

Smart Pill Bottle

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Abstract: Adherence to medication is one of the most intriguing and complex of patient behaviors. In this Modern world, many people are prone to diseases they need to use tablets or pills in appropriate time. To cure the diseases, we need to take tablets in appropriate time, assistance may be needed to remind at which time need to take medicine. To our health drinking enough water is very important and It is proven fact that drinking more water can lead to better overall health, clearer skin, productivity improvement and increased energy levels, brain function, and even reduction in body weight. In our busy life it is really hard to remember to drink enough water and most of the time we forget to drink enough water either we are in home, office or on the go. In order to solve the above problems, we have developed a system called Smart pill bottle it will track our hourly, daily, weekly water intake, and send notifications to mobile whenever we are in dehydration. Also, it can alerts the patients or elderly with notifications to take appropriate medicines at a scheduled time. For development of this system we have used ESP8266 based NodeMCU open source hardware platform which is rapidly used in the applications of Internet of Things (IoT).

Index Terms – Medication Adherence, Water in-take, NodeMCU, Internet of Things(IoT)

I. INTRODUCTION

Pharmacotherapy has been used in long term for the treatment of chronic illnesses. Even though these medications are effective in fighting disease, but approximately 50% of patients are nor realized of medications full benefits because they do not take their medications as suggested. For poor medication adherence there are many factors contributed that are related to Patients eg, no or less involvement in the disease treatment decision-making process and lack of awareness on medicine, taking prescription from multiple physicians, taking same medicine with different vendors and also factors included those that are related to physicians eg, prescription of complex drug/medicine, poor communication between patient and physicians, communication of information about adverse effects and factors those that are related to health care systems eg, limitations on hospital/office visit time, care taking has limited access, and lack of technology which displays/indicates health information). Because barriers to medication adherence are complex and varied, solutions to improve adherence must be multifactorial.

Medication adherence is one of the most fascinating and complex of patient actions. Non adherence to a therapeutic treatment can result in negative results, and it can be compounded in populations with chronic illness because of the extended duration of multiple drug therapies. To provide better comfort and support to the elderly and patients we are providing a solution “Smart Pill bottle”, which indicates the medicines to be taken at a scheduled time.

II. LITERATURE SURVEY

In its 2003 the World Health Organization (WHO) mentioned the statement report on medication adherence¹ by Haynes et al that “increasing the effectiveness of adherence interventions may have a far greater impact on the health of the population than any improvement in specific medical treatments.” Amid patients with chronic illness, approximately 50% won’t take medications as prescribed^{1,2}. This poor adherence to medication leads to increased illness and death and is estimated to experience costs of approximately \$100 billion per year³ Thus, Hippocrates' appeal to the medical doctor to “not only be ready to do what is right himself, but also to make the patient cooperate⁴ has constantly failed for more than 2000 years. Today's ever more complex medical treatments make it even less likely that medical doctor will be able to compel compliance and more important that they partner with patients in doing what is right together.

The burden of chronic disease is drastically increasing globally. Predicted to account for 3/4th of all deaths worldwide by 2020¹, chronic diseases is damaging the healthcare capacity of many nations that lack the resources to provide appropriate healthcare services. By the year 2035, the worldwide shortage of healthcare providers is likely to be 12 million². These problems, joined with increased expenses on health and long-term care, will remain to put burden on public budgets over the upcoming years, with healthcare costs in the U.S. alone expected to reach nearly 4.8 trillion in 2021³. As these trends continue, more healthcare systems will seek innovations to combat these challenges.

Japan Revitalization Strategy² which was established in June 2013 at japan stated that, "the japan government will indorse improved contributions of local drugstores and pharmacologists in encouraging self-medication of residents by making drugstores the community-based hub for providing information, giving guidance on the proper use of non-prescription drugs, etc. and offering consultation and information service regarding health".

In addition, the "Demanded Function and Ideal Form of Pharmacy," published in January 2014³, demanded a change, from drugstores that dedicated in providing medicines to pharmacies that serve as entire healthcare stations, providing pharmaceutical care based on patients' medical history, including the intake of dietary supplements. As mentioned above, the status of pharmacies and pharmacists has dramatically changed in the past 2 years, and such changes over time are required.

III. EXISTING SYSTEM

In the most of the countries the old people and patients are taking their medicines and having water with help of guided people and one of their family members or care takers spending their time to care of their respective old people and gives medicines at regular time.

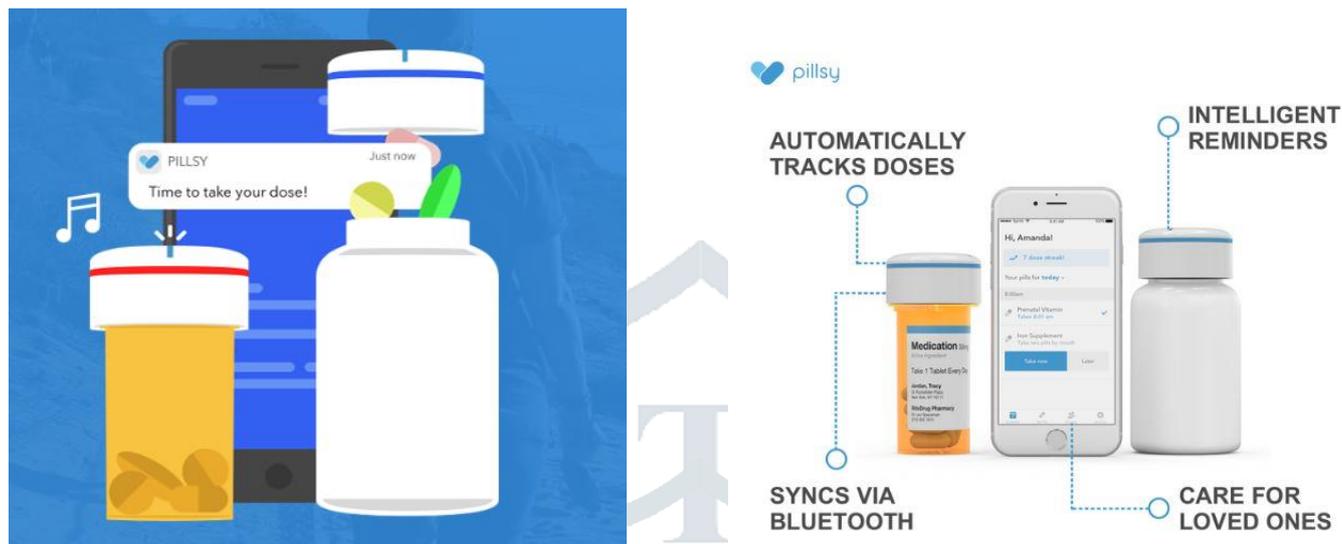


Fig 1: Pill Bottle Using Pillsy App

The above figure shows the Pillsy bottle and its app. This bottle⁵ was invented by Dr. Emil Jovanov of UAH (University of Alabama in Huntsville). Sensors in the bottle detect when the cap is twisted off and how much medication is removed. When it's time to take a pill, a blue reminder light pulses. Miss a dose? A chime goes off, and then the patient or a caregiver can get a phone call or text message. This is one of the ways to prevent medication adherence and also decreasing the deaths due to poor medical adherence.

IV. PROPOSED SYSTEM

The above existing system has a limitation that that bottle can hold only one or max two medicines at a time. So to overcome the limitation of the above system we are introducing a system that holds 8 medicines at a time and also we have added many features that include water level indication, calculates water intake of a person daily, weekly and monthly and sends notification to the mobile phone based on the user schedule to remind the medicine intake.

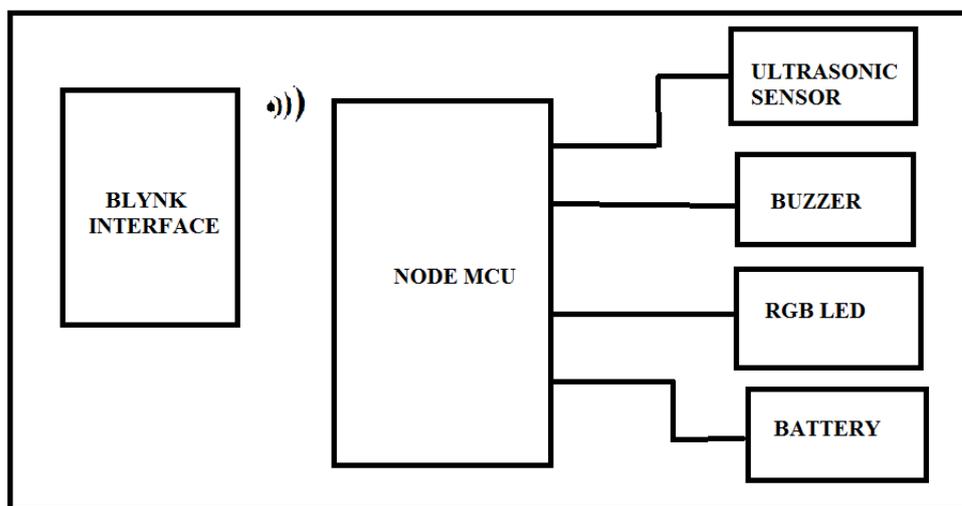


Fig 2: Block Diagram Of Smart Pill Bottle

This project consists of a water bottle which is designed in such a way that it can consist of small racks where we can keep medicines, we are using RGB LED which is placed inside the water bottle that indicates the different colors (e.g. for low level of water, medicine reminder and notification alert). We are using ultrasonic sensor which is used to detect the level of the water in the bottle and for notification alert apart from RGB LED we are using buzzer and vibrator for improvement of alerts. In this entire system all the sensors and actuators are connected to the brain called microcontroller. Here we are using NodeMCU board as brain for this system. To program the NodeMCU, Arduino IDE is used and Blynk application for notification alert as well as scheduling medicine intake.

HARDWARE REQUIREMENTS**1) NODE MCU:**

Node MCU is a microcontroller board based on open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. It is based on the eLua project and built on the Espressif Non-OS SDK for ESP8266. This NodeMCU microcontroller unit is used as a brain of our project, where it consists of 1 Analog pin and 8 digital pins with one UART port for serial communication devices.



Fig 3: Node MCU



Fig 4: Ultrasonic Sensor

2) ULTRASONIC SENSOR:

An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. By measuring the elapsed time between the sound wave being created and the sound wave returning back, it is possible to calculate the distance between the sensor and the object.

When an electrical pulse of high voltage is applied to the ultrasonic sensor's transducer it oscillates across a precise spectrum of frequencies and produces a bunch of sound waves. Whenever any obstacle comes ahead of the ultrasonic sensor, the sound waves gets reflected back in the form of echo and produces an electric pulse. It calculates the time taken between sending sound waves and receiving echo. The echo patterns will be compared with the patterns of sound waves to determine detected signal's condition. This sensor used as to determine water level in the bottle which can track water intake.

3) RGB LED:

The RGB color model is an additive color model in which red, green and blue light are added together in various ways to reproduce a wide array of colors. The main purpose of the RGB LED is for the sensing, illustration and display of images in electronic systems, such as computers and televisions, however it has also been used in conventional photography. This RGB LED is used in our project to indicate the water level,



Fig 5: RGB LED



Fig 6: Buzzer



Fig 7: Vibrator Motor

4) DC MOTOR:

There are two basic types of vibration motor. An eccentric rotating mass vibration motor (ERM) uses a small unbalanced mass on a DC motor when it rotates it creates a force that translates to vibrations. In this project this vibrator is used to notify the user to refill the bottle or take the medicine with in scheduled time.

5) BUZZER:

A buzzer or beeper is audio signaling device which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. In this project this buzzer is used like vibrator is used to notify the user to refill the bottle or take the medicine with in scheduled time.

SOFTWARE REQUIREMENTS

1)BLYNK APP:

Blynk is a open source platform with Android and iOS apps to control different popular microcontroller and microprocessor boards like Arduino, NodeMCU, MSP430, Raspberry Pi and the likes over the Internet. It has a digital dashboard in which you can create a customized graphical user interface for your development by simply dragging and dropping widgets.

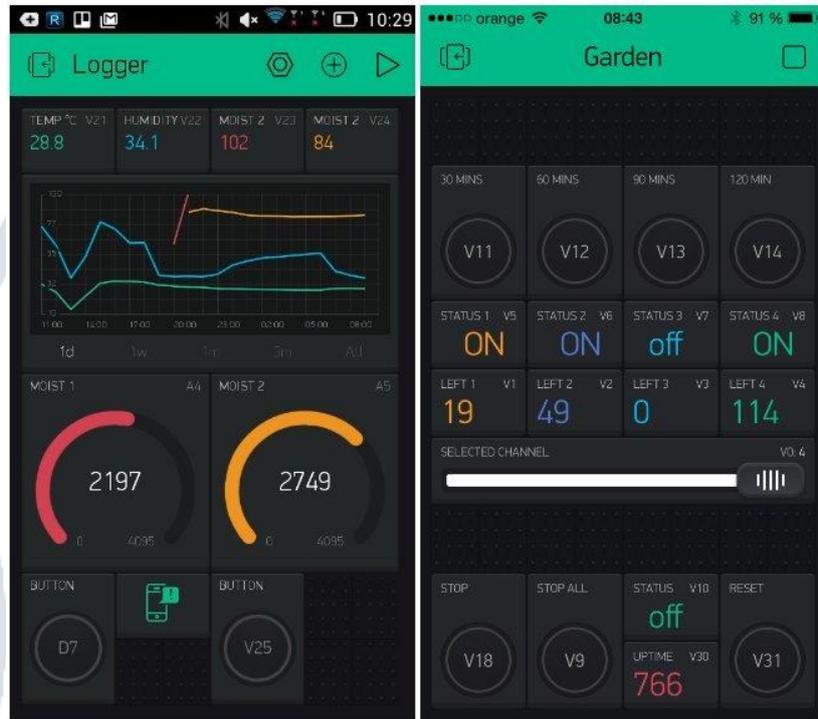


Fig 7: Blynk Application

2)ARDUINO IDE:

Arduino is an open source computer software and hardware and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital components and interactive objects that can sense and control objects in the digital and physical world.



Fig 7: Arduino Logo

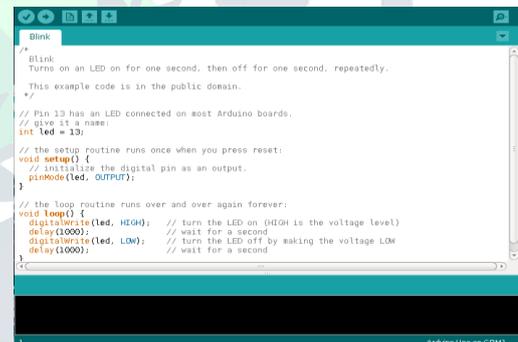
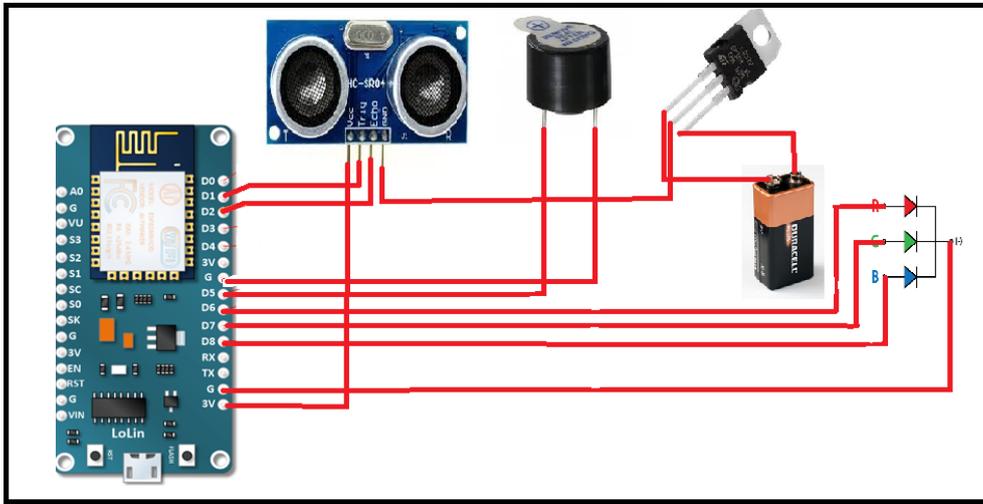


Fig 7: Arduino IDE

V. WOKING:

The ultrasonic sensor is connected to the NodeMCU detects the water level by measuring distance. Whenever water level is low LED flashes as well as vibrator and buzzer notifies the user with motion and sound. We give scheduling time in which user has to take the particular medicine in that particular time, in the blynk app which is connected to the NodeMCU via internet. Once we set the time immediately our current time compares the scheduled time in the cloud, when the time matches with the scheduled time immediately user gets notified via mobile notification, buzzer, RGB LED and vibrator. Here LEDs are arranged in such a way that each LED is placed on top of racks where medicines will be stored. A 9vbattery is to provide power and the regulator is to control the battery voltage as NodeMCU works on only 3.3V. The data will be sent to the Node MCU and the same data to be carried out to the Blynk server. The Blynk App may send an Authentication code to the registered mail Id. The Auth code must enter in the source code of the Arduino Ide software

RESULT:**Fig: Working diagram of our system**

Ultrasonic sensor is placed at the top the cap the connections made with Node MCU and all other components connections are given to their respective pins. Through Blynk interface server the distance measurement is displayed and active notification sent through the Eventor to the respective mobile. The display of serial monitor results that if water level exceeds 15 then it displays please refill the bottle. If not then it display the measurement of distance. The RGB LED indicates the particular rack where user need to take medicine from, when time which is scheduled in the blynk server matches with our current time.

VI. CONCLUSION:

The Water level distance measurement is easy at any conditions using this ultrasonic sensor and measures vertical water level. In this project, a design for the smart water bottle designed, simulated and tested. It uses the advanced features of Node MCU with ultrasonic sensor, proves to effective in achieving the results as expected. It is applicable at every aspect of the water level distance measurement. Refilling the water bottle and active text notification and the communicable electronic systems re the salient features and the added advantage of the product. With this system we can reduce the problems of medical adherence and keep track of the daily water intake. As it saves some expenditure and time saving, It is less economical at above mentioned process than traditional water level distance measurement. We know that though it is very beneficial, it is also impossible to install such system at each and every place, but it gives certainly a considerable benefit to us.

VII. ACKNOWLEDGMENT:

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