IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Med Link Monitor: Smart Medicine Distribution System

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Abstract: Hospitals and healthcare centers are facing problems in distributing medicines to patients. The nurses are primarily employed to administer and distribute medicines to the patients. Nurses are trained to do this job, however, there is always the risk of errors in medication distribution due to the load of patients or long hours of work. This fatigue of nurses brings in the threat of the wrong administration of medicines and puts patient's health at risk. This work presents a simple distribution system for dispensing medicine to the right patients. The designed system caters to hospitals or elderly care centers providing an innovative and functional medicine serving tray with a sliding mechanism. The design used various sensors and wireless communication techniques for dispensing the medicines. The design prototype is a medicine dispensing tray that helps dispense the right medicine dose to the patients non-invasively and safely.

Index Terms **– Medicine distribution, Medicine dispensing tray, Sliding mechanism**

I. INTRODUCTION

Healthcare is an important factor in everybody's life. Living a healthy lifestyle will protect everyone from diseases and illness. Additionally, medicines are important in controlling diseases and illnesses. Some people take medications on a regular or occasional basis to assist avert harmful situations. In some situations, it is found that some patients might forget to take their medications. Several studies report that elderly patients also called as old adults are taking medicines in the wrong way, with improper dosage [1]. Hence, this calls for an ingenious medicine distribution that helps patients or nurses who monitor patients to handle the situation of forgetfulness. Medication errors can occasionally happen at different phases, such as while writing prescriptions and giving shots. These mistakes have the potential to have deadly results among other dire outcomes. The main goal of this study and reports on drug errors is to pinpoint the underlying reasons for these mistakes and offer preventative measures. This work has proposed a medicine distribution tray, this tray helps patients to collect the prescribed medicines on schedule and without missing a dosage. This tray will enable medical professionals and nurses to treat patients more effectively. The nurse places medicine containers on the tray and then pulls the attached portion underneath the tray to place the medicines on the table. Hospitals play an important role in providing medical services. Among all of that, this is a different purpose initiated for patients. For instance, to ensure that the patient gets their medication on schedule, it is also used to track and monitor the effective distribution of medication, ensuring that the patient has received it on time. Additionally, it will instantly alert the patient's caregiver, enabling in-the-moment observation and communication to improve patient care. This comprehensive solution improves medicine management by ensuring effective distribution and reliable tracking. Once the nurse activates the tray, the medication doses are prepared and placed on it. This system's creative and distinctive approach to medicine delivery has the potential to distinguish the hospital. This creative idea can improve the hospital's reputation, which will also face competition and present opportunities for other healthcare providers to use and implement for future growth.

II. LITERATURE SURVEY

Medical errors claim the lives of about 700–1700 people in Finland annually. A report by the authors in [2] indicates that 3, 40,000 patients' data has medical errors over the past five years. It was also found that errors were primarily caused by tasks related to dispensing medications. Maintaining patient adherence to treatment is an issue in both auto medication and hospitals. Numerous applications target the preparation as well as the intake of medications [3]. A few tools to help direct and encourage medicine intake are Wang et al. [4], healthcare at home (H@H) [5], e-pills [6], Smart TV medicine tracker [7], and others.

However Smart medicine distribution systems are automated systems that can be used to dispense medication to patients in a variety of settings, including hospitals, nursing homes, and assisted living facilities. These systems can help to improve the accuracy and efficiency of medication distribution, and they can also help to reduce the risk of medication errors. Two recent examples of smart medicine distribution systems are the Smart Dosing System and the Smart Medicine Storing and Delivering Tray System. The Smart Dosing system is a web-based application that helps nurses fill and dispense medication trays more efficiently. The Smart Medicine Storing and Delivering Tray system is a prototype system that uses RFID technology and the Internet of Things to track the dispensing of medication to patients. Both systems offer several benefits over traditional methods of medication distribution. For example, smart medicine distribution systems can improve the accuracy and efficiency of medication distribution by automating tasks such as dispensing medication and tracking inventory [8], [9]. Also, the authors Kadam et al. [10] have proposed a design of a multi-pill dispenser for the elderly population. This is a microcontroller and an RFID-based alarm pill dispenser. Today many applications are supported by the handled smartphones. In [11], the authors have implemented a mobile application that reduces medication errors, saves time, and assists complex nursing procedures. This research work is an example of technology intervention in the healthcare sector. Along similar lines, several categories of medicine dispensing mechanisms and adherence to the appropriate dosages and measures are designed in [12],[13], and [14].

They can also help to reduce the risk of medication errors by tracking the movement of medication by preventing unauthorized access to medication. Additionally, smart medicine distribution systems can free up nurses and other healthcare professionals to focus on other tasks, such as patient care, and they can provide real-time data on medication compliance, which can be used to improve patient care. Research on smart medicine distribution systems is still in its early stages, but the results of existing studies suggest that smart sliding trays have the potential to significantly improve the safety, efficiency, and quality of medication distribution. Future research should focus on developing and evaluating new smart medicine distribution systems with advanced features, such as the ability to dispense multiple medications at once, track the location of medications in real-time, and provide alerts to healthcare professionals when there is a potential problem with medication distribution.

III. PROPOSED METHOD

The proposed medication distribution system entails an innovative and effective manner of distributing tablets to patients or people in various sectors, such as nursing homes, old age homes, hospitals, etc. The details of the sensors and the components used in this work are described in Table 1. The smart medicine distribution systems have a sensor-based medicine tray with sections/slots for the medicine.

Table No. 1: Components and Sensors

Components	Description
IR Sensors	Devices designed to detect and measure infrared radiation. Widely used for detecting, measuring, and monitoring heat, motion, and proximity in various applications.
Wi-Fi Module [ESP8266MOD Wireless Module in NodeMcu]	A Wi-Fi module is a compact electronic component that provides wireless networking capabilities to a device or system. When the patient does not receive medicines, a message is sent through a WI-FI module indicating that the patient has not received the medicine
Green LED	Light Emitting Diodes that emit green light, respectively. The anode (longer lead) is the positive terminal, and the cathode (shorter lead) is the negative terminal.

The tray has been split into two sections: the sliding area, which enables the tray to be slid and the cups to be placed on the surface, and the section above, which has various slots for the tablets to be placed according to the needs of various patients. The medicine cups are placed in the slot as shown in figure 1. Further, the figure represents a design of the medicine dispensing tray as a low-fidelity prototype. The tray is embedded with a WI-FI module to facilitate network connectivity. The network connectivity is indicated by a green LED light, which blinks twice when the module is linked to the designated network. Sensor 1 detects if the tray is slid after it is connected and the medicine cup is placed on it. If only one light is visible, Sensor 2 will determine whether the medication cup is still on the tray. A green light will appear after a few seconds to show that the patient has received the medication. In case the medicine cup is still on the tray after the allotted time through the wi-fi module, the message is sent to a Telegram bot at regular intervals of time until it is reset to the loop.

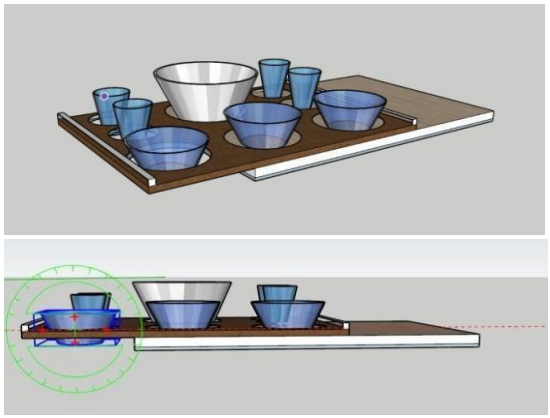

Figure 1: Low-fidelity Prototype of the medicine dispensing tray

Figure 2: High-fidelity Prototype of the medicine dispensing tray with network connectivity

Fig 2, depicts a high-fidelity prototype that shows the network connectivity using a green LED light. At the beginning, if the LED light blinks twice, it indicates that the device is connected to the allotted network and the tray is ready to be slid.

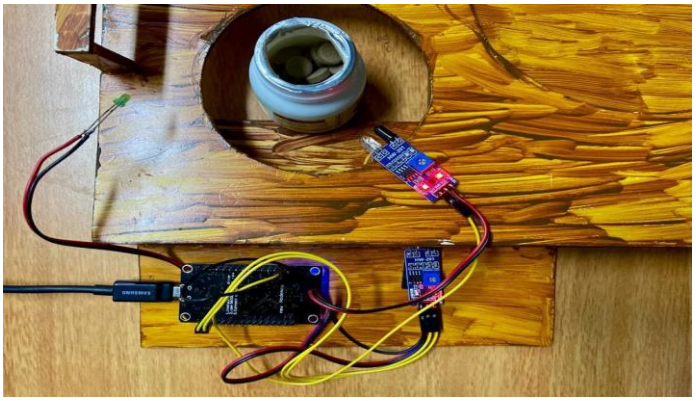

Figure 3: High-fidelity Prototype with tablet box placed in the slot

Further, in Fig 3, the tray has been slid, sensor 1 the light is lit up and sensor 2 determines if an object is present after a predefined time.

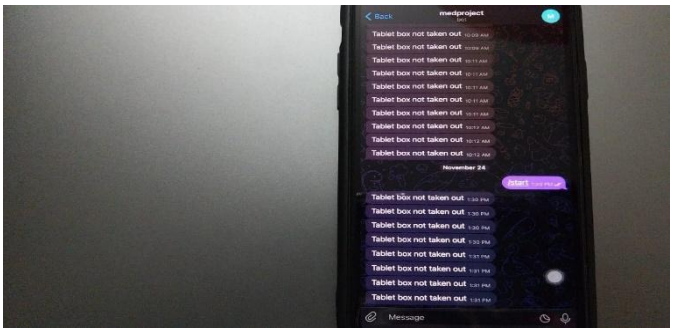

Figure 4: Message displayed on the telegram bot

The medicine dispensing tray is WI-FI enabled and can communicate with the patient or the nurses monitoring the patient about the status of the medicine tray. Fig 4, shows the message sent to the telegram bot when sensor 2 detects a container after the predetermined time.

IV. RESULTS AND DISCUSSION

The hospital staff now finds it easier to give medications to patients using a sliding system thanks to the suggested medicine distribution tray. The foam board prototype utilized in this instance has a designated area on the tray for holding the medications. Additionally, a second piece is fastened below so that when the medication is pulled, it should be placed on the patients' tables. The authorities receive messages indicating that the medications are not being taken using a telebot in the Telegram app for tracking purposes. Both the staff and the patients find this system to be comfortable to use, which suggests that other healthcare facilities should adopt it in the future. Several factors were covered in the discussion, including patient satisfaction and ease of use. Following the findings, a few changes were made, such as adding a green LED light to indicate that the medications were received. Previously, only the red light would appear, along with a message informing the recipient if the tablets were not received. Now, the green light appears first when the medicines are taken out from the tray. The medicines not received message will be sent on the loop that is four to five times.

V. CONCLUSION

In conclusion, the medicine distributing tray for delivering medicines in hospitals holds great potential for improving efficiency, accuracy, and patient experience in healthcare. By introducing this smart system and innovative design for the process of delivering medicines, hospitals/healthcare can enhance their services. Patient care is positively impacted by this. This prototype tackles important issues in healthcare delivery while also assisting hospital staff in giving patients their medications. There exist prospects for additional healthcare facilities to expand. Since it is a novel and distinctive strategy, the market can use it to implement this for its expansion. The system improves patient safety by distributing errors more evenly and lowering complexity and error risk.

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