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Revolutionizing Wellness: The IoT Smart Bottle for Health Monitoring

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ABSTRACT

Intelligent and health-focusedIoT project designed to monitor and provide information about the contents of a bottle, such as temperature and water level. This system utilizes a DHT11 sensor for temperature monitoring, an ultrasonic sensor for water level detection, and an LCD to display real-time information. The project aims to promote health awareness by allowing users to monitor the temperature of liquids and ensure anadequate water supply in their bottles.

The smart bottle's sensors detect when the medication is dispensed, and thedata is transmitted to a centralized platform via a secure IoT network. This not only assists healthcare professionals in tracking patient compliance but also facilitates personalized healthcare by enabling timely adjustments to treatment plans. With the ability to send alerts and notifications to both patients and healthcare providers, the Smart Bottle Health Care using IoT enhances patient engagement, fosters medication adherence, and ultimately contributes to better health outcomes. This innovative solution holds great potential in transforming medication management, particularly for individuals with chronic conditions who require consistent and precise dosage adherence for effective treatment.

Through continuous monitoring and data analysis, the IoT-enabled smart bottle not only ensures timely medication reminders but also provides a holistic view of patients' medication adherence trends. This data-driven approach empowers healthcare providers to make informed decisions, intervene proactively, and tailor treatment plans for improved patient outcomes. The system's ability to send notifications and alerts fosters a collaborative healthcare ecosystem, engaging both patients and caregivers inthe medication

Keywords: DHT11 Sensor,Ultrasonic Sensor, Buzzer

1. INTRODUCTION

Smart Bottle Health Care using IoT heralds a groundbreaking fusion of healthcare and technology, aiming to revolutionize medication adherence. In response to the persistent challenge of patients forgetting or mismanaging their medication, this innovative solution employs the Internet of Things (IoT)to create an intelligent and connected medication dispensing system. The smart bottle, equipped with sensors and connectivity features, becomes an active participant in healthcare by

monitoring and transmitting real-time dataon medication usage.

This transformative technology offers healthcare providers, caregivers, and patients unprecedented insights into medication adherence patterns through acentralized cloud platform. The system goes beyond conventional reminder systems, allowing for proactive intervention and personalized healthcare management. By seamlessly integrating IoT, Smart Bottle Health Care not only enhances patient engagement but also enables healthcare professionals to make data-driven decisions for optimized treatment plans. This introduction encapsulates the essence of a solution poised to elevate medication management, promising a future where connectivity and intelligence convergeto improve health outcomes and patient well-being.

2.LITERATURE REVIEW

A literature review on Smart Bottle Health Care using IoT reveals a burgeoning field at the intersection of healthcare, Internet of Things (IoT), and medication management. Researchers have explored the integration of sensor-equipped bottles to address medication adherence challenges, a critical issue in chronic disease management.

Various studies emphasize the potential of IoT technologiesin enhancing patient outcomes and healthcare efficiency. Existing literature highlights the importance of real-time monitoring and data analytics for understanding patient behavior and improving treatment strategies.

Research articles delve into the technical aspects of smart bottle design, emphasizing the incorporation of sensors, connectivity protocols, and secure data transmission mechanisms. Studies also explore the usability and acceptability of smart bottles among diverse patient populations, considering factors such as age,health literacy, and technological proficiency. The literature underscores the role of cloud-based platforms in aggregating and analyzing medication adherence data, providing healthcare professionals with actionable insights forpersonalized care.

Furthermore, the literature survey sheds light on the impact of Smart Bottle Health Care on healthcare systems, including potential cost savings, reduced hospitalizations, and improved overall patient well-being. Researchers are actively exploring the ethical considerations, data privacy concerns, and regulatory aspects associated with deploying IoT in healthcare contexts. Overall, the literature reveals a promising landscape where the convergence of IoT and healthcare is poised to revolutionize medication management, offering innovativesolutions to improve patient outcomes and enhance the efficiency of healthcare delivery, Researchers have delved into the intricate technical aspects of smart bottle design. This includes the development and integration of various sensors such as weight sensors, pressure sensors, and RFID technology. Connectivity protocols, ranging from Bluetooth to low-power wide-area networks (LPWANs), are investigated for their suitability in ensuring seamless communication between smart bottles and centralized cloud platforms. Encryption and security measures to protect patient data during transmission and storage are also explored

3. EXISTING SYSTEM

Healthcare industry is becoming expensive day by day, but the number of diseases has also increased. IoT associated gadgets are procuring huge potential nowadays because it is abating the human effort for a certain task which is repetitive. Low-cost IoT products make the system less expensive for patients rather than appointing more staff for tedious work. Healthcare Industry is becoming costlier day by day but the number of patients and diseases is still increasing which causes the overload on the staff as well as abates quality of treatment given nurse station. Blynk mobile application is very user-friendly for hospital staff to monitor many patients simultaneously.

Several works are being done to monitor the saline water level which includes the use of a weight sensor [1] wherein the weight of the saline bottle is being continuously measured but it doesn't include the clamping mechanism, whereas in [2]

IR based sensor is used in which output voltage changes when IV is below some threshold; comparator then compares the output with a predefined threshold. In [3], the drip rate is being measured with the use of an optical sensor and a motor, and an actuator to clamp the tube. The firm called shiftlabs has developed a device named 'dripassist infusion rate monitor' wherein it counts drops flowing through the IV tube and is attached to the cannula.

In [4], presented a design study that proposed a system made by electromechanical components. in this design, Spring acts as a weight sensor for monitoring the saline solution. In [5], presented a design study that proposed a system that is built using the Arduino microcontroller. The proposed system comprises an IR sensor that acts as a level detector for monitoring the critical level of the saline in the

saline bottle. From, his study the IR sensor-based approach formeasuring saline level is understood. In [6], presented a design study that proposed that calibrates the weight of the saline bottle with the volume of saline solution. This saline monitoring system sends an alert to the nurse station when the saline solution weight is below a threshold level as calibrated in the program.

In this work, a new and low-cost approach is used where LEDs and photodiodes are used as sensors and detectors respectively, also clamping mechanism is developed where it will clamp the tube when the saline bottle would be limited.

4. PROPOSED SYSTEM

The proposed Smart Bottle for Health care using IOT with Blind stick is an innovative stick designed for visually disabled people for improved navigation. We here propose an advanced blind stick that allows visually challenged people to navigate with ease using advanced technology. The blind stick is integrated with ultrasonic sensor along with light and water sensing. Our proposed project first uses ultrasonic sensors to detect obstacles ahead using ultrasonic waves. On sensing obstacles the sensor passes this data to the microcontroller. The microcontroller then processes this data and calculates if the obstacle is close enough. If theobstacle is not that close the circuit does nothing. If the obstacle is close the microcontroller sends a signal to sound a buzzer. It also detects and sounds a different buzzer if it detects water and alerts the blind. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today.98 percent of all microprocessors are manufactured as components of embedded systems. with general-purpose counterparts are low power consumption, small size, rugged operating ranges, and low per-unit cost. This comes at the price of limited processing resources, which make them significantly more difficult to program and to interface with. However, by building intelligence mechanisms on the top of the hardware, taking advantageof possible existing sensors and the existence of a network of embedded units, one can both optimally manage available resources at the unit and network levels as well as provide augmented functionalities, well beyond those available

KEY FEATURES:

ARDUINO NANO

Arduino can control the environment by receiving input signals (Digital/Analog) and can effects its surroundings by controlling lights, relays andotherdevices. ‘

The microcontroller on the board is programmed using Arduino software.On sensing obstacles the sensor passes this data to the microcontroller.

4.1.1DHT11 SENSOR:

The DHT11 sensor plays a crucial role in Smart Bottle Health Care by monitoring environmental conditions, particularly temperature and humidity. This sensor is commonly used in various applications, including IoT devices, to provide real-time data on environmental parameters. Inthe context of a smart bottle designed for healthcare

4.2.2ULTRASONIC SENSOR:

Generating, detecting & processing ultrasonic signals Ultrasonic is the production of sound waves above the frequency of human hearing and can be used in a variety of applications such as, sonic rulers, proximity detectors, movement detectors, liquid level measurement. Ultrasonic Ranging Module HC

- SR04.

Figure 1 :Ultrasonic Sensor

When GSM modem receive a Message the microcontroller will process the message with the keyword saved in it. Then, it will get the location of the stick from the GPS modem and transmit the locationto the GSM modem in order to respond to the sender. In case of an emergency,the user of the stick can press the emergency button the microcontroller access the location from the GPS modem and transmit the location to

the GSM modemwhich will send a SMS messages to the all saved numbers in the microcontroller.

electrical energy into mechanical energy) that typically operates A buzzer is in the lower

Figure 2:Buzzer

portion of the audible frequencyrange of 20 Hz to 20 kHz. This is accomplished by converting an electric, oscillating signal in the audible range, into mechanical energy, in the form of audible waves. Buzzer is used in this research to warn the blind person against obstacle by generating sound proportional to distance from obstacle. VIBRATEMOTOR. A vibrator motor is included to enhance the overall feedback for the person who receives the warning against obstacles closeness in different formats of vibrations.

5. RESEARCH METHODOLOGY

The research method used in the construction of this system is the SDLC (System Development Life Cycle) method. System Development Life Cycle(SDLC) is the process of creating and changing systems and the models and methodologies used to develop an application. SDLC is also a pattern taken to develop software, which consists of the followingsteps:

1. Planning: In the planning phase, things that are related to studies of needs, feasibility studies, both technically and technologically, and scheduling are alsocarried out in this study.
2. Analysis: In the analysis phase direct observation is carried out by looking at the problems that arise and are realized regarding the components and software and hardware.
3. Design: At this stage the application will be described in detail about the design process of each component in the prototype according to the needs in the prototype discussed earlier.
4. Implementation : At this stage implementation is carried out from the system planning to the real situation that is by selecting the components to be used andthe preparation of the software (coding / coding)
5. Testing: At this stage testing is carried out to see whether the system createdis in accordance with the needs of the user or not, if not, the next process is iterative, i.e. returning to the previous stages. And the purpose of the test itselfis to eliminate or minimize defects so that the system developed will really help the users when they carry out their activities
6. Maintenance: At this stage the process of operating the system begins and ifnecessary small repairs can be done.

6. RESULTS & DISCUSSION

As of my last knowledge update in January 2022, specific experimental results forSmart Bottle Health Care using IoT may not have been universally documented orpublished in the literature. However, I can provide you with potential outcomes and benefits that researchers and developers might expect based on the goals ofsuch a system

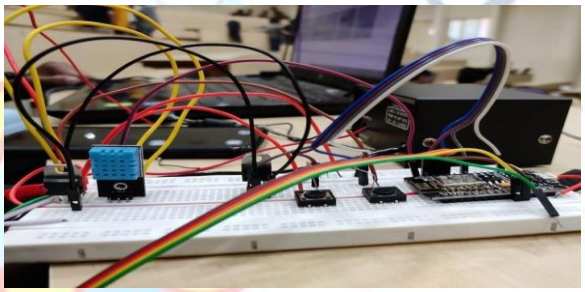

Figure 3: Smart Bottles, with their IoT capabilities

Experimental results would likely demonstrate a positive impact on medication adherence. Smart Bottles, with their IoT capabilities, can send timely reminders topatients, reducing the likelihood of missed doses and leading to improved adherence rates. The ability to monitor medication usage in real-time would be a key aspect of experimental results. This continuous monitoring helps healthcare providers identify patterns, intervene proactively incase of non-adherence, and make informed decisions to optimize treatment plans.Researchers may observe the value of data-driven healthcare. The data collectedfrom smart bottles can be analyzed to derive insights into patient behavior, preferences, and responses to treatment. This information is crucial for personalized healthcare approaches. Experimental outcomes would likely highlightthe effectiveness of remote patient management. Healthcare providers can remotely access patient data through the cloud, reducing the need for frequent in-person visits while maintaining a comprehensive view of the patient's medication adherence and health Improved patient engagement and

empowerment may be observed as patients actively interact with the smart bottle's technology. Features like personalized reminders, educational content, and feedback mechanisms couldcontributeto increased patient involvement in their By leveraging the data collected from smart bottles, healthcare providers can optimize treatment plans.This may involve adjusting medication dosages, modifying prescription schedules,or tailoring interventions based on individual patient Experimental results might indicate potential cost savings and increased efficiency in healthcare delivery. By preventing medication non-adherence-related complications and hospitalizations,Smart Bottle Health Care could contribute to overall healthcare cost reduct Assessing user experience and acceptance through experiments would be crucial.P ositive feedback from patients and healthcare providers regarding the ease of use, effectiveness, and overall satisfaction with the smart bottle system would bekey indicators of its success.It's important to note that actual experimental results can vary based on the specific design of the smart bottle system, the population studied, and the contextof the experiments conducted. For the latest and most accurate information, I recommend checking recent scientific publications and research articles in the field of IoT in healthcare and smart medication adherence solution.

7.CONCLUSIONS

In conclusion, Smart Bottle Health Care using IoT represents a promising and innovativesolution at the intersection of healthcare and technology. The integration of Internet of Things (IoT) technology into medication management through intelligent, sensor-equipped bottles offers a range of benefits with the potential to significantly impact patient outcomes and healthcare efficiency.

The smart bottle's ability to monitor and transmit real- time data on medication adherence provides healthcare professionals and caregivers with valuable insights into patient behaviors. This, in turn, allows for proactive intervention, personalized healthcare management, and optimized treatment plans. The continuous monitoring facilitated by IoT technology not only enhances medication adherence but also contributes to a data-driven approach to healthcare, fostering better decision-making and improving overall patient care.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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