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AN INNOVATIVE MEDICINE PILL DISPENSER USING BUBBLE SORTING METHOD FOR HEALTH CARE APPLICATIONS

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Abstract— **We are now in such a state where one doesn't even have enough time to take care of ourselves. As this became a big issue among individuals health issues are quite common these days among people who are old and even young. Proper medicine intake has been a necessary, but it became difficult due to today's conditions. So, we as a team thought of designing a system that might be able to dispense medicines or something at the prescribed time and amount followed by some instructions. A medicine pill dispenser is one such device which solves the problem. This will become an important asset in humans life by alerting or informing them to take a particular medicine at the particular time. A mobile app is used to make it much easier to track and maintain the data about the medicines.**

***Keywords*—Pill dispenser; BLE,**

I. INTRODUCTION

Assistive technology is such a thing that helps individuals to maintain their life properly. As we go further into the future it will become an essential thing in everyone life. But now adays many people are not able to use it because of its complexity and expense [1].This gives a lot more advantages over many other commercial products in the same line.AT will be a lot more useful and functional towards many things [2].

For now, everyone needs to be monitored in order to track their health status and act according to it. Considering this situation for old aged people who are in their 50's and 70's, pregnant women's, persons with disabilities, or someone with diseases or even kids [3]. Life has been difficult for these kinds of people and even for those who have not got enough time even to examine themselves. In this approach we came on different technologies and encountered some premium and more futuristic products that helps to tackle these situations. Especially for these people a special care taker has to be maintained to give medicines stuff and all [4].

Proper medicine in take is essential which eventually saves lives. But this is a very common issue in which people forgot to take what medicine at what time. This will eventually lead to many diseases and in some cases even death. We have even seen robots giving medicines to people instead of humans. Even this is a good one but many failed to use it as it was expensive and difficult to use [5]. So, we thought why don't we use IOT technology to tackle this type of problems and hence eventually reducing the cost of manufacturing and it will be easy for organizations to make them available to even common people. IOT has been an emerging technology since its beginning. Today we see everything related to IOT and how it functions in everyone life [6].

If medicine intake was not properly organized in both time and dosage it will cause severe after effects which will cost us a lifetime to suffer. Many researches and observations have concluded that this a major issue as patients avoid taking

medicines as prescribed by the doctors and this will lead to severe damages to health both physically and mentally. As per reports the treatment for chronic diseases require long time pharmacotherapy, although this will cure but many patients fails to take and to other things continue [7].

The use of IOT along with existing technologies will solely solve problems in this case. This could lead us to future where we can use cloud as a database to retrieve or store data etc. In this paper we propose an approach that combines all the technologies and has been built considering some quality attributes as proposed by the organizations in order to design products for the elderly to use. The paper is presented as followed by some related works in section II, a detailed methodology is discussed in section II along with the software application used. Results obtained from SMD are presented in section III a conclusion in section IV followed by references in section V.

II. RELATED WORKS

In this section we will discuss about different types of medicine pill dispensers. A lot of dispensers have a very common feature of reminding the user to take the medicine just by giving an alarm or something . As we researched further many of the pill dispenser have a problem in identifying the correct time by not sorting them in order as it has to be manually entered by the user. One such is the design of MEDI-box, a system which alerts the user to take the medicine by giving them a buzzer sound. Many other dispensers have also used the same technique. Over the years out of all a decent dispenser is the GSM based medicine remainder system which alerts the user through a SMS [8].

A current design presented in Cheyenne [9] shows a dispenser unit which store different supplements and allows dispensing them in loose. This even has an alarm system along with it. But, this system is limited only some kind of pills and fails to manage the different categories of pills.

Another such design is the e-pill [10]. This device is mainly user/keeper dependent as the time or medicine lock will have to be controlled by the keeper every time it has been locked. The only disadvantage is the interaction of keeper [11].

As discussed above and keeping all the problems in mind we considered all the points and designed our system through all these exceptions using different alert forms and IOT. Also, the dispenser units discussed above are economically difficult to use. In this work, a solution is proposed to solve all these problems.

III. CONCEPTUAL DESIGN

Our device aims to bringing up the overall health development status of the elderly sick people and also in normal sick people. In case of elderly people due to gradual decrease in memory power there has been an problem for the proper medicine taking process. Also, we need to design in such a way that even normal people can be able to use it easily. Designing a unit which will automatically set the remainder by sorting the time and popping out the remaining time is much difficult. This will be a big relief to the care taker or doctors who are in need to daily check the patents status manually [12]. Considering all these we use basic hardware and software techniques to construct the device so it will be a lot more user friendly. As in fig 1 shows the block diagram of the dispenser unit along with the components that are used, in constructing the device.

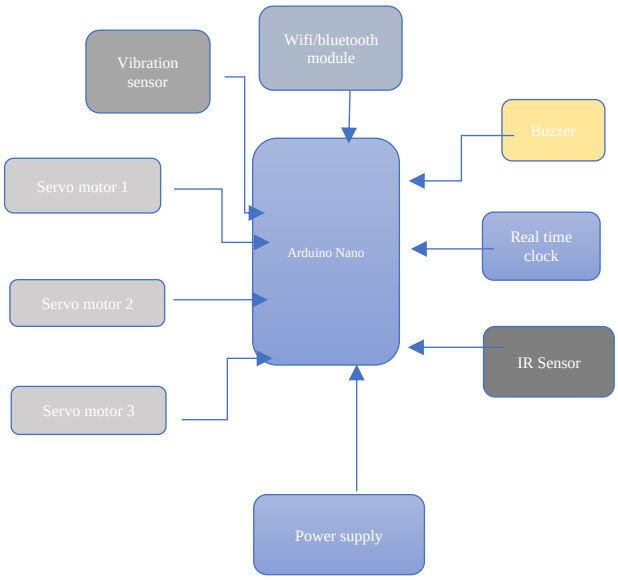


Figure 1. Pill Dispenser block diagram

IV. HARDWARE COMPONENTS

The hardware components are selected based on the functionalities that we give to the device.
The selected components are listed below:

1.Arduino Nano:

Arduino Nano is an intelligent development board designed for building faster prototypes with the smallest dimension. Arduino Nano being the oldest member of the Nano family, provides enough interfaces for your breadboard-friendly

applications. At the heart of the board is ATmega328 microcontroller clocked at a frequency of 16 MHz featuring more or less the same functionalities as the Arduino Duemilanove. The board offers 22 digital input/output pins, 8 analog pins, and a mini-USB port

2.Servo Motors:

A servomotor (or servo motor) is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity, and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often dedicated module designed specifically for use with servomotors. Servomotors are used in applications such as robotics, CNC machinery, and automated manufacturing.

3. RTC DS-1307 module:

The DS1307 Serial Real-Time Clock is a low-power, full binary-coded decimal (BCD) clock/calendar plus 56 bytes of NV SRAM. Address and data are transferred serially via a 2-wire, bi-directional bus. The clock/calendar provides seconds, minutes, hours, day, date, month, and year information. The clock operates in either the 24-hour or 12-hour format with AM/PM indicator. The DS1307 has a built-in power sense circuit that detects power failures and automatically switches to the battery supply.

V.DEVICE STRUCTURE

A detailed structure of the device has been discussed in this section. As the design must be user friendly and effective to make people take the correct doses of medicine at correct time. Arduino Nano is used as a principal micro controller. A small box like structures is used to hold the medicines which are dispensed using the servo motors along with an alarm system that comes with the RTC module. A Bluetooth module is used to connect with the app and lets the user to control the pill dispensed timings and all.

1.Pill dispensing system

When the alarm gets activated, the pills are dispensed one by one into a tray that is placed at the base of the unit. The servo motors dispense the medicine based on their time and the process continues till the last pill is dispensed. The confirmation is done on whether the pill is dispensed or not using a vibration sensor that senses and sends its data to the microcontroller to continue or repeat a particular process.

2.Alarm System

A buzzer is placed beneath the tray so that after the pills are dispensed it is activated so that the user has to take out the tray to take the medicine. The buzzing continues till the user empties the tray and places it back to its original position.

3.User Interface

A simple app is designed in MIT app inventor that lets the user to interact with the device. A connect button which is used to establish a connection in between the app and the dispenser unit, an add button to add any medicine details along with the time at which the medicine is to be dispensed , an update button to update the details which are modified. An lcd display is used to show the user all the necessary details about the medicine.

VI.TESTING METHODOLGY

In order to verify the working of the device, some testing has to be done before actually deploying it. They are

- Hardware testing
- Functionality testing

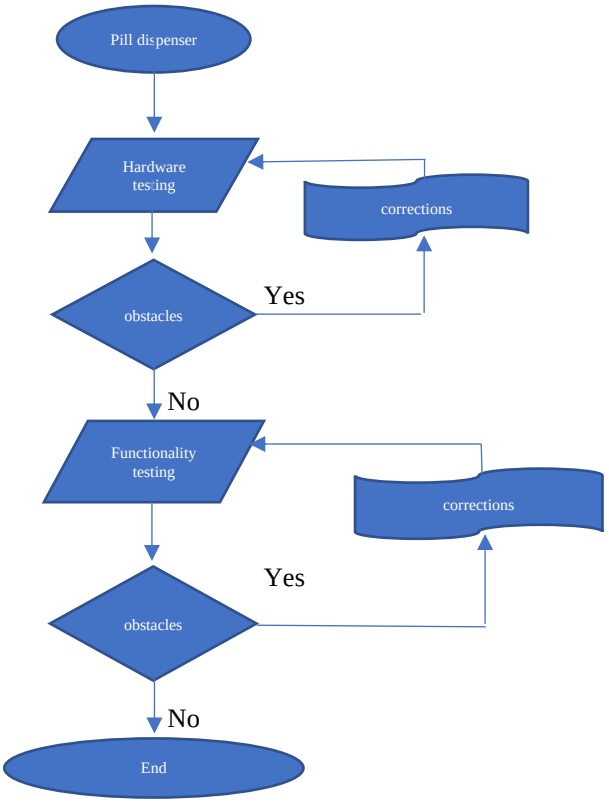


Figure 2. Testing flow diagram of pill dispenser

1. Hardware testing

This testing refers to the entire checking of the system hardware like PCB design, connections in between the devices etc. Testing can be done by using a multi meter to make sure each and every component should work perfectly.

Figure 3. Hardware testing

2.Functionality testing

In this stage the functionality of the components is tested by connecting them along with the lcd displays, servo motors and sensors with the microcontroller. The principal controller is Arduino Nano, so all the components works as an extensions of Arduino. An example program is uploaded to the Arduino ,the corresponding pins are connected to the device and a simple prove is made.

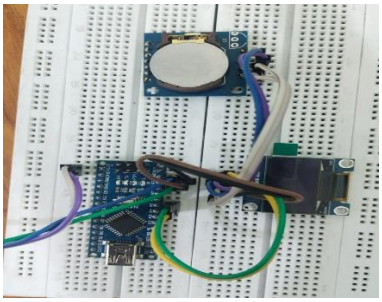


Figure 4. Arduino nano+ Bluetooth module + OLED display + RTC

This table shows the time and prescription that are entered into the app for the medicine to be dispensed.

S. No	Time	Prescription
1	9:00	100
2	12:00	010
3	14:00	001
4	17:00	110
5	20:00	011

Table 1 - Pill Dispenser – Time and Prescription values

3. Testing “Pill dispenser”

The system consists of different components that are controlled by Arduino Nano. Figure 5 shows the pill dispenser composition.

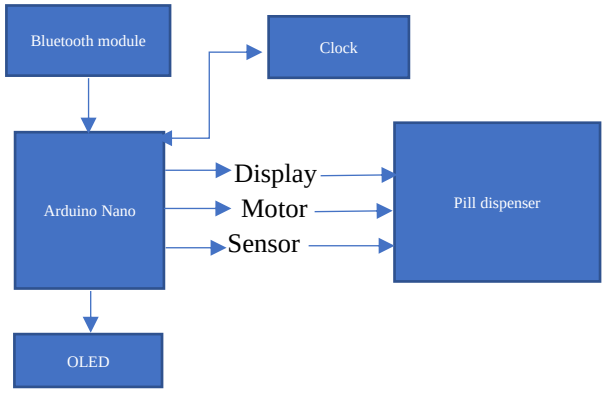


Figure 5. Pill dispenser composition

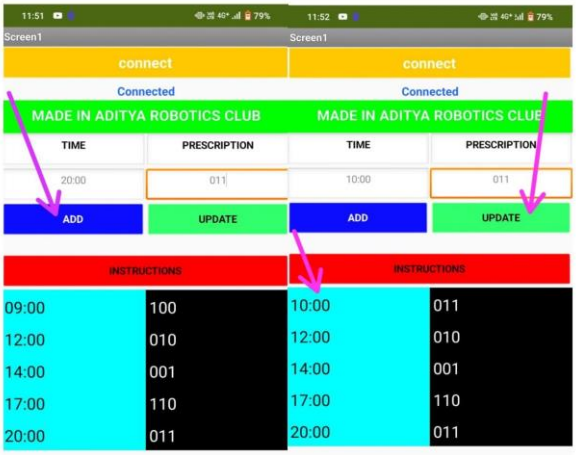
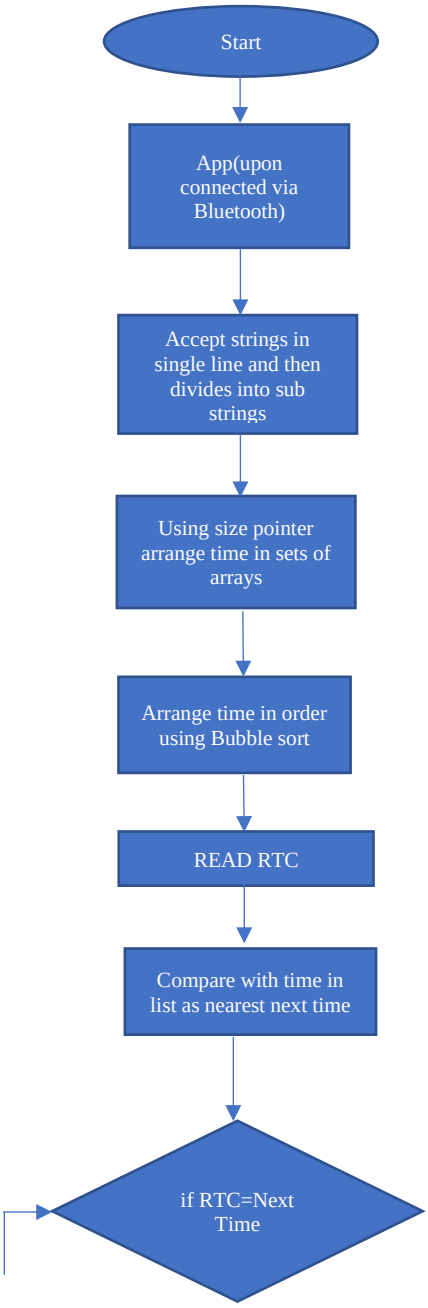


Figure 6. MIT-User interfaces

Figure 7. Pill dispener unit

The working flow of the pill dispenser is shown in below figure 8.



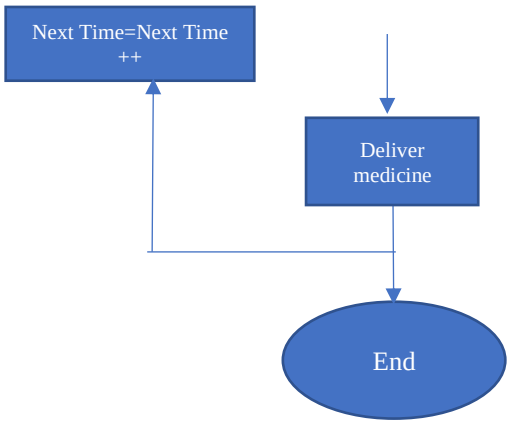


Figure 8. Work flow of pill dispensing system

Bubble Sort: it's important to note that bubble sort may be the most efficient way to sort pills in a dispenser , especially if you have a large number of pills There are other sorting algorithms that can be used, such as quicksort or merge sort, which may be faster and more effective for larger datasets

IRTC will set the time for the medicine to be dispensed. When the time has come the pill gets dispensed and the process continues till the last prescribed pill is dispensed.When the process gets completed the buzzer gets activated and it alerts the user to take the medicine out from the tray and the buzzing continues till the user empties the tray and replaces back to its original position.

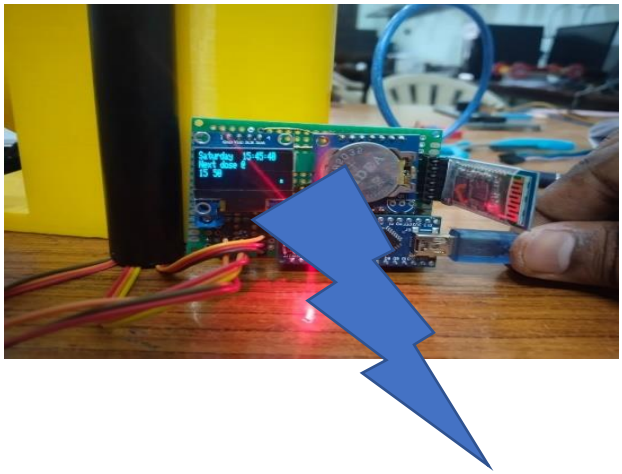


Figure 9. Arduino Nano+ Bluetooth Module + OLED display + RTC Module connected on a single PCB

VII. FUTURE SCOPE

While this paper has shown the potential of IOT technology to design a simple pill dispenser, many opportunities for extending the study of this paper is remain.

- Raspberry pi

  All this work is done using Arduino Nano is used. For future may be a powerful controller may be needed. For this Raspberry pi Model 3B can be used as it has more powerful processor, RAM, additional ports and interface.

- Security
  For security purposes login authentication will be added in order change the prescription details or time of the medicine etc.

- Cloud Storage
  This can be used to store the user login credentials and other details such as patient details ,medicine details etc. so that the keeper/doctor can easily access the data.

- Internet of Things (IOT)
  A study of the Innovative pill dispenser performance into IOT will be made. Protocols, efficiency, availability and other topics will be studied in order to proof the feasibility or not to include this device into the network. The mean idea it is that a doctor or keeper could be able to configure the medications schemes and obtain information about the patient remotely

VIII. CONCLUSION:

Especially in older patients and individuals taking chronic or period medications, medication adherence will undoubtedly increase with the usage of the IMPD, improving treatment effectiveness. The IMPD will undoubtedly be advantageous to insurance companies as it will help their clients live healthier and better lives free from the catastrophic catastrophes brought on by forgetting to take their medication or giving it at the correct amount. Last but not least, the user interface, which is the same across all operating systems and devices, is simple, easy to use, intuitive, and accessible to even older patients. The design is adaptable, allows the user the freedom to add new containers, and is also amenable to future improvements.

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