Improving Medication Adherence with an Arduino Nano-Powered Reminder System

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ABSTRACT

In today's modern world, everyone is fully occupied with their work and does not have time to take care of their health. It has become a common practice to forget often about taking medicine at the right time. This bad habit creates many health hazards at a later stage of life. Sometimes people take the medicine after a meal that was supposed to be taken before the meal, thinking that it will work normally. In many cases, it is worse than not taking the medicine. Our proposed innovation is targeted toward the people who forget to take their medicines at the right time and put their health in danger. We have invented this device to make their life easier. This innovation is based on alerting the user so that the user does not forget to take medicine on time. This is an Arduino-based device in which we have implemented other electronic and electrical components to make things work. We believe that this invention will create a huge social impact by helping people take care of their health.

Keywords: *Medicine, reminder, Arduino, social impact, human health, invention*

Introduction

In today's fast-paced world people have very less time to take care of themselves. As a result, it is seen very often that people forget to take medicine at the proper time which affects the health of that person. It can be seen that people take morning medicine in the afternoon and evening medicine at night. These habits do not allow the medicine to work properly making the medicine inefficient and risking the person's health. It also can be seen that medicines create side effects just for taking them at the wrong time. That is why our device reminds people to take medicine before and after every meal. Our device has the special ability to change the reminder time as per the user's behavior dynamically. We believe that this device will improve the user's health and create a social impact.

A few devices do exist in the market that remind people to take medicine on time [1]. But the fact that makes those devices inappropriate is that those devices work based on a timer [2]. It will remind people after a fixed time interval each time but it is not necessary that a person will take meals at the same time each and every day. In that scenario the devices become irrelevant. Our device is tailored to become fully responsive and the working of our device depends solely on the user behavior. That makes the device relevant, efficient, and effective as well.

Components Required

The following components are required to make this project: Arduino nano, 0.96" 128x 64 OLED display, push button switches, buzzers, LED, Vero board, resistors, 3.7v 900mAh rechargeable Li-ion battery, TP4056 Li-Ion battery charging module with micro USB-1, connecting wires, two pin connectors, On-Off switch.

Component Assembly

The entire device has two parts, one is a ring that the user will wear on one of his/ her hand fingers and the other part is the band that the user should wear just like wrist wristwatch. In the ring we have only the water sensor, all other components are assembled in the band.

Methodology

This device is made up of two main parts one is a ring and the other is a band. The ring has

a wire lying on it which has two open ends. The wire is connected to a battery through the Arduino. That means, usually no current is flowing through the ring. When the user washes hands water comes in contact with the open ends of the wire and acts as a bridge between them. As water is a great conductor of electricity current flows through water and makes the circuit closed. Whenever the circuit gets closed a voltage signal is sent to the Arduino through the wire. Upon getting the signal from the ring, the Arduino in the band starts working accordingly and shows 'WILL YOU EAT NOW?' on the screen asking the user if he/ she will have a meal now. If the user gives input as 'YES' by pressing the 'Yes' switch available on the band, 'TAKE YOUR MEDICINE' will be displayed on the screen reminding the user to take medicine before the meal. On the other hand, if the user gives input as 'NO', 'HAVE YOU EATEN' will be displayed on the screen, asking the user if he/ she already has taken the meal. If the user gives input as 'YES', 'TAKE YOUR MEDICINE' will be displayed on the screen, reminding the user to take the medicine after the meal and if the user inputs 'NO', that means the user neither had a meal right then nor going to have one. In that case 'IGNORE' will be displayed on the screen. It is important to have the ignore feature because it is not necessary that a person wash hand hands only before and after a meal. This feature will help the person to ignore the messages shown on the display. By doing this we can avoid many misleading situations. After every cycle, the user has to press the reset button of the controller manually to keep it ready for the next cycle. Throughout this whole process, washing hands has acted as a trigger movement because, washing hands before and after a meal has been a common habit for everyone.

Block Diagram

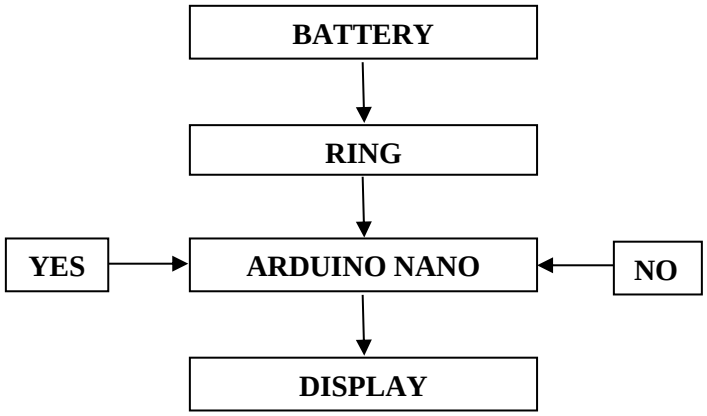


Fig: Block Diagram

Proposed Workflow

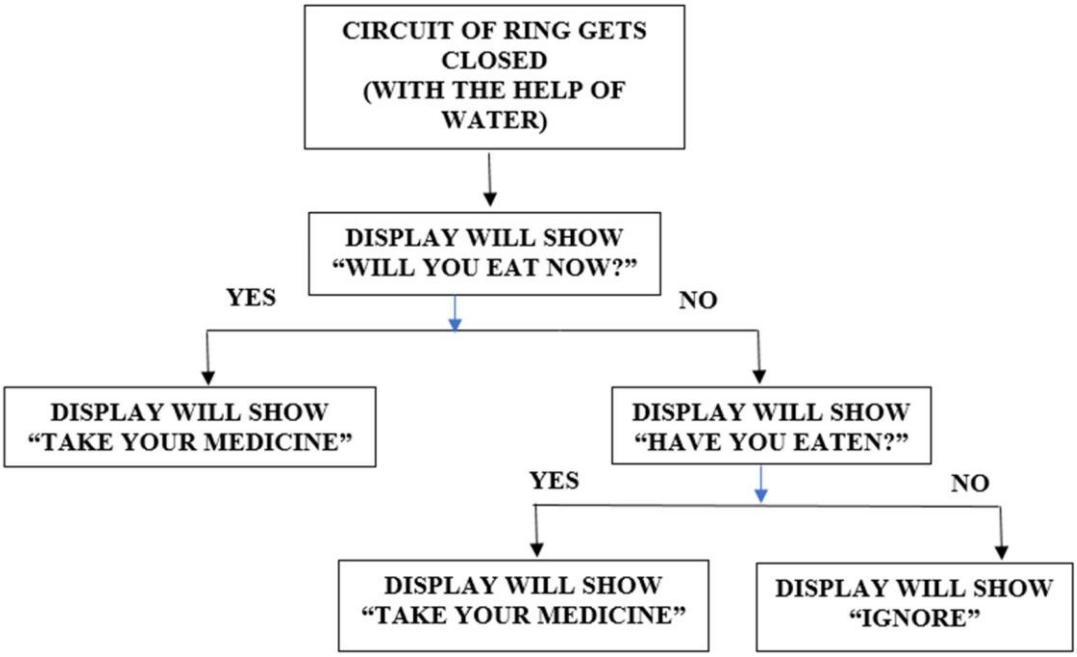


Fig: Proposed Workflow

Image of Prototype

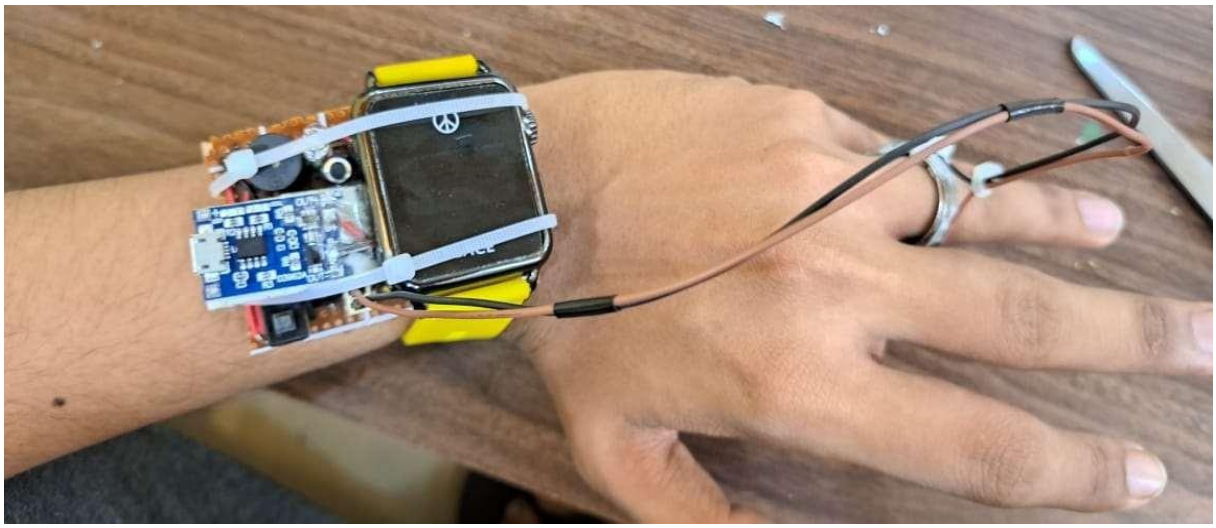


Fig: User wearing the prototype

Circuit Diagram

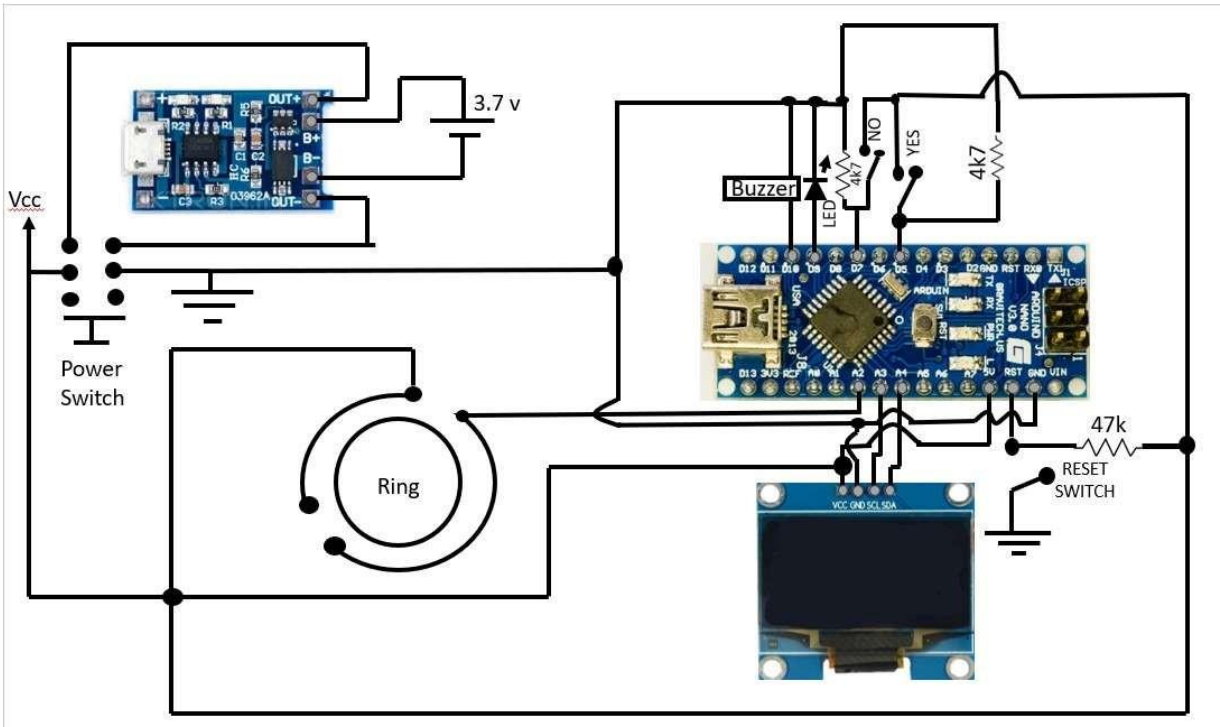
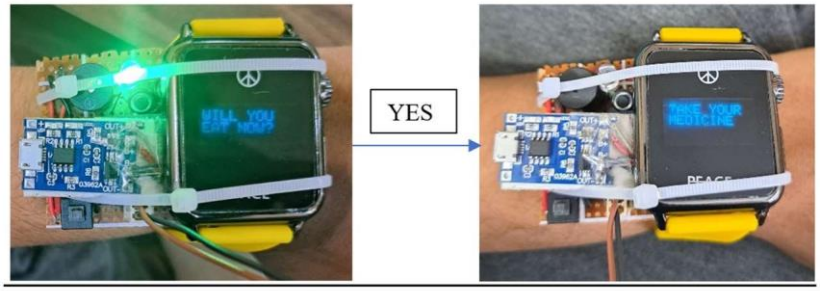


Fig: Circuit Diagram

Results

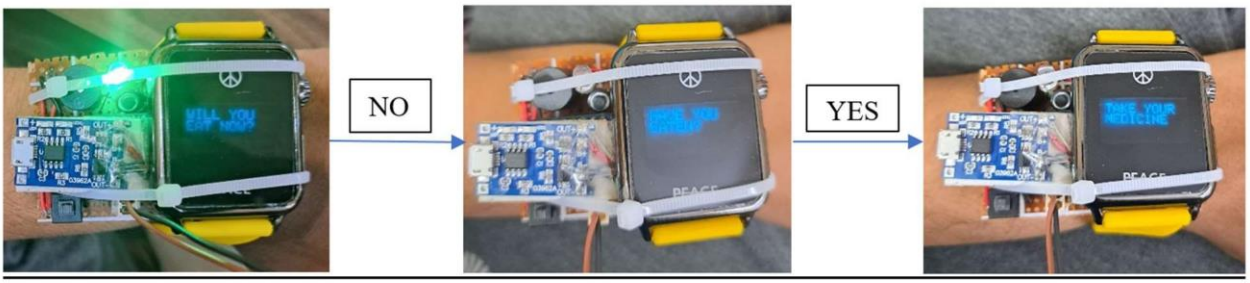
Our device has run successfully and has shown the desired outputs. The pictures of the project showing real-time outputs are shown below:

CASE-1



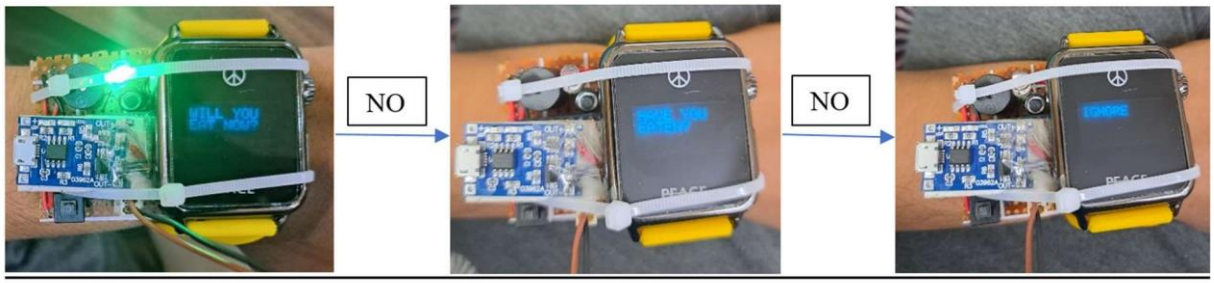
Display Showing 'Will you eat now?' **Display Showing 'Take your Medicine'**

CASE-2:



Display Showing 'Will you eat now?' **Display Showing 'Have you eaten?'** **Display Showing 'Take your Medicine'**

CASE-3:



Display Showing 'Will you eat now?' **Display Showing 'Have you eaten?'** **Display Showing 'Ignore'**

Innovativeness of the Device

- This device reminds people to take their medicines at the correct time.
- Devices available in the market remind people to have medicines, but that is nothing but an alarm that beeps at a preset fixed time. Our project is different from this point of view. It is not necessary that the user will take food at a fixed time every day. In today's busy world, it is very difficult for a normal person to have a meal at the same time every day. That's why our device doesn't need any fixed time to be taken as input from the user rather it reminds the user to take medicine when he has finished a meal or he is going to take a meal.
- This device is very lightweight and the user will not feel uncomfortable wearing this.
- The device is very cost-efficient and easily affordable by common people.
- The dimensions of the band and the ring are also very comfortable to wear.
- User can interact with the device and control its functionality with the help of given switches on the band.

- The device is rechargeable so that the user does not have to change the batteries frequently.

Scalability and Cost-Effectiveness:

This device is highly scalable to be manufactured in bulk quantities. The components used in this device are easily and readily available in the market. All we need to do is just to set up an assembly line and assemble the components.

The total cost required to make this device is approximately Rs.900. We need a medium-sized room to manufacture a good volume of the product. The components as well as the final product are small in size and require a small area for storing. So the overall production cost will be less. This will result in a low price for the final product and will be affordable to the end users.

Advantages over Prior Art:

The existing medicine reminder devices require regular updating of the time setting for taking medicines. This is quite difficult for the user to set the time of taking medicine. Moreover, a person cannot have a meal at a fixed time regularly. In this case, the functionality of the above device fails since the time of having a meal may not match the time set for taking medicine in the device. The size of the existing medicine reminders is quite large and difficult to carry all the time. So people may forget to use this medicine reminder since it is not portable.

Our Smart Medicine Reminder is very user-friendly and does not require any setting of time to take medicine. It works dynamically by activating a circuit while washing hands before and after a meal. So there is no chance of skipping or taking medicine associated with the meal. Our Medicine reminder is a combination of a band and a ring that can be worn easily all the time. This will ensure that the user will not skip any medicine associated with a meal.

Our user-friendly interactive accurate experience of the medicine reminder will attract many users to this product.

We intend to marketize the product at a lower price range which is pocket-friendly for normal people. As already stated, this device will keep people healthy by alerting the user to take medicine at the correct time.

Future Improvement Scopes:

Though the project is very brilliant itself, as we all know nothing is perfect. We also have some future improvement ideas that can be implemented into our project to make it better in the future.

- As of now, the project is wired. But we can use the RF Transmitter and Receiver module to enhance this project with wireless technology.
- We can implement the medicine names along with the reminder with the help of Artificial intelligence.
- Some sensors can be added to add some more functionality regarding our health like Blood Pressure checking, Pulse Rate checking, Body Temperature checking, etc.
- We can also implement a fall detector along with the cloud especially for old age users so that whenever they fall on the ground by accident an SOS will be sent to 3 emergency contacts saved earlier.

Conclusion

This device is made to help people take their medicines on time. The device is based on Arduino Nano and works with other components. Throughout the whole process of making this device, we have given the most priority to usability, practicality, cost-effectiveness, user comfort, and errorless output. We designed test cases to check every aspect of the device. We ran test cases on the device and got the desired output every time. Hence we can conclude that we succeeded in doing this project. We hope this device will solve the addressed problem to a great extent.

References

[1] Rohan Sarkar, Rohan Roy, Bipasha Pal, Rijit Chakraborti, Antara Mukherjee, Shankhadeep Ghosh, Sovan Saha," CarePro: A Complete Arduino and Android-based Elderly Care Health and Security Monitoring System", 2021 International Conference on Computational Performance Evaluation (ComPE), DOI: 10.1109/ComPE53109.2021.

[2] O. Erkaymaz, M. Ozer and M. Perc, "Performance of small-world feedforward neural networks for the diagnosis of diabetes", *Appl. Math. Comput.*, vol. 311, pp. 22-28, 2017.

[3] M. Chen, S. Gonzalez, V. Leung, Q. Zhang, and M. Li, "A 2G-RFID-based e-healthcare system", IEEE Wirel. Commun., vol. 17, no. 1, pp. 37-43, Feb. 2010.

[4] G. K. Reddy and K. L. Achari, "A noninvasive method for calculating calories burned during exercise using heartbeat", *Proceedings of 2015 IEEE 9th International Conference on Intelligent Systems and Control ISCO 2015*, pp. 1-5, Sep. 2015.

[5] A. A. Bin Ariffin, N. H. A. Aziz and K. A. Othman, "Implementation of GPS for location tracking", *Proceedings -2011 IEEE Control and System Graduate Research Colloquium ICSGRC 2011*, pp. 77-81, 2011.

[6] F. S. Lesani, F. F. Ghazvini and R. Dianat, "Mobile phone security using automatic lip reading", 2015 9th International Conference on e-Commerce in Developing Countries: With Focus on e-Business ECDC 2015, pp. 1-5, Jul. 2015.

[7] S. A. Kokalki, A. R. Mali, P. A. Mundada and R. H. Sontakke, "Smart health band using IoT", *2017 IEEE International Conference on Power Control Signals and Instrumentation Engineering (ICPCSI)*, pp. 1683-1687, 2017.

[8] M. H. Rahman, M. R. Islam, and M. Ahmad, "Design and Implementation of a Smart Health Band for the Measurement of Blood Pressure Pulse Rate and Body Temperature", *2018 4th International Conference on Electrical Engineering and Information Communication Technology (iCEEiCT)*, pp. 156-161, 2018.

[9] H. Fei and M. Ur-Rehman, "A Wearable Health Monitoring System", *2020 International Conference on UK-China Emerging Technologies (UCET)*, pp. 1-4, 2020.

[10] N. Al Bassam, S. A. Hussain, A. Al Qaraghuli, J. Khan, E. P. Sumesh and V. Lavanya, "IoT-based wearable device to monitor the signs of quarantined remote patients of COVID-19", *Informatics Med. Unlocked*, vol. 24, pp. 100588, 2021, [online] Available: https://doi.org/10.1016/j.imu.2021.100588.