International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 10 Issue: 05 | May 2023 www.irjet.net p-ISSN: 2395-0072

Smart Pill Reminder and Monitoring System

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Abstract - *A new reminder system based on Internet of Things (IoT) has been created to aid individuals, particularly those suffering from dementia, who often neglect their health. The system includes an IoT device and an Android application, aiming to alleviate the burden of daily medication for patients. Through data analysis, the system detects when medication needs to be taken and sends timely notifications via the mobile application. This solution not only benefits dementia patients but also proves useful for others. By utilizing an IoT-enabled Arduino device and an infrared (IR) sensor, the system can monitor whether the patient has taken their medicine, ensuringproper healthcare management.*

Key Words: Reminder system, IOT, Dementia, medicine scheduler, IR sensors.

1. INTRODUCTION

Nowadays, people are often caught up in their busy lives and tend to prioritize work over their health. As a result, commondiseases 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 for us to remind them about their medication schedules all thetime. To address this issue, we need a system that can monitor patients and provide care. With the prevalence of technologyin our lives, we can leverage it in a way that benefits us. Mobile phones are no longer just for making calls; they can now be equipped with embedded sensors that enable various applications, including healthcare, social networks, and environmental tracking. In the healthcare sector, the use of mobile phones is increasingly valuable. The Internet of Things (IoT) can play a crucial role in monitoring real-time conditions, and it offers an efficient means of storing data collected by sensor devices in the cloud. Our project aims toutilize IoT-enabled devices to control an integrated monitoring system. Additionally, we will develop an Androidapplication that assists patients by reminding them of their medication intake and more.

2. LITERATURE REVIEW

According to the World Health Organization, more than 80% of individuals aged 60 and above are prescribed medications that need to be taken 2 to 4 times per day. Due to therise in cardiovascular diseases and diabetes among this age group, it has become essential to ensure regular administrationof medicines. However, a significant portion of this population, around 40-60%, faces difficulties in remembering to take their medications at the right time. Currently available techniques in the market, such as using alarms and pill boxes, do not address the issues of overdose or incorrect dosage. These methods rely on a clock that generates an alarm after aset time has passed. Furthermore, there is often a lack of timely reminders for refilling the pill box, leading to interruptions in the course of therapy. To address these challenges, the sensing of pill box slots can be done using either Load Sensing methodology or Light-based sensing. Slot-based sensing offers several advantages, such as the ability to detect individual moments of medication intake, thereby identifying problems related to overdosing and incorrect dosage. A comprehensive survey has been conducted to analyze and compare different modes of slot sensing, both theoretically and practically.

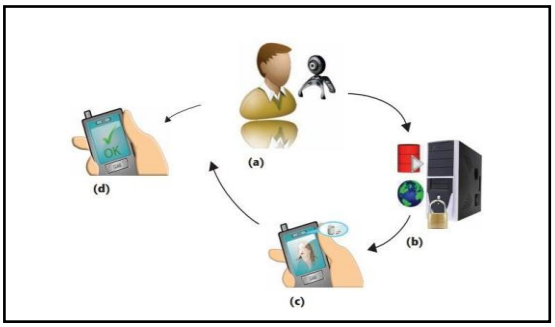


Fig-1: 1G Mobile Application.

Mei-Ying Wang et al. developed a system called Wedjat, which serves as a reminder for users to take their medications at the appropriate times. It also helps users keep track of their medication records and provides a means for healthcare professionals to review them.[1]

Guanling Chen et al. introduced a Mobile-phone based PatientCompliance System (MPCS) aimed at streamlining the time-consuming and error-prone procedures associated with current self-regulation practices. The system assists in self-reporting,detecting noncompliance, and providing reminders to promote medication adherence.[2]A mobile reminder system, based on video technology, has been developed to

provide memory support for individuals inthe early stages of Alzheimer's disease. [3]

My MediHealth is a mobile application specifically designedfor children and accessible on devices like personal digital assistants. Its purpose is to provide a graphical user interfacethat allows users to create drug schedules and set up an alarmsystem to remind patients of medication times and otherrelevant details **[4]**.

Zao et al. have developed an application that serves as a smartphone application with the aim of assisting patients in preventing medication administration errors **[5].**

Prasad B has introduced an application called 'Medicine update expert' that allows users to set up to 15 medication reminders. The app offers two options for reminder patterns: repeating or non-repeating alerts. Users can choose one pattern at a time, and there should be a minimum one-hour gapbetween two reminder patterns.[**6]**

Hamida et al. have proposed a secure and efficient system for monitoring and diagnosing insomnia called the inHabitation Wearable system. **[7]**.

An architectural framework for monitoring health of elderly people" by P. Ray discusses a proposed framework for monitoring the health of elderly people using Internet of Things (IoT) technology. The framework involves the use of various sensors to monitor health parameters such as blood pressure, heart rate, and body temperature, which are then transmitted to a central hub using IoT protocols.**[8]**

The article "Home Telehealth by Internet of Things (IoT)" by S. S. Al majeed discusses the potential of IoT technology to improve home telehealth services. The article provides an overview of IoT technology and its applications in healthcare, including remote patient monitoring, medication management, and fall detection.**[9]**

The paper titled "The Intelligent Pill Box - Design and Implementation" by S. Huang, H. Chang, Y. Jhu, and G. Chenwas published in 2014.**[10]**

The paper titled "Work Embedded Platform for Web-based Monitoring and Control of a Smart Home" was authored by C. List, O. F. Authors, D. Moga, N. Stroia, D. Petreus, R. Moga, and R. A. Munteanu. The paper was published in 2015and appears in issue number 53, spanning pages 1-3.**[11]**

The paper you are referring to is titled "Intelligent pillbox: Automatic and programmable Assistive Technology device" and was presented at the 2017 13th IASTED International Conference on Biomedical Engineering (BioMed) in Innsbruck, Austria. The authors of the paper are J. M. Parra,W. Valdez, A. Guevara, P. Cedillo, and J. Ortíz-Segarra.**[12]**

The M.S. thesis by G.H.-W. Kuo titled "Research and Implementation of Intelligent MedicalBox" describes the design and implementation of an intelligent medical box system that can monitor and dispense medication automatically. The system consists of a microcontroller unit,a medication box, and a user interface.**[13]**

The paper "Multidisciplinary Approaches to Achieving Efficient and Trustworthy eHealth Monitoring Systems" was presented at the 2014 IEEE/CIC International Conference on Communications in China (ICCC). The authors of the paper are A. Sawand, S. Djahel, Z. Zhang, and F. Na. **[14]**

3.EXISTING METHOD

The delivery of healthcare services to patients is changing as a result of technological advancement. The primary mobile computer and communication devices of smartphones today not only serve as communication devices but also come equipped with a range of built-in sensors. These sensors enable diverse applications across various industries such as homecare, healthcare, social networks, safety, environmental monitoring, e-commerce, and transportation. In modern healthcare systems, the use of mobile devices is increasingly prevalent. Mobile technology plays a crucial role in managing chronic diseases, empowering elderly individuals and expectant mothers, send medication reminders at precise times, extending services to underservedareas, and enhancing health outcomes and the efficiency of the medical system. Mobile phones are not only feature-rich and powerful but also cost-effective due to advancements in various technology domains. In addition to their primary purpose of personal communication and entertainment, they can be effectively utilized in various health and wellness monitoring applications. The widespread availability of user- friendly smartphones with multi-touch interfaces, multimedia capabilities, and robust embedded systems, such as the iPhone and HTC Touch, has contributed to the rapid growth of smartphone and mobile internet usage worldwide in recent years. These devices offer intuitive usage and accessibility, making them suitable for individuals of all abilities, including disabled and elderly patients.

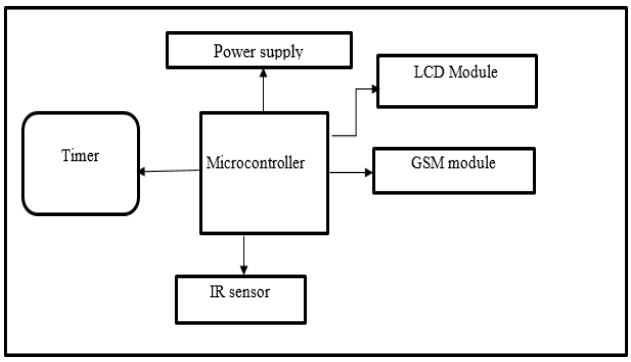


Fig 2: Block Diagram of existing model.

The main components used in the existing method was,

- Power Supply 5v.
- ARDUINO-UNO microcontroller.
- Relay.
- Ir sensor.
- LCD.
- GSM module.

4. PROBLEM IDENTIFICATION AND SOLUTION

The microcontroller that serves as the main component of the circuit in the current version is the Arduino Uno. A microcontroller is connected to an IR sensor in accordance with our block diagram. Monitoring the medication to see if the box is empty is the drawback in this situation. Even if there is a Buzzer alerting system, it is still a prototype. In addition, since most of these models are made to order, only the person who created or designed them can use them; it is not possible for several people to utilize them. The current model makes it difficult for the carer by failing to deliver alerts regarding the number of pills present in the pill box and failing to save the data in the cloud.

This section discusses the limitations of the current model and proposes future work to address them. The proposed solution involves integrating an ESP module and buzzer to overcome the existing model's limitations. The ESP module and buzzer can enhance the system's capabilities significantly. There have been advancements and improvements made to the indicators and buzzers, which have been incorporated into our proposed system.

Fig 3: ESP module

Fig 4: Buzzer

5. PROPOSED SYSTEM

The suggested model has many upgrades and advantages over existing smart pill reminder and monitoring systems. The addition of the ESP module, which offers an Android appto update the data to that app so the caretaker may watch the patient, is the reason we refer to it as a "smart pill reminder." The buzzer being utilized here is advantageous for those who are blind since they can hear the buzzer.

The important components in proposed method are,

- ESP module
- IR sensor
- Arduino microcontroller
- 5v Power supply.
- GSM Module.
- Buzzer.
- LCD Display for level and real time sensing data

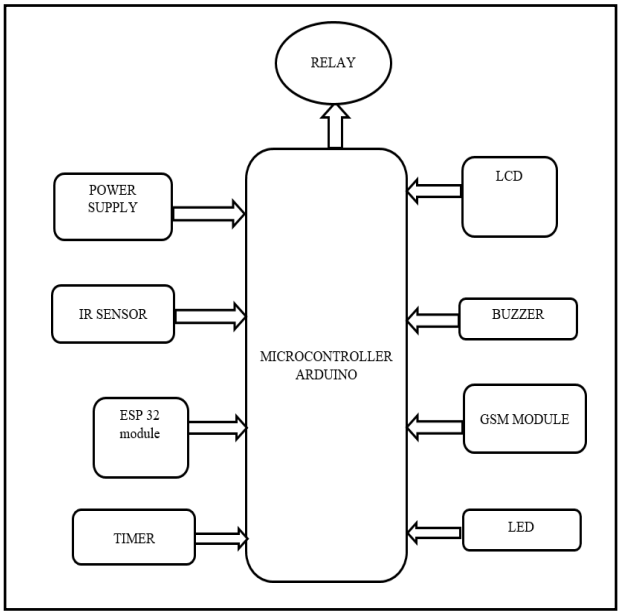


Fig 5: Block diagram of Proposed Module

Due to benefits like the buzzer and Esp module, the existing system may be preferred over the suggested solution. The notification is updated in the Android app and is communicated to the smartphone by GSM when the time limit is met by the ir sensor, which also identifies the area if the pill is consumed. If the medication is not taken, a notice stating "Med not taken" is delivered to the caregiver's app and to the respected person through SMS via GSM module.

6. IMEPLEMENTATION

A. Hardware Interface

In our system concept, we have developed a smart IoT box that incorporates an alarm and storage compartment for medications. The essential components used in its design include an Arduino Uno microcontroller, IR sensors, a buzzer, a pill box, and jumper wires.

There are several possible hardware interfaces that could be used for a smart pill reminder and monitoring system. A Bluetooth: Bluetooth interface could be used to connect the smart pill reminder and monitoring system to a smartphone or other mobile device. This would allow users to receive reminders and track their medication use through an app.

Wi-Fi: A Wi-Fi interface could be used to connect the smart pill reminder and monitoring system to a home network, allowing users to receive reminders and track their medication use through a web interface.

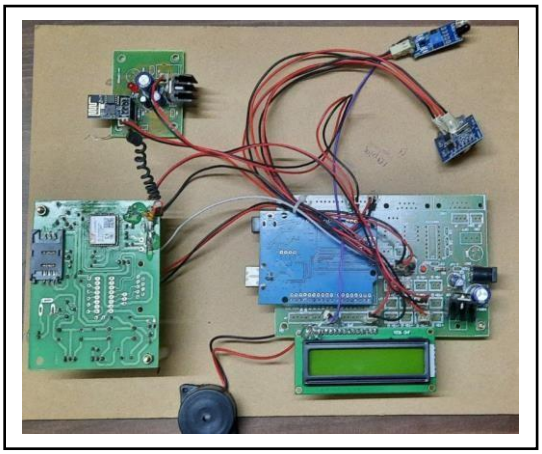


Fig 6: Hardware Interface

B. Hardware Requirements

The Arduino Uno is a popular microcontroller developed by Arduino.cc. It is a versatile and affordable device based on the Atmega328 microcontroller. With the advancement of electronic devices, they have become smaller, more flexible, and cheaper, while also being capable of performing more functions. Microcontrollers play a significant role in embedded systems, enabling devices to operate according to specific needs and requirements. Jumper wires are commonly used to transfer electrical signals between two points in a circuit. They are often used for troubleshooting circuit defects or making changes to the circuit configuration

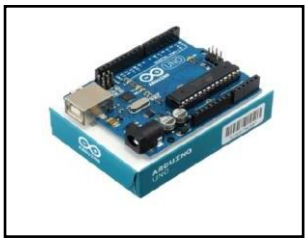


Fig 7: Arduino

IR sensor: IR wireless refers to the utilization of wireless technology in devices or systems that transmit data using infrared (IR) radiation. Infrared refers to electromagnetic energy with wavelengths slightly longer than those of red light. The shortest-wavelength IR is located at the border of visible red light in the electromagnetic spectrum, while the longest-wavelength IR approaches the range of radio waves.

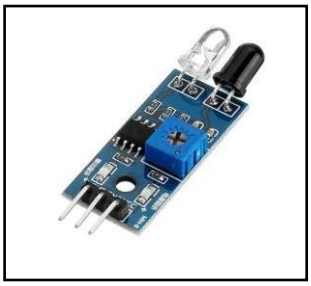


Fig 8: IR sensor

ESP module: The ESP module is a chip developed by Espressif Systems, which offers embedded devices Wi-Fi connectivity and, in certain models, dual-mode Bluetooth capabilities.

Although ESP technically refers to the chip itself, manufacturers often use the term to encompass modules and development boards that incorporate this chip. These ESP models come with Wi-Fi and Bluetooth connectivity, or sometimes just Wi-Fi connectivity. The ESP chip is primarily designed for use in mobile devices, wearable technology, and Internet of Things (IoT) applications, such asNabto.

Additionally, Mongoose OS has introduced an ESP IoT Starter Kit, further solidifying the ESP's reputation as a top choice for hobbyists and developers working on IoT projects.

Fig 9: ESP module

C. Software Implementation

The Arduino Software is a freely available software that simplifies the process of coding for Arduino boards. It includes a text editor for writing code, and the programs written for Arduino are referred to as sketches. These sketches are saved with the '.ino' extension and are stored in a designated location known as the sketchbook. This software is compatible with all Arduino boards and allows users to easily write and upload code to their chosen board.

The Arduino software is open-source, with the Java environment's source code released under the GPL and the C/C++ microcontroller libraries under the LGPL. To begin using the Arduino IDE, first install it on your computer and connect the Arduino board via USB cable. Open the Arduino IDE and select the appropriate board by navigating to Tools

> Boards > Arduino/Genuino Uno. Choose the correct Port by selecting Tools > Port. Arduino Uno is programmed usingthe Arduino programming language, which is based on Wiring. To start with the Arduino Uno board and make the built-in LED blink, load the example code by selecting Files

> Examples > Basics > Blink. Once the example code (also provided below) is loaded into the IDE, click on the 'upload' button located on the top bar. Once the upload process is complete, you should observe the Arduino's built-in LED blinking. The term "sketch" refers to an Arduino program.

D. System Architecture and Working Procedure

The pill reminder system can be designed as follows:

- The device incorporates various methods toremind the patient to take their medication.
- It has a capacity to store up to 10 doses of pills.
- The device allows family members or caregivers to remotely monitor the patient's medication intake and activity.
- Sensors are implemented to detect the status ofthe medication, whether it has been taken or not.
- The system provides an alert when the stock of medicine is running low.

Operational Process: The pill dispenser is loaded either by the patient themselves or with the assistance of someone else. The information about the medications is stored in a cloud database, and reminders are set accordingly.The system can access the stored information and generate reminders for the user to take their medication, sendingnotifications to a mobile application.The system provides alerts when it's time to take medication, and these details are automatically updated from the cloud.

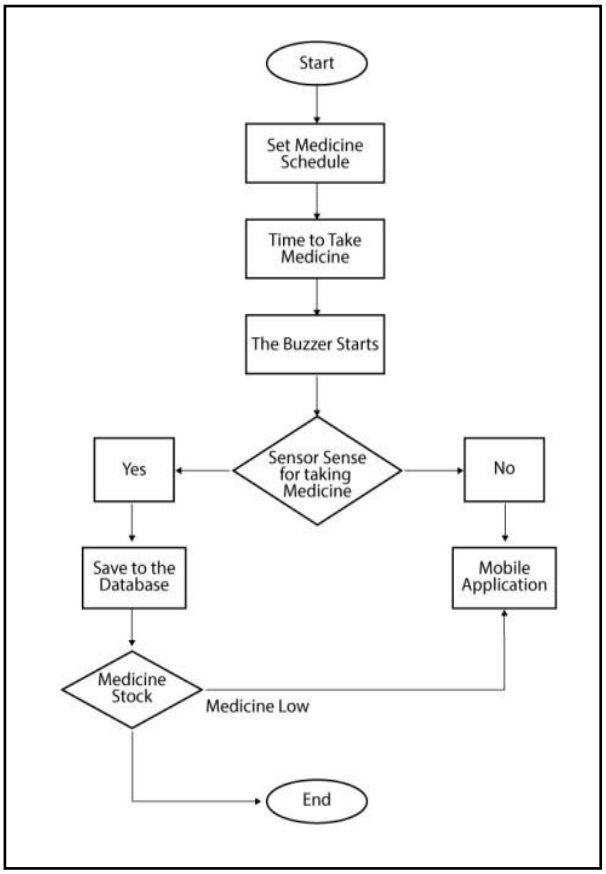


Fig 10: Flow chart of system design.

1. When the patient takes the pills and opens the dispenser lid, an infrared (IR) detector connected to the lid detects the lid opening and sends the signal to an Arduino. The Arduino is capable of stopping the reminder, and this event can be recorded as the successful intake of medication by the patient.

2. If the patient fails to take the medication or refuses to do so, the dispenser lid remains closed, causing the reminder to automatically stop after a predetermined time and allowing for a snooze option. If the medication is missed again by the patient, the system will send a notification to the mobile application, prompting a message to be sent to the patient, reminding them that they have missed a dose.

7. RESULTS AND DISCUSSION

Smart medicine reminder application helps people who suffer with dementia i.e., they forget to take medicine on time. Our project generates alarm signals to remind aiipatient to take medication. We focus on helping patients and improving the monitoring system of medication. Smart medicine reminder consists of arduino, ESP module which isa Wi-Fi module helps in creating the database in the cloud. This reminds whenever the pill box has less than 5 pills. Smart pill reminder reminds the patient to take medicine by buzzer sound or mobile notification along with the medicinename. This is most useful for the people with dementia and who needs a care taker.

Once the kit is given the power supply then the working begins.

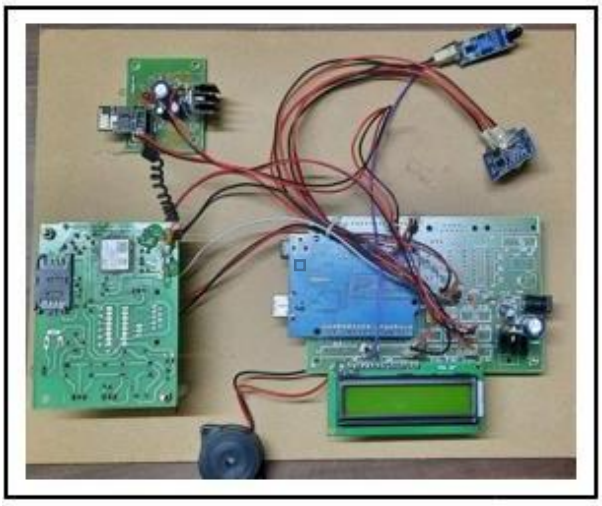


Fig 11: Hardware Interface of the smart pill reminder.

As soon as the kit is started the LCD display shows as below:

Fig 12: LCD displaying the title

Once the android adds and the mobile number is connected then the LCD shows as above.

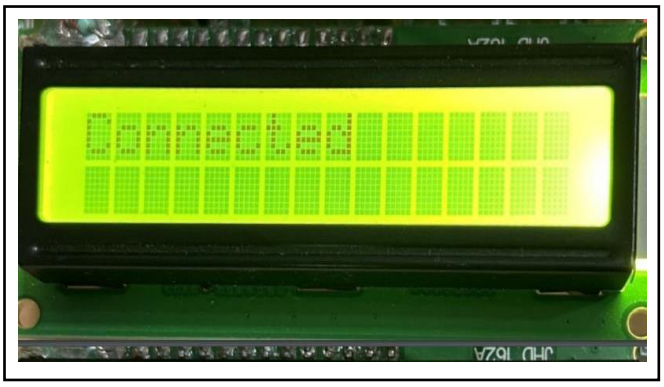
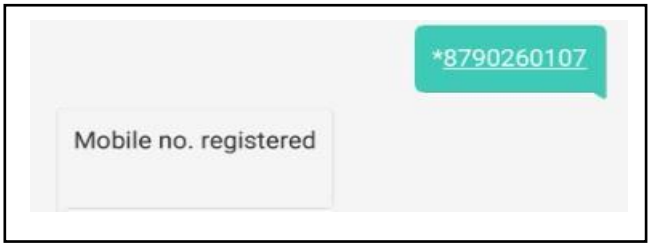


Fig 13: LCD displaying that the kit and mobile network is connected

Once the timer is set and the alarm rings 'Medicine Reminder' and the count of the pills is sent via SMS throughGSM.



The below figure is displayed in the android app by the ESPmodule

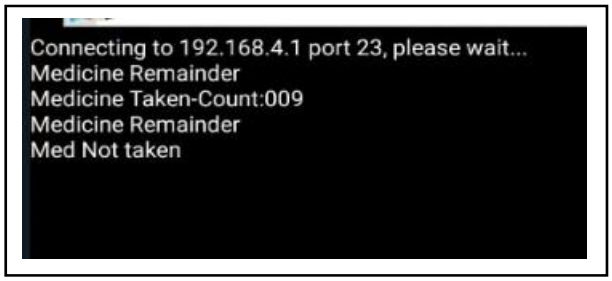


Fig 14: The android app displaying the alert and count of the pills

8. CONCLUISION

In summary, the mobile application named Medicare servesas a reminder system by generating alarm signals to promptpatients to take their medication. Its primary focus to assist patients and enhance the monitoring system. The application,Medicare, is easily accessible, and it combines a sensing system with an Android application to track and measure a patient's medication intake in real-time. The utilization of sensors and other healthcare IoT devices improves patientcare and enables continuous monitoring. By implementingour proposed framework, we can achieve better complianceand adherence to medication schedules. This frameworkensures patient safety, prevents incorrect dosages, andsupports medication adherence.

9. FUTURE SCOPE

The proposed system can be enhanced by increasing the capacity of the pill and mobile application usage by the caregiver. The features such as heartbeat rate monitoring, pulse monitoring, identification of the pill to be taken, doctor search, and more can be added. As an enhancement to the drug update framework by introducing additional features through the mobile application and integrating with other healthcare services. Developing a data-sharing feature between patients and healthcare professionals. Implementinga voice-alert notification system that not only alerts the patient but also provides information to them can be considered.

REFERENCES

[1] Mei-Ying Wang, John K. Zao, P.H. Tsai, J.W.S. Liu, " Wedjat: A Mobile Phone Based Medicine In- take Reminder and Monitor", Ninth IEEE International Conferen ce on Bioinformatics and Bioengineering, 2009.

[2] Guanling Chen, Bo Yan, Minho Shin, David Kotz, Ethan Berkel, "MPCS: Mobile-Phone Based Patient Compliance System for Chronic Illness Care", 2009.Mark Donnelly, Chris Nugent, Sally

McClean,Bryan Scotney, "A Mobile Multimedia Technology to Aid Those with Alzheimer's Disease", Published by the IEEE Computer Society 2010.

[3] Mark Donnelly, Chris Nugent, Sally McClean, and Bryan Scotney, "A Mobile Multimedia Technology to Aid Those with Alzheimer's Disease", Published by the IEEE Computer Society 2010.

[4] lagle, J.M., Gordon, J.S., Harris, C.E., Davison, C.L., Culpepper, D.K.,Scott P. and Johnson, K.B., (2011) "MyMediHealth– Designing a next generation system for child-centered medication Management", Journal of Biomedical Informatics, Vol. 43, No. 5.

[5] Zao, J.K., Wang, M.Y., Peihsuan, T. and Liu, J.W.S., (2010)" Smart Phone Based Medicine In-take Scheduler, Reminder and Monitor",IEEE e-Health Networking Applications and Services (Healthcom).

[6] Prasad, B., (2013) "Social media, health care, and social networking",Gastroin test Endosc. Vol. 77.

[7] S.T.-B. Hamida, E. Ben Hamida, B. Ahmed, and A. AbuDayya. Towards efficient and secure in-home wearable insomnia monitoring and diagnosis system. 13th IEEE Int. Conf. Bioinforma. Bioeng.pp. 1– 6; 2013.

[8] P. Ray.Home Health Hub Internet of Things (H 3 IoT): An architectural framework for monitoring health of elderly people. Sci. Eng. Manag. Res. , pp. 3–5, 2014.

[9] S. S. Al-majeed. Home Telehealth by Internet of Things (IoT). pp.609– 613; 201.

[10] S. Huang, H. Chang, Y. Jhu, and G. Chen. The Intelligent Pill Box - Design and Implementation. pp. 235–236; 2014.

[11] C. List, O. F. Authors, D. Moga, N. Stroia, D. Petreus, R. Moga, and R. A. Munteanu. Work Embedded Platform for Web-based Monitoring and Control of a Smart Home no. 53, pp. 1–3; 2015.

[12] J. M. Parra, W. Valdez, A. Guevara, P. Cedillo and J. OrtízSegarra, "Intelligent pillbox: Automatic and programmable Assistive Technology device," 2017 13th IASTED International Conference on Biomedical Engineering (BioMed), Innsbruck, Austria, 2017, pp. 74- 81, doi: 10.2316/P.2017.852-051.

[13] G H.-W. Kuo, "Research and Implementation of Intelligent MedicalBox," M.S.thesis, Department of Electrical Engineering, I- ShouUniversity, Kaohsiung, TW, 2009.

[14] A. Sawand, S. Djahel, Z. Zhang, and F. Na. Multidisciplinary Approaches to Achieving Efficient and Trustworthy eHealth MonitoringSystems. Commun. China (ICCC), 2014 IEEE/CIC Int. Conf., pp.187–192; 2014