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Ekalusugan: An Intelligent health observation system using Internet of Things

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Abstract: - In today's technological landscape, the Internet of Things (IoT) has ushered in a multitude of applications, with wearable technology and smart healthcare standing out as paramount. Amidst this backdrop, we present "eKalusugan," an innovative intelligent health monitoring system harnessed by IoT. Traditional health observation systems often fall short in catering to the needs of sick patients, a concern this study addresses through an insightful exploration of challenges and innovative remedies. Our work also delves into the evaluation of a prototype observation system, gauging user acceptance based on its novel features. Employing a mixed-methods approach, encompassing both a comprehensive questionnaire and in-depth interviews, we engaged five (5) medical experts, thirty (30) healthcare providers, and eighty (80) patients from diverse locales. This collaborative effort yielded invaluable insights into the existing gaps, such as inadequate sickness monitoring, role ambiguity, and the struggle to maintain comprehensive medical histories under the conventional model. To surmount these limitations, our proposed solution boasts two pivotal facets. First, we advocate for leveraging IoT's capabilities to streamline the creation of an intelligent health observation system. Second, we emphasize the necessity of a user-centric approach, rendering the system significantly more intuitive for medical professionals and patients alike, in stark contrast to conventional methods. Our findings underscore the potency of the eKalusugan system, with respondents lauding its functionality (rated 4.62), reliability (rated 4.52), usability (rated 4.68), and performance (rated 4.70) as either excellent or good (with an average rating of 4.59). Encouragingly, our study indicates that the envisaged system could potentially gain traction at the behest of governmental health agencies, paving the way for its integration in monitoring the well-being of sick individuals. In this era where the confluence of IoT and healthcare beckons transformative progress, eKalusugan shines as a testament to the possibilities that emerge when cutting-edge technology aligns with human well-being.

Keywords: Internet of Things, Smart Healthcare, Intelligent Patient Observation, Patient Wellness Tracking, conventional model

I. INTRODUCTION

Science has now permeated every element of people's life in a very short period of time and in a variety of packages, simplifying and enriching their lives in many ways. Many health observation system developers rely on databases because they are critical to establishing a dependable health observation system. Using the study's results, a new technique of regulating and monitoring the health observation system was devised.

For more than a decade, physicians have depended on health monitoring systems. Historical data reveal that the health observation system has gone a long way since its start. It was evident early on that having a health surveillance system in place through the internet of things would be critical for keeping track of ailments. For decades, large numbers of sick people have been inappropriately monitored in many regions of the world. IoT-basedhealth observation systems, a critical component of the healthcare industry, enable proactive m onitoring of patient health.

Throughout the years, health observation systems have been a significant help to the science of illness monitoring. The current notion of health observation prioritizes lowering the occurrence of unplanned disease in order to reduce its impact on patient treatment. Let's speak about computers, eternal observation systems, and automated monitoring gadgets that might make monitoring sick patients simpler. Learn how to use your knowledge of availability theory to observation management. Discuss the stages needed in early disease detection, such as the terminology required, the availability of relevant medications, the use of both automated

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and traditional health monitoring tools, and any other elements that must be considered while tracking down sickness.

Aside from processing health observation data with high integrity and ignoring commonly seen health issues. Because it may be difficult for patients to control, monitor, or detect sickness early, the author of the paper "eKalusugan: An Intelligent health monitoring system leveraging Internet of Things" suggests a technique. The useof the Internet of Things is critical to this.

II. METHODOLOGY

This study will collect data using both qualitative and quantitative methods. The present study adopts a mixed-methods approach, combining both qualitative and quantitative methods to comprehensively explore and evaluate the proposedeKalusugan system. The chosen methodology seeks to provide a holistic understanding of the existing issues and potential solutions, ensuring robust insights for system enhancement. The qualitative aspect of this study delves into the depths of the current patient monitoring landscape. In this vein, in-depth interviews are conducted with various stakeholders, including medical experts, healthcare providers, and patients. This personalized engagement allows for a nuanced exploration of the challenges inherent in conventional health observation systems. These interviews not only identify existing pitfalls but also pave the way for the identification of necessary features to be incorporated intothe new system. The quantitative facet of this research employs an International Organization for Standardization (ISO 9126) questionnaire to gauge user satisfaction with the proposed eKalusugan system. This instrument evaluates the critical aspects of usability, usefulness, reliability, and effectiveness, providing a comprehensive measure of the system's performance. By employing this approach, we aim to quantify user perceptions, corroborating qualitative insights with quantifiable data.

Additionally, this study draws inspiration from various applications of information technology in healthcare systems globally. The landscape of healthcare delivery, from patient information management to remote health monitoring, isevolving rapidly. In light of this, a synthesis of prior research, methods, and solutions is integral to the comprehensiveunderstanding and development of the eKalusugan system.

III. HEALTH PLANNING IN HEALTHCARE THROUGH RESOURCING

Healthcare professionals, including clinicians, physicians, nurses, and administrators, require robust tools to navigate and harness the advances in medical technology and strategies to ensure the delivery of high-quality healthcare services. Take, for instance, a healthcare facility that handles data across a multitude of departments, each with its own distinct needs, some of which necessitate data sharing for effective service provision. This data assumes varyingroles depending on department functions, such as administration and planning. Thus, it becomes imperative to ensure that this information is accessible to the relevant departments at the appropriate times. Recognizing the pivotal role data plays in the healthcare system, it serves as the backbone for physicians' tasks, patient home care, and continuouscare management.

Nonetheless, the amalgamation of diverse services and methods could potentially revolutionize healthcare organizations by dismantling the traditional silos that hinder information sharing. In the current landscape, disjointedstrategies have often led to inadequate information sharing. To address this issue, the implementation of integrated systems becomes pivotal, enabling healthcare institutions to streamline management processes and enhance patient care efficiency. In this context, Enterprise Resource Planning (ERP) systems hold significant promise, serving as a catalyst for improved integration of healthcare strategies and services.

A prominent research insight underscores the potential transformative impact of ERP systems within the healthcare domain. It suggests that a successful ERP implementation in a healthcare organization could catalyze significant changes, particularly in key areas such as finance, human resources, capacity management, revenue optimization, andresource allocation. The adoption of ERP has the potential to drive substantial advancements in these facets, ultimatelycontributing to the holistic enhancement of the healthcare sector.

As the healthcare landscape continues to evolve, the integration of robust ERP systems emerges as a strategic imperative. By embracing ERP solutions, healthcare organizations can pave the way for comprehensive transformations, redefining how data is managed, shared, and utilized across departments. This, in turn, has the potential to lead to improved patient outcomes, enhanced operational efficiency, and the optimal allocation of resources, thereby reinforcing the core mission of healthcare providers.

IV. PROPOSED PROTOTYPE SYSTEM

Innovative health monitoring solution designed to provide robust and automated patient condition tracking through the utilization of the Internet of Things (IoT). Our system is adept at collecting and analyzing pertinent health data, empowering it to autonomously assess patient well-being. The collected data encompasses a range of vital indicators,including temperature, movement, heart rate, blood pressure, and ECG readings. By amalgamating this comprehensive dataset, the system instantaneously transmits alerts to both the attending physician and the designated caretaker, offering real-time updates on the patient's condition. This dynamic interaction grants medical professionals and caregivers the flexibility to monitor patient health irrespective of geographical boundaries.

Central to our approach are intelligent sensors, which adeptly gather raw data from each sensor unit. This data is then seamlessly transmitted to a cloud-based server, where it undergoes in-depth analysis and statistical processing. This centralized data repository serves as a foundation for informed decision-making.

The proposed methodology is anchored in the utilization of a Raspberry Pi, a compact yet powerful computing platform. By harnessing the processing capabilities of the Raspberry Pi, we establish a robust foundation for our healthmonitoring system.

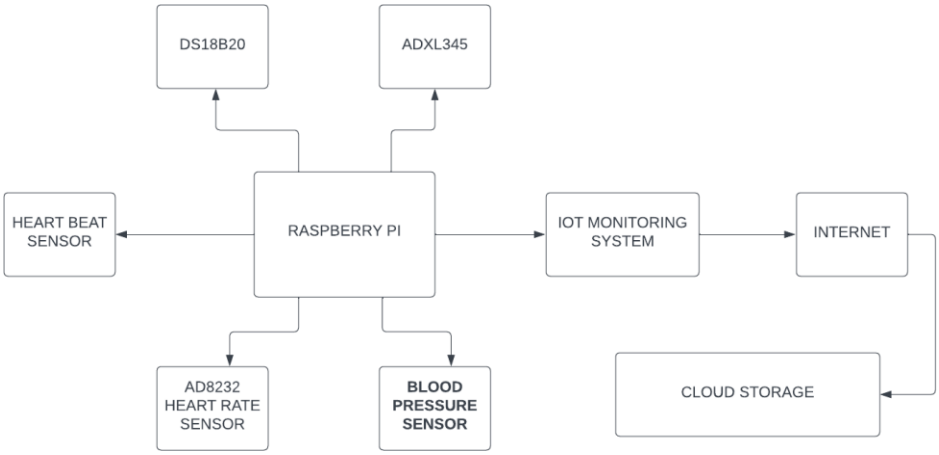

Figure 1. Block diagram

PROTOTYPE SYSTEM PARTS

Raspberry Pi

A credit card-sized computing marvel, Raspberry Pi forms the core of our system. Its series of single-board computers provide the computational backbone for our health monitoring solution. While it doesn't include inherent input devices, additional hardware can be seamlessly integrated.

Temperature Sensor - DS18B20

The DS18B20 sensor is our gateway to precise temperature measurements. Notably, this sensor reduces the hardwareand wiring complexity associated with temperature measurement. Through a digital protocol, it conveys accurate temperature readings directly to the development board.

Heartbeat Sensor (Calculates BPM)

Our system integrates a heartbeat sensor to determine the beats per minute (BPM). By calculating the heart rate, the system gauges the body's physiological state, reflecting elements like oxygen intake, carbon dioxide excretion, physical activity, stress, and more.

Accelerometer Sensor (ADXL345)

ADXL345, a 3-axis digital output accelerometer, enriches our solution with position and location data. Its low powerconsumption and inherent properties render it versatile across diverse applications.

ECG Sensor (AD8232)

The AD8232 ECG sensor captures the heart's electrical activity over a specific period. Electrodes placed on the skin capture minute electric changes, revealing the heart's electro-physiological pattern. This cardiology assessment is commonly employed for diagnostic purposes.

Blood Pressure Sensor

Inclusion of a blood pressure sensor is instrumental in measuring key blood pressure metrics, including systolic, mean arterial pressure, and diastolic values. Employing the oscillometric process, this sensor accurately gauges blood pressure parameters.

Cloud Computing Sensing Process

Our system leverages cloud computing, an internet-based paradigm, to provide shared processing and data resources to devices on demand. By facilitating ubiquitous access to configurable computing resources and storage, the cloud enhances the system's capacity for seamless data management and processing.

V. RESULTS AND DISCUSSION

Challenges of Conventional Health Observation for Unwell Individuals

Through in-depth interviews, participants illuminated significant challenges inherent in conventional health observation methods for patients in compromised health conditions. Three pivotal issues were identified and expounded upon:

1. **Inadequate Sickness Monitoring**

The traditional health observation systems were shown to have the potential for inadequate monitoring of patients' health conditions, raising concerns about accurate data collection and interpretation.

2. **Duplication and Confusion**

Participants highlighted instances of data duplication and confusion within the traditional health observation system, signifying inefficiencies in data management and the need for improved organization.

3. **Maintenance of Sickness Records**

The traditional approach demonstrated challenges in maintaining comprehensive and accurate records of patients' medical histories, casting a spotlight on the importance of streamlined data management.

Addressing Challenges and Building Effective Features

The insights gathered from respondents shed light on crucial features that could be developed to overcome the aforementioned challenges:

1. **Leveraging the Internet of Things (IoT)**

The unanimous consensus among respondents was that integrating IoT technology could substantially expedite and optimize the health observation process. This integration was anticipated to enhance the precision of data collection, thereby improving overall accuracy and effectiveness.

2. **Intelligent Health Observation System**

Respondents collectively supported the transition to an intelligent health observation system, one driven by IoT principles. This shift was perceived as highly advantageous, particularly due to its potential to enhance user experiences for medical professionals, including doctors and nurses, as well as for patients.

Discussion on Implementation Medium

While the focus of this section primarily revolves around the challenges, solutions, and acceptance of the proposed system, it is essential to provide insight into the implementation medium that facilitates these advancements. The proposed intelligent health observation system relies on a seamless integration of advanced

sensor technologies, data processing components, and cloud-based solutions. These elements synergistically interact to ensure real-time data acquisition, analysis, and remote access to patient information.

The incorporation of Raspberry Pi as the computational core, intelligent sensors for data collection, and cloud computing for data storage and processing are pivotal aspects of the implementation medium. Through these interconnected components, the proposed system achieves its overarching goal of delivering effective, real-time health observation capabilities.

Respondents' level of acceptance toward the developed systemFunctionality

The findings underscore a high degree of acceptance for the functionality of "eKalusugan: An Intelligent Health Observation System Using the Internet of Things." The robust aggregate mean score of 4.62 demonstrates strong agreement among respondents regarding the system's efficacy in delivering its intended functionalities.

Reliability

The results emphasize a significant level of trust in the system's reliability. With a total mean score of 4.52,respondents' positive perceptions of the dependability of the system are evident.

Usability

Participants expressed a high degree of trust in the usability of the system, as reflected in the "Very Good" degree of agreement. The system's user-friendly nature resonated well with respondents, corroborated by the total mean score of 4.52.

Performance

The findings highlight the respondents' substantial satisfaction with the system's performance. The "Very Good" degree of agreement, combined with an aggregate mean score of 4.59, underscores their endorsement of the system'sperformance.

Summary

Collectively, respondents' robust overall approval of "eKalusugan: An Intelligent Health Observation System Using the Internet of Things" is characterized by an impressive mean score of 4.61. The analysis and discussions affirm thesystem's effectiveness and its potential to revolutionize patient care through the seamless integration of IoT technology.

VI. CONCLUSION

This study has derived into the development and evaluation of "eKalusugan: An Intelligent Health Observation System Using the Internet of Things," a revolutionary healthcare solution. The investigation unearthed pivotal challenges inherent in conventional health observation methods and paved the way for a comprehensive exploration of viable solutions.

Addressing these challenges, respondents unequivocally advocated for the integration of the Internet of Things (IoT)to streamline the health observation process. By adopting an intelligent health observation system based on IoT principles, the study posits the potential for transformative enhancements in patient care and healthcare management.

Furthermore, an important addition lies in the implementation medium, which forms the cornerstone of the proposedsystem's functionality. The synergy among advanced sensor technologies, Raspberry Pi's computational prowess, and cloud-based data processing ensures real-time data acquisition, analysis, and remote access to critical patientinformation. This integration signifies a crucial stride towards optimized healthcare delivery.

The integration of wireless network sensors and cloud computing introduces an innovative paradigm that resonates across various dimensions, including cost-effective patient monitoring, reduction of occupied hospital beds, and heightened clinical staff efficiency. This confluence of technologies promises to revolutionize healthcare management,propelling it towards a more efficient and patient-centric future.

As we look to the future, there lies a promising trajectory for this system's evolution. By augmenting the system

withadditional sensors and scaling its deployment to encompass a wider sample size of patients, its capacity and impact could be exponentially enhanced.

In summary, "eKalusugan: An Intelligent Health Observation System Using the Internet of Things" holds the potential to reshape the healthcare landscape by leveraging cutting-edge technology for superior patient care, efficient data management, and a seamless integration of IoT-based health observation processes.

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