficients | $t$ | Sig. | 95.0% confidence interval for $B$ | |
| | | $B$ | Std. error | Beta | | | Lower bound | Upper bound |
| | (Constant) | 66.809 | 3.300 | | 20.245 | 0.000 | 59.731 | 73.887 |
| | Experiment ID | 0.621 | 0.725 | 0.489 | 0.857 | 0.406 | −0.933 | 2.175 |
| 1 | Lab test values | 0.000 | 0.268 | 0.000 | −0.001 | 0.999 | −0.576 | 0.576 |
| | Treatment record train | 0.036 | 0.006 | 0.459 | 5.644 | 0.000 | 0.022 | 0.049 |
| | Image resolution | 0.000 | 0.001 | 0.014 | 0.459 | 0.653 | −0.001 | 0.002 |
| | Epoch size | 0.019 | 0.067 | 0.086 | 0.286 | 0.779 | −0.125 | 0.163 |

a. Dependent variable, accuracy of IoT devices.

Table 5: ANOVA.

| ANOVA | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of squares | df | Mean square | $F$ | Sig. |
| | Regression | 1061.181 | 5 | 212.236 | 261.353 | 0.000[b] |
| 1 | Residual | 11.369 | 14 | 0.812 | | |
| | Total | 1072.550 | 19 | | | |

a. Dependent variable, accuracy of IoT devices. b. Predictors (constant), epoch size, image resolution, treatment record train, lab test values, experiment ID.

In the case of doctors, the results were not statistically significant, which suggests that the accuracy levels of doctors vary among them [27]. Not all doctors were highly significant; however, in the case of IoT devices, the complete result was significant. It suggested that IoT devices maintain a similar range of accuracy throughout various devices. The doctors were not able to provide effective management plans to mitigate chronic diabetes [28].More recent rapid increases in incidence and prevalence of diabetes could be due to a shift away from the conventional way of life in favour of westernization, which has resulted in increased body weight and decreased physical exercise. Because every day, diabetes care is predominantly managed by patients and families, self-care tactics and habits have a significant impact on blood

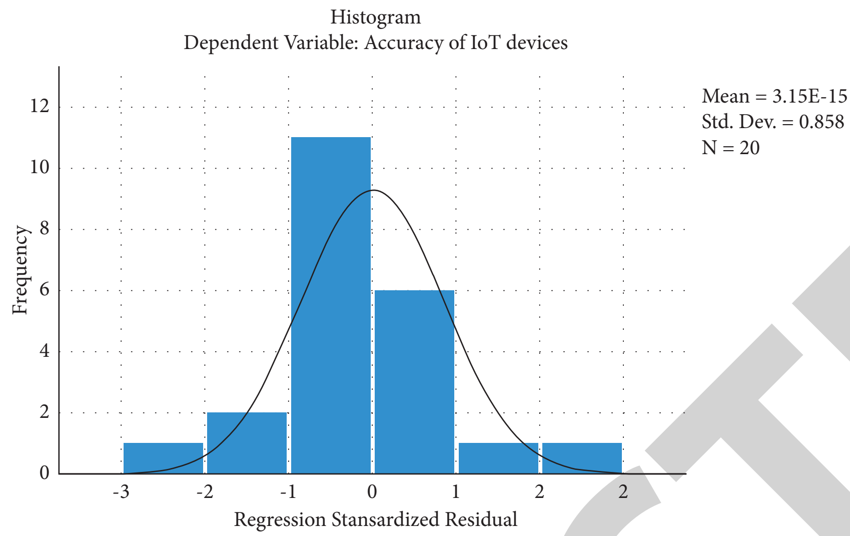


FIGURE 8: Histogram analysis of the accuracy of IoT devices.

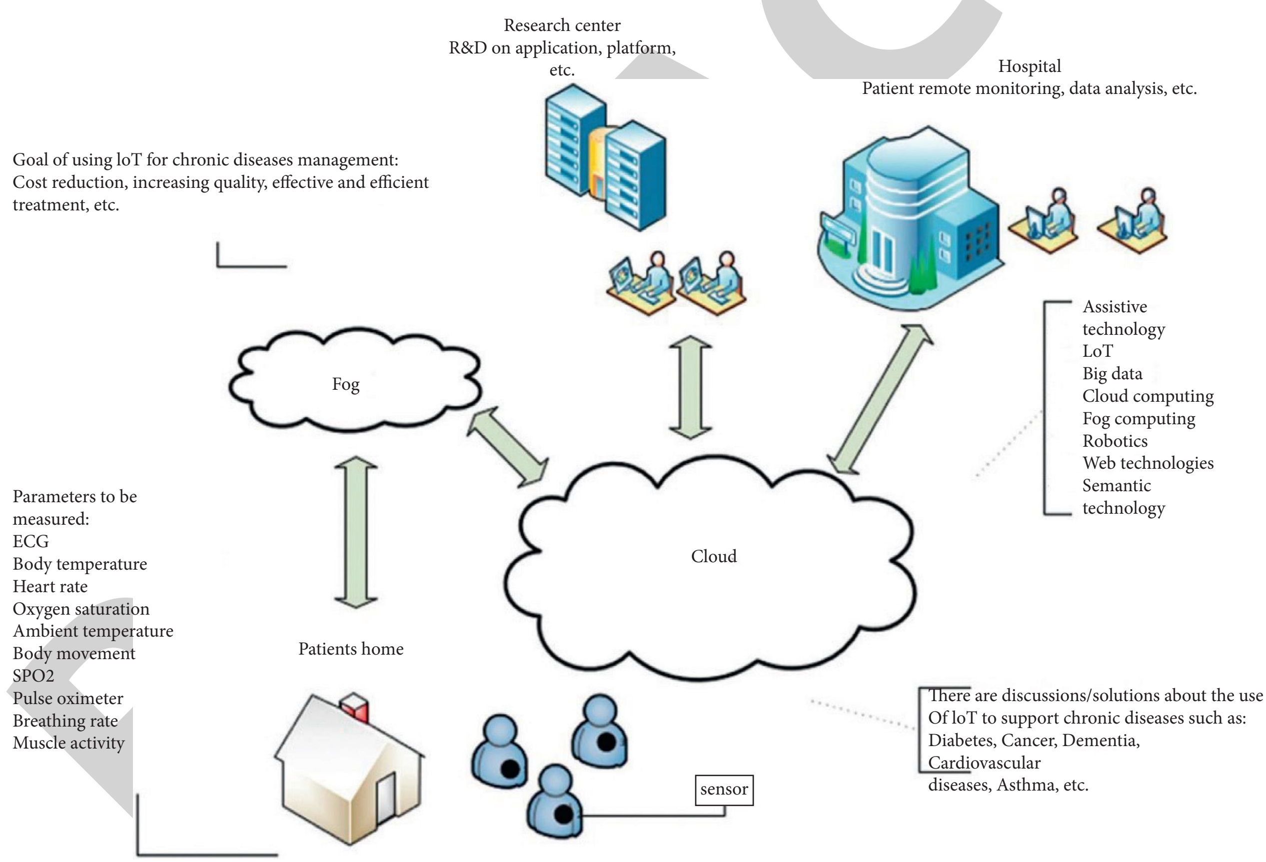


FIGURE 9: Management frameworks for chronic diabetes includes IoT sensors, laboratory tests, fog computing, cloud computing, and further research [14].

sugar control. Many health and wellbeing-associated technologies, such as software, websites, mobile applications, and social media, have emerged to help people manage their diabetes on their own [29]. Different types of devices are used to detect and monitor chronic diabetes among elderly adults [30]. The devices include the SpO2 measuring oximeter, electrocardiogram, blood pressure measuring device, and heart rate measuring device. In this study, the accuracy of CGM has been measured, which showed a maximum of 99% accuracy and a minimum of 74% accuracy. The maximum accuracy of doctors crossed 98% which is higher than IoT devices. However, the variation was higher. The entire management framework of chronic diabetes has been shown in Figure 9 [14].

Concerning this, Chatterjee et al. and coworkers suggested that IoT devices and machine-driven decisions are not enough for the effective management of chronic diabetes. The patient data, cloud data, and fog data need to be transported to the clinicians for validating the data [14]. Healthcare professionals believe that only machines, robotics, and Artificial Intelligence (AI) devices are not enough for intelligent decisions [31]. Data missing may occur during the training and testing period. Thus, doctors need to identify and justify the outputs before implementing a patient [32]. The need for IoT devices is important because clinicians cannot identify the lifestyle of the patient. The clinicians are only responsible for monitoring and observing the laboratory test reports. However, clinicians say that chronic diabetes also occurs when the lifestyle is not maintained properly. Therefore, IoT devices will be responsible for assisting adults throughout their lifestyles. It will ultimately improve the management of chronic diabetes among adults.

## 6. Conclusion

Early diabetes management is necessary to enhance the recovery rate among elderly patients. IoT devices such as CGM machines help in continuous blood glucose monitoring, assess an individual's dietary needs, and provide safe food recommendations. The accuracy of IoT in facilitating chronic diabetes management and assessing food safety has been evaluated in this study. To achieve the study's goals, the researchers used linear regression analysis to see if IoT devices and artificial intelligence (AI) can aid in food safety and diabetes management. Lab findings, treatment records, AI epoch size, and image resolution of the training dataset were picked as independent variables. The precision of the IoT was one of the dependent variables. The accuracy of IoT and AI has been determined in the above work. Furthermore, physician accuracy in diabetes treatment has been demonstrated. In this way, doctors and medical care professionals can reduce the rate of patient mortality. Moreover, the regression analysis has shown that the accuracy of IoT devices has a statistically significant relationship with the independent variables. This shows that when considering large patient data and a high number of lab test results, IoT devices have higher accuracy than traditional methods. The accuracy of doctors has been observed to be statistically nonsignificant which implies that the detection of diabetes varies among different doctors and depends upon their capacity of accurate detection. On the other hand, IoT devices can monitor blood sugar levels with the same accuracy in every patient. Therefore, it can be stated that IoT devices have a positive influence in the healthcare and food safety industries in the effective detection and management of diabetes in elderly patients. Unfortunately, the work is limited as no further investigation has been conducted into the effectiveness of diverse IoT devices. A comprehensive comparison of several IoT devices could have been carried out with the conclusions assisting scientists and health specialists in picking the finest IoT system for insulin surveillance.

## 7. Future Scope

The regression analysis has helped in analyzing the accuracy rate and effectiveness of IoT devices in diabetes monitoring. However, further research could have been done by observing the accuracy level of different IoT devices. A comparison analysis could have been done on different IoT devices, and the results would have helped doctors and medical care professionals in determining the best IoT device for diabetes monitoring. In the future, a comparison-based analysis will be performed to determine the accuracy and significance level of different IoT devices over the same patient data. This analysis will help the researcher in accurately defining the potential role of IoT devices in diabetes detection and will help researchers in determining the IoT device that has the highest accuracy. Larger datasets of different food items and their nutritional benefits would help healthcare professionals customize meal plans for diabetics and help manage the disease in the long run. Therefore, this research provides an adequate future scope for researchers to analyze the importance of diabetes monitoring and management. Continuous monitoring and management of diabetes helps medical care professionals and doctors in saving the patient from dramatic consequences of diabetes such as organ failure. Effective detection of this chronic disease has reduced the mortality rate and increased the recovery rate in diabetic patients. IoT in this way has improved the service quality in the healthcare and food sectors of the United Kingdom.

## Data Availability

The data shall be made available on request.

## Conflicts of Interest

The authors declare that there are no conflicts of interest.

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