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Kampus Sungai Petani

Faculty of Administrative
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MEDICINE REMINDER WITH LOW BATTERY ALERT “MEDMINDER”

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ABSTRACT

Elderly who suffer with dementia tend to forget their daily routine in the new norm when living alone during lockdown. Furthermore, they require proper management for their medications. Taking wrong medicines at the wrong time including incorrect prescription, missed doses, or excessive dosage of medicine can lead to serious disease, hospital visits and even death. Even though a traditional medicine box is capable of resolving the management issue for prescription, there are several features that can be designed to assist the elderly in managing their daily prescription intakes. The current automated pill box is typically inexpensive and produces reliable performance. In addition, it allows users to administer on-time via increased accessibility in elderly care. However, their reminder box is sold for a normal 16×2 LCD panel. The size is too small for the elderly to see it clearly from a certain viewing distance especially for those who are facing vision loss. Medicine Reminder with Low Battery Alert (MEDMINDER) is designed as a portable medicine reminder box with a low battery alert function and to improvise the existing medicine box with additional features. In this work, the design uses Arduino Uno as controller and interface with the push button as input in performing action to set the alarm for the reminder. The output of the 20 × 4 LCD will display the time, date, and day of the alarm set together with the percentage of battery indicator. The LED was used to alert the elderly on the day that they should take their medicine by blinking along with the buzzer. Finally, the speaker will be added as an additional feature for elderly with dementia who are facing vision loss to hear the alert of time taken to eat their medicine and alert to do battery replacement once the battery is running out. MEDMINDER was tested using Proteus to emulate the concept of the pill compartment for the elderly

Keywords: portable pill compartment, traditional medicine box, automated medicine box, reminder pill box, elderly with dementia.

INTRODUCTION

The number of women who suffer from dementia outnumbered men with a ratio of 2:1[1]. The studies show the rate of brain cells is dying faster in women's brains than in men and cause dementia [1]. Research has shown that dementia disease is more prevalent as the age of women and men increases from 65 to 85 years old. The frequency of patients who suffer from dementia per year between 65 to 69 years old patients, are usually less than 2%. While elderly between 75 to 79 years old is around 5% and more than 20% are patients from the group age of 85 to 89 years old [2]. Issues arise when elderly living alone in a new norm. Some studies have shown that people who live alone are much more likely to experience poor health conditions, poor vision, everyday activity problems, and social isolation especially for the elderly [3]. While this may not occur in every case, it is important to consider when it comes to elderly who suffer from dementia. They are most likely to be a vulnerable group of people among the

elderly due to critical reasoning and physical mobility issues that occur with age, which makes it even difficult to complete day-to-day tasks. Furthermore, 4 out of 5 elderly over the age of 75 take at least one medication, and most of them had to consume more than four types of medication which approximately 36% of the elderly of the age group [4]. The timing for each of these medications is important to avoid any health complications from occurring. For elderly who are facing memory problems, they might have trouble remembering to take their medicine on a specific schedule. Hence, this could lead to many side effects and pose some threats to their health [5]. An alternative solution is needed to assist the elderly with assistive technology especially their timely medication for pills [6]. Some traditional medicine boxes lack a reminder alarm, no screen time, and no day indication. Even though the existing medicine box consists of the standard pill box with seven pill compartments for seven different days in a week. However, this pill box does not have a reminder for medication. Thus, the MEDMINDER idea is aimed to accommodate the elders via technology devices for pill boxes. The medicine box is designed for its portability, and the add-on features to assist the elderly for scheduling their pills intake daily. The design will be cheap and practical as an automatic reminder box. Also, the box can minimise the difficulty faced by the elderly.

CONCEPT IDEA for *MEDMINDER*

Proof of concept for MEDMINDER is presented in two stages: 3D concept and software simulation. The software simulation consists of code for MEDMINDER to function for daily reminders using Proteus software. 3D design is an illustration prototype using SketchUp Free. As shown in Figure 1 and Table 1 are the block diagram of MEDMINDER and design specification of MEDMINDER, respectively. Details on the specification are explained in Table 1.

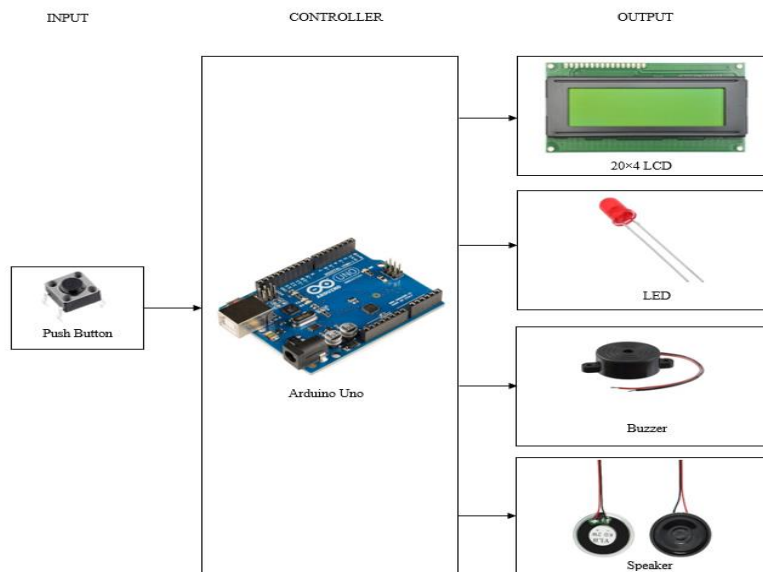


Figure 1. Block diagram of MEDMINDER

Table 1. Design Specification of MEDMINDER

Specification	Current Condition	Desired Condition	Reason	References
Height of character size	0.523 cm	1.05 cm	The character size is eligible for the elderly vision.	[7]
Time taken before the failure of battery	973 hours	960 hours	Usage of 2 9V batteries will consume approximately 1 year (960 hours) battery life before its failure.	[8]
Battery capacity	6929 mAh	1100 mAh	Usage of a 9V battery is much suitable for the functionality and practicality of the device.	[8]

RESULTS AND DISCUSSION

3D modelling

Figure 2 exhibits the 3D modelling prototype using SketchUp Free software. MEDMINDER consists of two main parts which are the pill compartment and the alert system. The medicine required by the elderly can be stored into the pill compartment with a dimension of 19 cm × 7.5 cm that was divided into 3 partitions for each 7 days. While for the alert system, it consists of a connection of electronic components used in developing the MEDMINDER which are the 20×4 LCD, push buttons, LED, buzzer, speaker, and Arduino Uno. Figure 3 represents the side view of MEDMINDER. It is to show the compact and practical medicine box with a total dimension of approximately 30 cm × 11.5 cm × 4 cm. The pill compartment holds the size of 19 cm × 7.5 cm × 4 cm from the total dimension of the design.

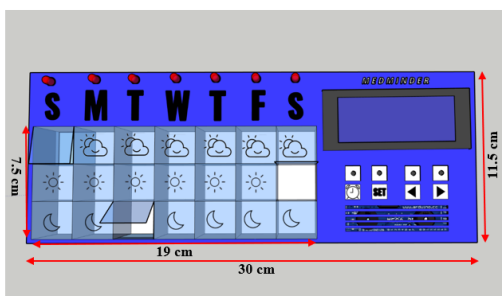


Figure 2. 3D Modelling Prototype of a MEDMINDER

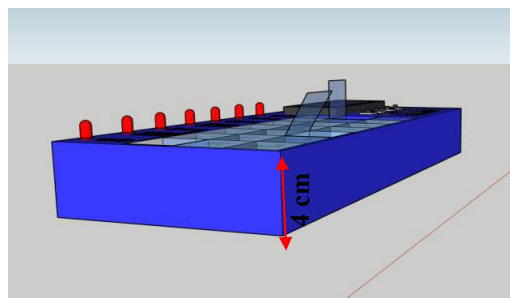


Figure 3. Side View of MEDMINDER

As displayed in Figures 4 and 5, the alert system consists of a connection of several electronic components such as 20×4 LCD, push buttons, LED, buzzer, speaker, Arduino Uno and two 9V batteries. The 20×4 LCD is to display the character size as well as to improve the legibility of the character size for elderly's vision. The push buttons are to set the time, day, and date of the desired reminder. Furthermore, the 7 LED is placed on the top of the pill compartment for daily indicator by blinking to alert the elderly on day, their medicine time, and the alarm to alert with the buzzer. An additional feature such as a speaker is used for the elderly with dementia with vision loss to capture the time alert for their medicine intake. The indicator for the battery replacement is designed with audio to alert the elderly.

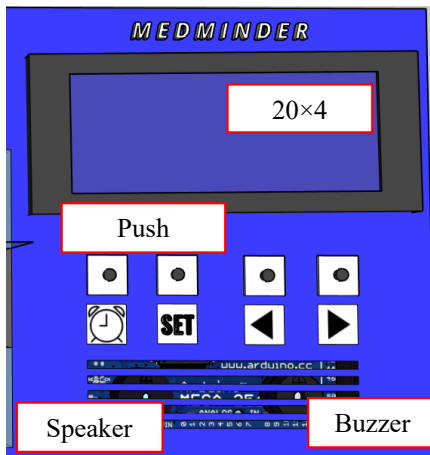


Figure 4. Alert System Structure

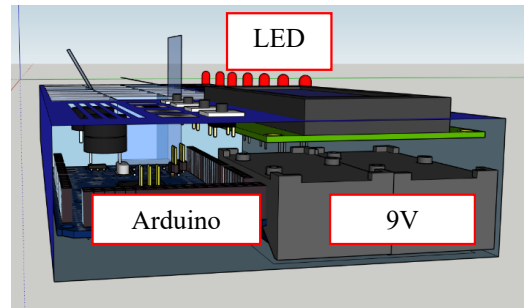


Figure 5. Side View of the Alert System Structure

Circuit Simulations

To illustrate the components to function according to the system design, circuit simulation is performed using Proteus simulation software. The components used for the simulation are DS3232 representing a real time clock (RTC), Arduino Uno, push button, LED, buzzer, LCD, speaker, and virtual terminal. Figures 6, 7 and 8 depict the setting of the current date and set the alarm, alarm 1 on Monday and alarm 2 on Tuesday, respectively. Figure 6 shows the setting of the current date, time, and year as well as setting the alarm for medication intake. This is to remind the elderly with dementia the time to take their medicine and it will be started as soon as RTC has reached the set time. The alarm has been set 3 times. Alarm 1 represents for morning, alarm 2 represents for afternoon, and alarm 3 represents for night. The alarm can only be set maximum 3 times per day. If the alarm is set more than 3 times, it will replace alarm 1 and so on. At the alarm setting, there are two options, which are activate and deactivate functions for the alarm.

Figures 7 and 8 display the examples of daily reminders. The function of alarm 1 on Monday. Alarm 1 was set at 3.50 AM, so the alarm will go off when the RTC reaches the set time. The LED will indicate Monday and the buzzer will turn on simultaneously. Both will turn on simultaneously until the next minute, which is when the RTC reaches 3.51 AM. When the alarm goes off, the blinking indicator at the LED and buzzer will change from blue to red. Similar action as in alarm 2 on Tuesday. Two LEDs function to indicate the day of the medicine. As depicted in Figure 8, Alarm 2 was set at 3.52 AM, so the alarm went off when the RTC reached the set time. The LED indicates Tuesday and the buzzer will turn on simultaneously. Both will turn on simultaneously until the next minute when the RTC reaches 3.53 AM. When the alarm goes off, the blinking indicator at the LED and buzzer will change from blue to red. As mentioned previously, the speaker is an additional function to guide the elderly with dementia who are also facing vision loss to hear the alarm of which medicine should the elderly take and when they should replace the device battery.

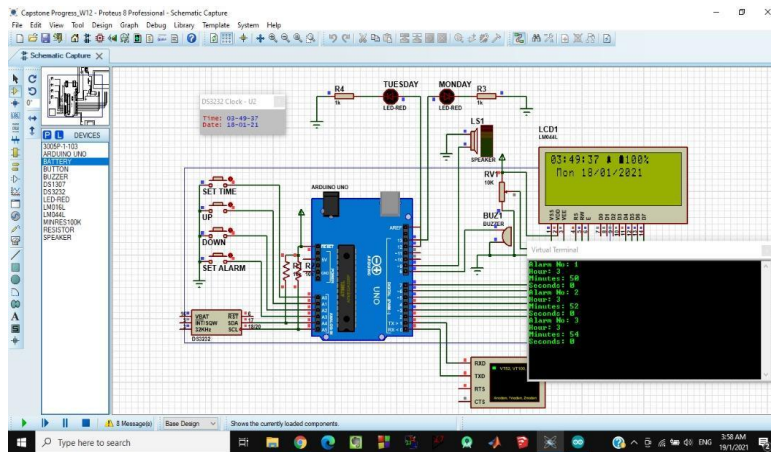


Figure 6. Simulation on setting the current date and set the alarm

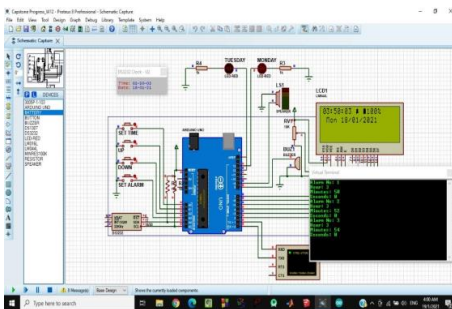


Figure 7. Simulation of alarm 1 on Monday

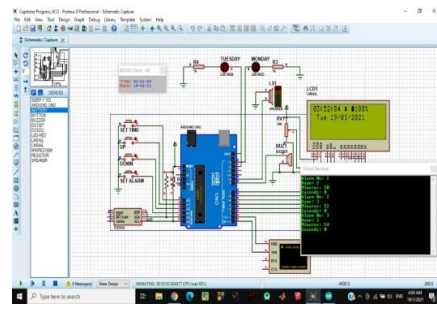


Figure 8. Simulation of alarm 2 on Tuesday

CONCLUSION

MEDMINDER was inspired to assist the elderly who suffer from dementia. They are facing difficulty in doing their daily routines especially when they have to live alone. An affordable and improved medicine reminder box has been successfully developed using an electronics system design concept. For easy reminders and alerts, a buzzer and an LCD display have been attached, thus the elderly with dementia can manage their pill on scheduled time without depending on their caretakers. The objectives have been achieved by assisting the elderly with dementia taking their medication, designing a portable medicine box, and improving the existing medicine box with more features.

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