Medicine Reminder and Automatic Alert for Low Medicine Stock

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Abstract: **Many medical errors happen because caregivers or family members have to manage multiple medications every day. This paper presents the design and implementation of a smart pillbox to address this issue. The pillbox is meant for patients who take regular medications or caregivers who assist them. It allows users to set pill intake schedules for three different medications and reminds them with sound and light alerts when it's time to take their pills. The smart pillbox contains three separate sub-boxes, allowing medical caretakers or clients to set data for three distinct pills. The device also monitors whether the patient has taken the medicine and sends an SMS alert to the caregiver using the GSM module when the medication is taken. Additionally, if the medicine stock is low, an SMS notification is sent to remind the caregiver to refill it. This smart pillbox makes medication management easier for patients, caregivers, and healthcare facilities, reducing the risk of missed or incorrect doses.**

INTRODUCTION

Nowadays, people are often caught up in their busy lives and tend to prioritize work over their health. As a result, common diseases like diabetes and high blood pressure have become more prevalent. It can be challenging for elderly individuals to keep up with their daily medication, and even younger people face similar difficulties. Many family members struggle to provide constant assistance to their loved ones who require regular care. However, it is not always feasible to remind them about their medication schedules all the time.

To address this issue, a system is designed to monitor patients and provide care. With the increasing integration of technology into our daily lives and canleverage it in a way that benefits us. Mobile phones are no longer just for making calls; they now come with embedded sensors that enable various applications, including healthcare, social networks, and environmental tracking. In the healthcare sector, the use of mobile technology is becoming increasingly valuable.

The Internet of Things (IoT) can be useful for real-time health monitoring. It serves as an effective paradigm for collecting data through sensor devices and storing it in the cloud. In this paper, an IoT-enabled device will control the overall monitoring system, helping patients by reminding them to take their medication on time and ensuring better healthcare management.

Problem Statement

Patients often fail to comply with their medication due to forgetting to take it, taking it at the wrong time, or even taking an incorrect dosage. To address this issue, various systems such as reminders and alarms have been developed to help patients stay on track. The main aim here is to focus on patients who struggle to take their medication on time and have designed a system to assist them in managing their medical prescriptions. This IoT-based solution provides a real-time monitoring system that allows caregivers or family members to remotely monitor the patient's medication activity. The system ensures that patients receive sound and light alarms to take the right medication at the right time, helping them adhere to their prescribed schedule and improving overall healthcare management.

LITERATURE SURVEY

There are various medication systems currently in use. They depend on different stages and ideas. One such system is the medicine update framework, My Medi Health [2], which has been created for children. It is available on mobile phones, such as personal digital assistants. This mobile application provides a Graphical User Interface (GUI) to design drug schedules and an alarm system to remind patients about the time and other details. Zao et al. have created an application—a smartphone app designed to help patients avoid prescription management mistakes [3]. Prasad B has proposed an application called 'Medicine Update Expert.' This app has a limit of 15 updates. A patient can select these updates while choosing between repeating or non-repeating alarm patterns. At any given time, only one pattern can be selected, and the interval between two alarm patterns must be at least one hour. A reminder shall be delivered at the scheduled time, which could be in the form of vibration or an LED signal [4]. Hamida et al. have recommended a secure and efficient In Habitation Wearable Insomnia Monitoring and Diagnosing System (2013) [5].

The sleeping data of a patient at home could be received by a remote clinical background system using recent technologies, including experimental evaluations of communication and security protocols in terms of safety and overhead. According to Ray (Home Health Hub Internet of Things, 2014), health is one of the most important aspects of life. One of the most desired things humans want to achieve is an easier life, made possible through recent IoT developments [6]. The novel framework designed by Ray helps monitor the health of elderly individuals at their homes using the H3IoT system. Again, according to Al Majeed et al. (Home Telehealth by IoT, 2013), IoT helps in real-time monitoring of health conditions. Related devices can sense, transfer data, and analyze it to facilitate healthcare processes. In their proposed system, they use a cost-effective and feasible algorithm to minimize complexity when processing large amounts of data. This data is generated by imaging devices, sensing devices, and human interaction [7]. Huang et al. [2014] proposed an Intelligent Pillbox System for elderly people. The purpose of this work is to provide a safe and secure way to take medication on time [8]. Moga et al. [2015] recommended an internet-based control and monitoring system—a low-cost embedded system for smart homes. This system uses distributed sensing and control technology to enhance user-friendliness and remote accessibility [9]. Assistive Technology (AT) plays a crucial role in improving personal activities and independence. However, very few people are aware of and have access to assistive technology due to its high cost, lack of training, and limited availability. According to a survey, by 2050, 2 billion people will require at least one assistive product, and elderly individuals may need two or more. Juan et al. have proposed 'The Intelligent Pill Box' [10]. They explain how to design and implement assistive technology devices using open-source technologies. This innovation provides a new way to manage medication dosages. They used Arduino Mega 2560 as the main controller. This assistive technology offers multiple options for medication intake and is based on an automatic alarm system that integrates a user-friendly interface and a notification system via the GSM network. A pillbox based on an MCS-51 microcontroller can dispense medicine using a stepper motor at a scheduled time, but it lacks a feature to record the exact time when the patient takes the medicine [11]. Sawand et al. have proposed an architectural framework to handle the life cycle and essential service components of e-healthcare [12]. They integrated IoT, WBSN (Wireless Body Sensor Network), and cloud computing to collect, transmit, analyze, and store healthcare data in the cloud for future use. Ahmad et al. proposed a solution that incorporates fog and edge computing in 5G and IoT systems. Self-adaptiveness and resilience in cyber-physical systems are the key concerns of their research [13]. Abdallah and Fayyoumi have developed a mobile application to assist deaf and mute individuals in their daily activities [14]. They use the Arabic language as the medium of interaction, allowing people with special needs to communicate with others by selecting sign images. Al-Haider et al. recently proposed a 'Smart Medicine Planner for Visually Impaired People' [15]. Their proposal is especially helpful for blind and elderly individuals in managing daily medication dosages. The system consists of two main parts: dispensing and alarming. Google Cloud is used to store and recognize recorded voice commands in the application. Additionally, Raspberry Pi 3 with Bluetooth connectivity is utilized to enable communication between the Smart Medicine Planner and the voice box.

EXISTING SYSTEM:

Currently available techniques in the market, such as using alarms and pillboxes, do not address issues related to medication adherence. These methods rely on a clock that generates an alarm after a set time has passed. Furthermore, there is often a lack of timely reminders for refilling the pillbox, leading to interruptions in the course of therapy. The conventional pillbox requires users or caregivers to load the box each day or regularly. To address these challenges, the sensing of pillbox slots can be done using either the Load Sensing methodology or Light-based sensing. Slot-based sensing offers several advantages, such as the ability to detect individual moments of medication intake, ensuring better adherence to prescribed schedules.

PROPOSED SYSTEM:

The proposed system is programmable, enabling medical caretakers or users to set up the pillbox, schedule medication timings, and define service times for each day. This project consists of three separate compartments, allowing caretakers or users to store and manage three different types of pills. Once the medication time is set, the pillbox will remind users or patients to take their pills using sound and light alerts. A Real-Time Clock (RTC) module is used to schedule three different timings for three pills. LED lights are placed on each compartment, which will glow when the corresponding medicine needs to be taken, and a buzzer will sound to remind the patient at the designated time. To monitor whether the patient has taken the medication, an IR sensor is used. If the medicine is taken, an SMS notification will be sent to the guardian via a GSM module with the message "Medicine Taken." If the patient does not take the medicine, no message will be sent. Additionally, ultrasonic sensors are used to detect the stock of medicine in the compartments. If the medicine box is empty, a notification will be sent to the guardian, prompting them to refill it. This system offers an improvement over conventional pillboxes, which require users or caregivers to manually load the box daily or regularly.

BLOCK DIAGRAM:

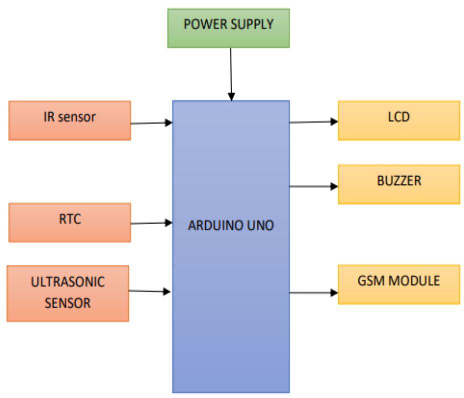

Fig.1. Block diagram

MODULE DESCRIPTION:

a. ARDUINO UNO:

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller. The board features both digital and analog input/output (I/O) pins, which can be connected to other development boards (shields) and various circuits. It has six analog input pins and 14 digital I/O pins, six of which support Pulse Width Modulation (PWM) output as shown in fig.1.

The Arduino Uno can be programmed using the Arduino IDE (Integrated Development Environment) via a USB Type-B cable. It can be powered either through a USB connection or an external 9-volt battery, and it can accept input voltages ranging from 7 to 20 volts.
The board is similar to Arduino Leonardo and Arduino Nano. It's hardware reference design is released under the Creative Commons Attribution 2.5 license and is available on the Arduino website. Additionally, design and assembly documents for some hardware versionsshown in Fig.2 are also accessible.

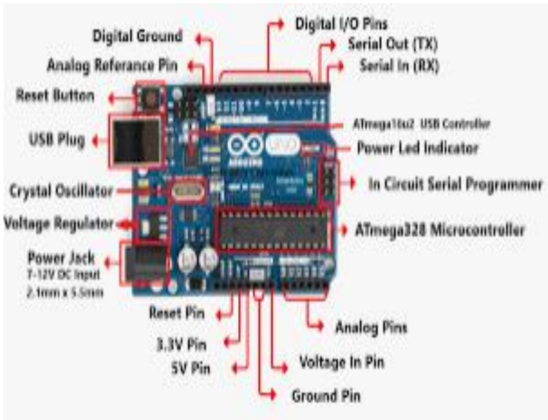

Fig 2: Hardware component Arduino uno

b. GSM MODULE:

The SIM900A is a ready-to-use GSM/GPRS module commonly used in mobile phones and PDAs shown in Fig.3. It can also be utilized for developing IoT (Internet of Things) and embedded applications.

The SIM900A is a dual-band GSM/GPRS device that operates at EGSM 900MHz and DCS 1800MHz. It includes multiple GPRS Class 10/Class 8 slots (optional) and supports GPRS CS-1, CS-2, CS-3, and CS-4 coding schemes.

Fig 3: GSM Module

c. ULTRASONIC SENSOR

An ultrasonic sensor depicted in Fig. 4 is an electronic device that emits ultrasonic waves and converts the reflected sound into an electrical signal to determine the distance of a target object. Ultrasonic waves travel faster than audible sound (i.e., sound that humans can hear). The sensor consists of two main components: a transmitter, which uses piezoelectric crystals to generate the sound waves, and a receiver, which detects the sound after it has travelled to and from the target.

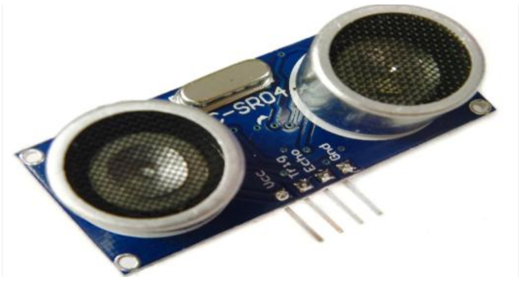

Fig 4: Ultrasonic Sensor

d. IR SENSOR

An IR sensor shown in Fig.5 is an electronic device that emits infrared light to detect objects in its surroundings. It can measure the heat of an object as well as detect motion. In the infrared spectrum, all objects emit some form of thermal radiation. These radiations are invisible to the human eye, but an infrared sensor can detect them.

Fig 5:IR Sensor

The emitter in an IR sensor is typically an IR LED (Light Emitting Diode), while the detector is an IR photodiode. The photodiode is sensitive to IR light of the same wavelength emitted by the IR LED. When IR light falls on the photodiode, its resistance and output voltage change in proportion to the intensity of the IR light received.

RESULTS

The conventional pillbox requires users or caregivers to load the box each day or regularly. To address these challenges, the sensing of pillbox slots can be done using either the Load Sensing methodology or Light-based sensing. Slot-based sensing offers several advantages, such as the ability to detect individual moments of medication intake, ensuring better adherence to prescribed schedules. This paper uses three pillboxes, depending on the prescription the medicine is filled. If the doctor prescription for three times daily, then three boxes be utilised otherwise any of the three boxes be utilised. This is the main advantage of this one compared to the other traditional methods designed by the previous authors.

CONCLUSION

The integration of hardware modules into the pillbox has been carried out carefully, ensuring optimal performance and accurate output. This system enhances user safety and ensures timely medication intake. It reduces the effort required to remember medication schedules. Also, an alert message will be sent in case of low medicine stock.

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